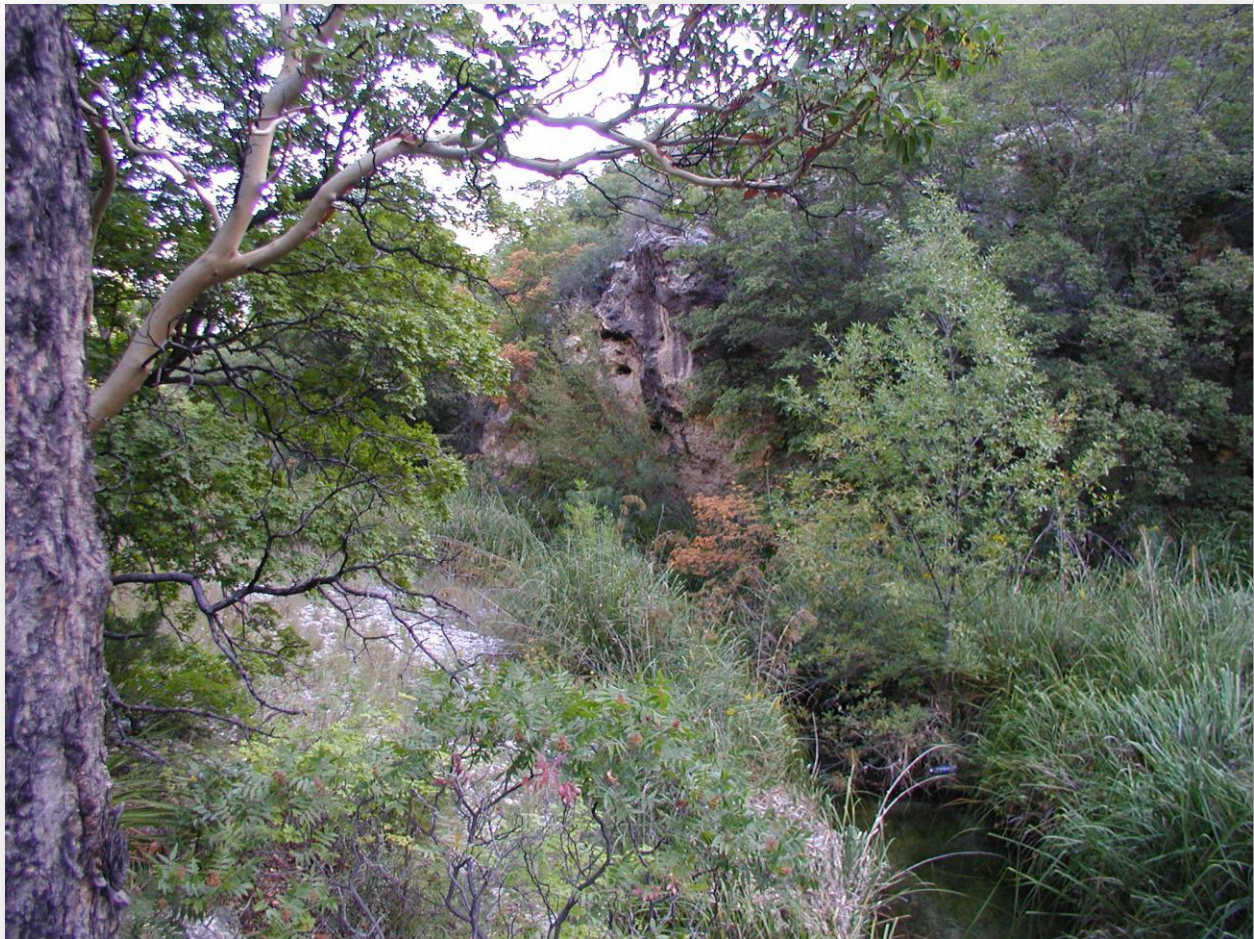




Seasonal Inventory of Birds in Low Elevation Riparian Habitats at Chihuahuan Desert Network Parks

2007 Final Report

Natural Resource Technical Report NPS/CHDN/NRTR—2011/491



ON THE COVER

South McKrittick Canyon, Guadalupe Mountains National Park, Texas
Photograph by Raymond Meyer.

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September 2011

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Meyer, R., D. Griffin. 2011. Seasonal inventory of birds in low elevation riparian habitats at Chihuahuan Desert network parks: 2007 final report. Natural Resource Technical Report NPS/CHDN/NRTR—2011/491. National Park Service, Fort Collins, Colorado.

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Acknowledgements

The assistance of Hildy Reiser and Bill Reid of the National Park Service, Chihuahuan Desert Network in the development of this project is greatly appreciated. We wish to thank the staff at each park for their support and assistance in completing this project: Renee West and Dave Roemer at Carlsbad Caverns National Park, Fred Armstrong at Guadalupe Mountains National Park, John Heiner at Fort Davis National Historic Site, and Bill Conrod and Diane White at White Sands National Monument. Kelly Bryan performed surveys of the Fort Davis sites and provided extensive information regarding the avifauna of the area and previous research conducted in western New Mexico and the Trans Pecos region of Texas. Robert Deitner assisted with data handling and analyses.

Introduction

Land managers depend on reliable natural resource information in the development and implementation of conservation strategies and in making decisions regarding resource use. Biological inventories are one of the most basic and important components of that information. The National Park Service (NPS) has undertaken a service-wide initiative to assess and monitor the condition of natural resources in its parks. To achieve this, the Service implemented an Inventory and Monitoring Program among networks of parks in similar settings. The Chihuahuan Desert Network (CHDN) that includes seven parks within this desert ecoregion developed its Inventory and Monitoring plan with network specific objectives (<http://science..nature.nps.gov/im/units/chdn/reportpubs.cfm>).

This project, which was conducted between 2004-2006 was intended to fulfill the low elevation riparian avifaunal inventory component of the CHDN Inventory and Monitoring Program. The project goal was to inventory the avifauna at pre-selected low elevation riparian habitat sites in some of the CHDN park units. The specific objectives of the project were:

1. Apply survey methodologies in spring, summer, and fall seasons in riparian habitat study sites to document species presence, species richness, and relative abundances.
2. Relate the project findings to existing information of the avifauna at each of the sampling areas and update species lists.
3. Provide the baseline data and site evaluations necessary for the development of monitoring programs in the CHDN.

Methods

Study Sites

The seven NPS park units of the CHDN are located in the northern portion of the Chihuahuan Desert ecoregion. Twelve study sites were selected by NPS I&M personnel at four of the park units: Carlsbad Caverns National Park (CAVE) and White Sands National Monument (WNSA) in New Mexico; Guadalupe Mountains National Park (GUMO) and Fort Davis National Historic Site (FODA) in Texas (Table 1, Figure 1, see Appendix A for site descriptions and transect locations, and Appendix B for representative photos). All sites were initially visited to assess the extent of the habitat, determine the appropriate survey technique for the area, and establish the locations of point count stations or delineate the survey area. The particular survey method chosen for individual sites was based on size and configuration of the area to be surveyed. Point count transects were established at Andrecito Creek (ANCR) site on White Sands National Monument, Rattlesnake Springs (RASP) and Walnut Canyon (WACA) at CAVE, McKittrick East, North and South Canyons (EMCK, NMCK, and SMCK, respectively) at GUMO, and in Hospital Canyon (HOCA) at FODA (Ralph et al. 1993, Hamel et al. 1996, Ralph et al. 1995b). Survey points were located at minimum intervals of 200m but usually $\geq 250\text{m}$ along transects. Because of limited habitat, a timed area search method (Ralph et al. 1993) was considered most appropriate for WNSA park headquarters (HEQU), Oak Spring (OASP) and Grammer Seep (GRSE) at CAVE, and Guadalupe Spring (GUCS) and Chozas Springs (CHSP) at GUMO. In addition to the point count transect (HOCA) at FODA an area search survey route (MEGR) was established in a mesquite grassland adjacent to the point count transect. The MEGR surveys provided more thorough survey coverage of the park and augment the park species list which was lacking at FODA.

Avian Data Collection

Avian data was collected during formal surveys, before and after surveys, between points on point count transects, and informal surveys during additional visits to the sites. The informal surveys usually were performed later in the day of a site survey or the day before or after a survey of the site.

Point Count Surveys

Surveys were initiated not earlier than 15 minutes before sunrise and completed by 1130 hrs. Surveys were not conducted during inclement weather or when wind speed exceeded 15 km/h. Station count time of 5 minutes was divided into periods of 3 and 2 minutes (0-3 mins and 3-5 mins). Detections were recorded according to when and where the bird(s) was first heard or seen during a point count.

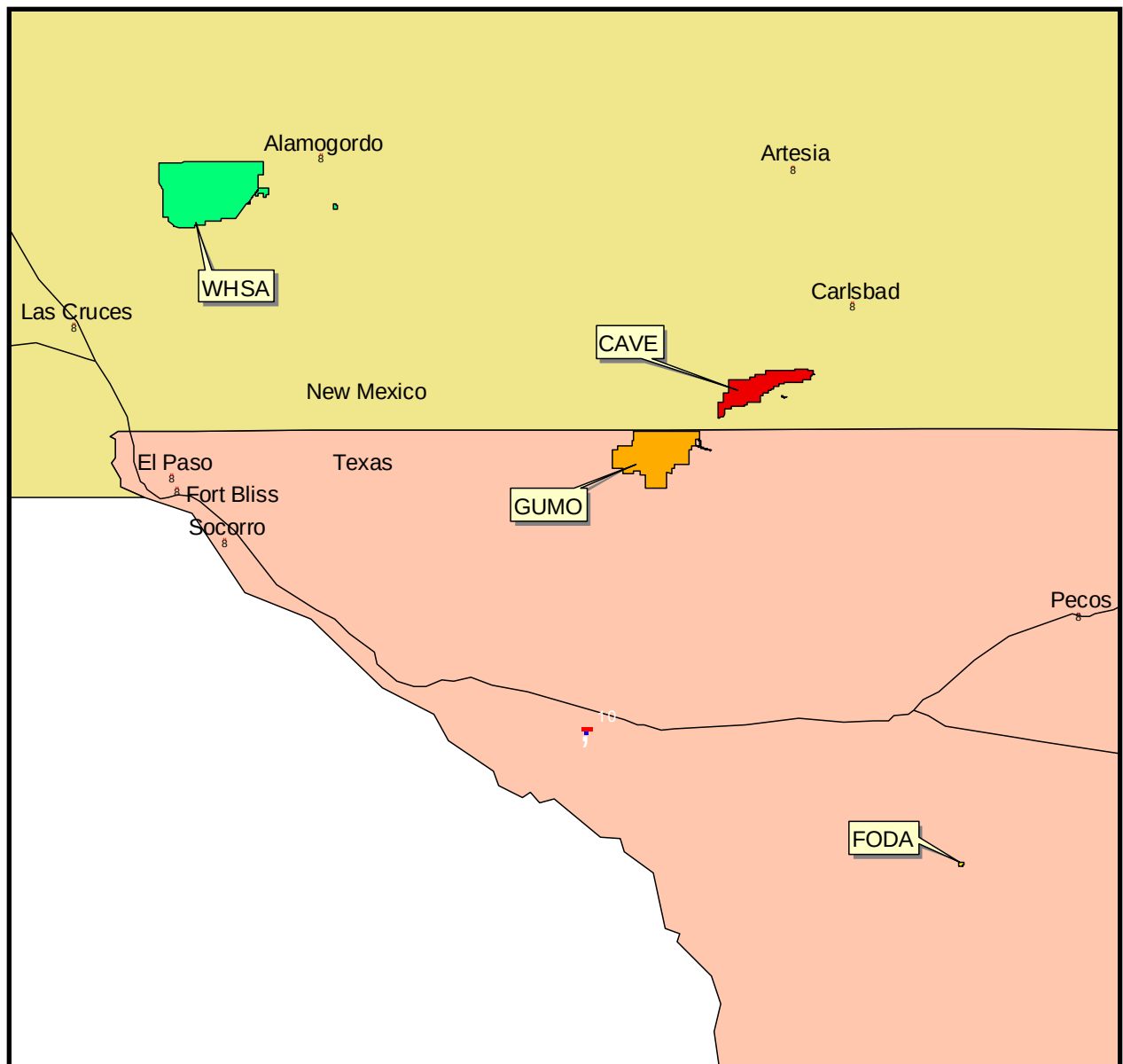


Figure 1. Locations of the four Chihuahuan Desert Network Park unit study sites.

CAVE=Carlsbad Caverns National Park; FODA=Fort Davis National Historic Site; GUMO=Guadalupe Mountains National Park; WHSA=White Sands National Monument.

Table 1. List of parks and inventory sites included in the project.

Park	Site	Abbrev.	Survey type	No. stations/ area (ha)
Carlsbad Caverns NP (CAVE)	Rattlesnake Springs	RASP	Point count transect	9
	Walnut Canyon	WACA	Point count transect	11
	Grammer Seep	GRSE	Area search	0.13
	Oak Spring	OASP	Area search	0.15
Guadalupe Mountains NP (GUMO)	North McKittrick Canyon	NMCK	Point count transect	5
	South McKittrick Canyon	SMCK	Point count transect	8
	East McKittrick Canyon	EMCK	Point count transect	11
	Guadalupe Canyon Spring	GUCS	Area search	3.7
	Choza Spring	CHSP	Area search	4.2
Fort Davis National Historic Site (FODA)	Hospital Canyon	HOCA	Point count transect	7
	Mesquite Grassland	MEGR	Area search	8.5
White Sands National Monument (WHSA)	Andrecito Creek	ANCR	Point count transect	12
	Headquarters	HEQU	Area search	4

Every bird detected during a 5 minute survey period was recorded in one of four categories:

- Typical detection 0 to 50 m: birds up to top of vegetation/canopy, <50 m from the station center point.
- Typical detection >50 m: birds up to top of vegetation or canopy, >50 m from the station center point.
- Fly-over associated: birds above top of vegetation or canopy but are associated with the local habitat, e.g., a swallow foraging above the canopy.
- Fly-over independent: birds above top of vegetation or canopy and, in the observer's judgment, are unassociated with the local habitat.

Juveniles and birds that flushed before or after the count and were not detected during the count were recorded separately. After a count was completed, attempts were made to identify all birds with questionable identity. We used the U.S. Geological Survey's North American Bird Banding Manual four letter code system for bird species on data sheets and the digital database (<http://www.pwrc.usgs.gov/BBL/manual/speclist.cfm>). Following each point count transect survey, the observer retraced the route in reverse listing all of the species observed along the way.

In comparisons of point count transects, bird detections were categorized as follows. Typical detections and detections of flyovers associated with the site were regarded as birds detected in the survey area and included in relative abundance estimates. Birds detected flying over a site and not associated with the habitat, birds flushed before or after the beginning of a point count, and birds detected between points were considered incidental detections. There were two other categories of incidental detections – return surveys of a site following the point count survey and any additional informal site visits that were made during the project.

Area Search Surveys

A timed area search technique was used to survey the smaller sized and fragmented study sites (Ralph et al. 1993). For each study site a general route was followed in all surveys, but the observer was allowed to deviate from the course in order to pursue and identify birds. Birds were recorded as present within or outside the survey area based on the location of the bird when initially detected. Birds in flight not originating from or entering the site that were not associated with the habitat (e.g., a swallow foraging above the trees) were considered flyovers.

Sampling Schedule

Sampling was conducted during migration and breeding seasons over the three year period beginning summer 2004 and ending with final surveys in summer 2006 (Table 2). Spring migration periods were in April and May, and the fall migration periods in September and October. An early-to-mid June period sampled the local breeding bird community. Priority sites were surveyed more frequently than others. For the very limited habitat at the Oak Spring and Grammer Seep sites, only single surveys were performed in conjunction with site evaluations.

In 2004, surveys were performed at ANCR and HEQU (WHA) in summer and fall. Fall surveys also were performed at WACA, OASP and GRSE (CAVE); EMCK, SMCK, and NMCK (GUMO); and in HOCA and MEGR (FODA).

For the 2005 survey effort, the spring and fall survey seasons were divided into early and late periods in order to sample more intensively the migration periods when variability in bird numbers and community composition was greatest. At all point count transect sites except Walnut Canyon (CAVE) and Andrecito Creek (WHA), we conducted surveys during each of the five periods. At area search sites we conducted at least two surveys per area. Early spring surveys were performed at all sites except Choza Spring and Guadalupe Spring/Canyon at GUMO, Walnut Canyon at CAVE, and the Housing and Visitor's Center and Andrecito Creek at WHA. Late spring and breeding season surveys were completed at all sites, and fall surveys were conducted at all sites except Guadalupe Spring/Canyon at GUMO and the Housing and Visitor's Center and Andrecito Creek at WHA (where only early fall surveys were conducted).

In 2006, spring and summer surveys were conducted at WACA and RASP (CAVE); and NMCK, SMCK, and EMCK (GUMO). Early spring, late spring and summer surveys were performed at HOCA and MEGR (FODA).

Data Analysis

Bird species lists were compiled for the overall project, park units, and individual sampling sites based on project surveys and incidental observations. We categorized bird species according to their association with wetland and riparian habitat: open water/wetland, riparian obligate, facultative riparian, generalist/unassociated (Hunter et al. 1987, Rich 2002, Bureau of Land Management no date). For the project and individual sites we highlighted Species of Concern that included federally and state (New Mexico and Texas) listed Threatened and Endangered species, Birds of Conservation Concern for Bird Conservation Region #35 Chihuahuan Desert-U.S portion (U.S. Fish and Wildl. Serv. 2002).

To relate our findings with the current state of knowledge regarding avian communities at project study sites, we accumulated all known literature of past studies and existing species lists

associated with the areas. Site specific inventories were only available for Choza Spring (Anderson and Mueller 2003) and the McKittrick Canyon areas (Newman 1983) at GUMO. For other sites we relied on regional or park unit lists.

CAVE – A park species list compiled in 1992 by the Carlsbad Caverns Guadalupe Mountains Association (1992) included 331 species, however, the Solitary Vireo and Rufous-sided Towhee had not been split at that time. In addition, species have been added to the list and currently totals over 350 species.

FODA - There has been no previous study of the avian communities for FODA specifically but general species lists have been compiled for the Trans-Pecos and the Davis Mountain regions (Espy and Williams 1991, Bryan et al. 1997, Peterson and Zimmer 1998) as well as studies of a more limited scope in more restricted portions of the Davis Mountains (Scudday 1973, Peterson 1978, Hedges and Bryan 1999).

GUMO – The latest species list, including 303 species, was produced by Carlsbad Caverns Guadalupe Mountains Association (1997) as a revised edition of an earlier list compiled by Newman (1983). Also, documented but not published observations of species during organized field trips were recorded by the Texas Ornithological Society (TOS Bird Walks from 5/7 and 5/8/2004 D. Bieri).

WHSA – The most recent WHSA checklist of birds includes 210 species that have been reported within monument boundaries (Southwest Parks and Monuments Association 1993). Additionally, an employee residing at the park compiled a species list for the headquarters complex during the period of 1996-1997.

For analysis of point count transect data, we used the likelihood and information theoretic approaches of Burnham and Anderson (2002) as data were derived from counts of bird abundances and there was no randomization involved. Each point was assumed to be an independent Poisson event and points within a site and time period were considered to be identically distributed, *i.e.*, equal rates within site and time. Counts or relative abundance were expressed as number per point and, likewise, richness was expressed as number of species observed per point. As expected, counts showed over-dispersion, ($\hat{c}=1.696$, 395 *df*) and richness variables showed under-dispersion ($\hat{c}=0.683$, 395 *df*). Differences between sites and between years were tested using computed deviance which is twice the difference between the likelihood of the reduced model which assumes equal means, and the full model which assumes the means are different. Significance (p-value) for deviance values were computed using the fact that deviance is approximately distributed as a chi-square variable with degrees of freedom equal to the difference in number of parameters. We looked at differences between early and late portions of any one season, differences among years within sites, and differences between sites assuming equal and unequal years. All tests assumed unique rates between spring, summer, and fall season.

Table 2. Surveys completed for the inventory of birds in riparian habitats at four Chihuahuan Desert Network Parks, National Park Service, 2004-2006.

2004

Site	Breeding Season	Fall Migration
	Jun. 5 - 15	Sep. 10 - Oct. 20
Carlsbad Caverns NP		
Oak Spring	--	X
Grammer Seep	--	X
Rattlesnake Springs	--	--
Walnut Canyon	--	X
Fort Davis NHS		
Hospital Canyon Point Count	--	X
Hospital Canyon Area Search	--	X
Mesquite Grassland	--	X
Guadalupe Mountains NP		
Choza Spring	--	--
Guadalupe Spring/ Guadalupe Canyon	--	--
East McKittrick Canyon	--	X
North McKittrick Canyon	--	X
South McKittrick Canyon	--	X
White Sands NM		
Andrecito Creek	X	X
Headquarters & Visitor's Center	X	X

Table 2... cont'd.

2005

Site	Spring Migration 1	Spring Migration 2	Breeding Season	Fall Migration 1	Fall Migration 2
	(Apr 20-30)	(May 10-20)	(Jun 5-15)	(Sep 10-25)	(Oct 5-20)
Carlsbad Caverns NP					
Rattlesnake Springs	X	X	X	X	X
Walnut Canyon	--	X	X	X	X
Fort Davis NHS					
Hospital Canyon Point Count	X	X	X	X	X
Hospital Canyon Area Search	X	X	X	X	X
Mesquite Grassland	X	X	X	X	X
Guadalupe Mountains NP					
Choza Spring	--	X	X	X	X
Guadalupe Canyon/ Guadalupe Spring	--	X	X	--	--
East McKittrick Canyon	X	X	X	X	X
North McKittrick Canyon	X	X	X	X	X
South McKittrick Canyon	X	X	X	X	X
White Sands NM					
Andrecito Creek	--	X	X	X	--
Headquarters & Visitor's Center	--	X	X	X	--

Table 2...cont'd.

2006

Site	Spring Migration 1	Spring Migration 2	Breeding Season
	(Apr 20-30)	(May 10 - May 20)	Jun. 5 - 15
Carlsbad Caverns NP			
Rattlesnake Springs	--	X	--
Walnut Canyon	--	X	X
Fort Davis NHS			
Hospital Canyon Point Count	X	X	X
Hospital Canyon Area Search	X	X	X
Mesquite Grassland	X	X	X
Guadalupe Mountains NP			
Choza Spring	--	--	--
Guadalupe Spring/ Guadalupe Canyon	--	--	--
East McKittrick Canyon	--	X	X
North McKittrick Canyon	--	X	X
South McKittrick Canyon	--	X	X
White Sands NM			
Andrecito Creek	--	--	--
Headquarters & Visitor's Center	--	--	--

Results

A total of 187 avian species were detected during the project with 155 detected during surveys and 169 species detected incidentally, 31 of which were not detected during formal surveys (Table 3). The greatest total number of species for the four parks was recorded at CAVE. We also documented the highest number of riparian obligate and facultative riparian species at this park. The lowest total number of species detected for parks occurred at FODA which, along with WHSA, also held the least number of species associated with riparian habitat (obligates and facultative users). Riparian obligate species were rare at WHSA.

By far, RASP was the most diverse site with respect to the avian community, yielding the greatest cumulative species list as well as the highest number of both obligate and facultative riparian species. A large species list also was compiled for EMCK along with relatively high numbers of riparian associated species. Few riparian bird species were recorded at the small, isolated GRSP and OASP sites. No riparian obligate species were detected at GUCS and NMCK. Incidental detections comprised significant proportions of the total species detected at CAVE, GUMO and WHSA parks. This was especially true during the migration periods. Most species known to breed in low elevation riparian systems were detected during formal surveys.

In 2005, spring migration counts were not spectacular, perhaps due to abundant precipitation and food resources for birds allowing them to use nonriparian habitats. A moderate El Niño Southern Oscillation event brought rains in the late winter/early spring of 2005 resulting in lush conditions in the Chihuahuan Desert, particularly east of the Guadalupe Mountains. This may have resulted in greater use of a wider variety of habitats for spring migrants. Casual observations noted high densities of birds in shrublands and grasslands on bajadas where food resources were unusually abundant. Ordinarily, birds will concentrate in more mesic areas with greater habitat structure. At Rattlesnake Springs, few unusual species were reported by birders in the spring 2005. Also, due to unstable weather patterns associated with the 2005 El Niño, very windy conditions throughout April and early May 2005 made early spring surveys in the GUMO and CAVE areas difficult and results of this round of surveys were somewhat compromised by these conditions. Conditions were much different in 2006. Areas were very dry during the spring and early summer of that year, especially in the Davis Mountains region and noticeably lower numbers of migrants and breeding birds were present in surveys at FODA during the corresponding survey seasons. Most breeding species appeared early at breeding sites in 2005. Territorial males for most breeding species were singing at CAVE and GUMO during the early spring surveys (late April). This phenomenon was also noted by Newman (1979) for sites at GUMO.

Table 3. Cumulative species totals recorded during the project at inventory sites.

STATE	PARK	SITE	Formal Visits	No. of species			Proportion detected in surveys
				Total	Riparian obligate	Facultative riparian	
NM	CAVE	GRSE	1	34	1	4	50.0
		OASP	1	20	1	3	75.0
		RASP	6	133	15	23	62.4
NM	CAVE	WACA	7	81	4	9	72.8
		Cumul.		151	17	23	68.2
NM	WHSA	ANCR	5	66	3	12	62.1
		HEQU	5	59	1	10	83.1
NM	WHSA	Cumul.		86	3	14	76.7
TX	FODA	HOCA	9	71	3	9	100.0
		MEGR	9	46	2	8	100.0
TX	FODA	Cumul.		80	6	11	96.3
		CHSP	4	66	4	13	95.5
TX	GUMO	GUCS	2	40	0	10	82.5
		EMCK	8	102	6	17	64.7
		NMCK	8	50	0	13	80.0
		SMCK	8	68	1	14	80.9
		Cumul.		121	6	20	82.6

Parks and Individual Sites

Carlsbad Caverns National Park

During the present study we recorded 151 species at the three CAVE sites. The greatest number of birds and facultative riparian species occurred at this park. Due mostly to the diverse riparian and wetland habitat at RASP, and the botanically rich desert scrub-arroyo riparian habitat at WACA, 36 bird species were unique to CAVE and not observed at other parks. These included water-associated species such as herons and ducks; low elevation riparian species including Bell's Vireo, Gray Catbird, Lucy's Warbler, Mississippi Kite, Painted Bunting, Varied Bunting, Willow Flycatcher, and Yellow-billed Cuckoo; eastern migrant species that occasionally occur at RASP such as Eastern Phoebe, Northern Parula, Magnolia Warbler, American Redstart, Baltimore Oriole, Northern Waterthrush, Rose-breasted Grosbeak; and other species including Peregrine Falcon, Western Meadowlark, and Hooded Oriole.

The 151 species that we detected represent about 45% of the 337 species known to occur in the park according to the latest CAVE checklist of birds (West 2004). Four species observed in this study, Common Raven, Eurasian Collared-dove, Gray Hawk, and Greater Pewee, were absent from the most recent list. There has not been a great deal of formal research pertaining to the avifauna of CAVE but portions of the park are visited by numerous birders. In his report of avifaunal changes in the Guadalupe Mountains, West (2004) provided a brief summary of avian work conducted in the Guadalupe Mountains including CAVE and GUMO. While there were certainly some earlier excursions to the area that he reported, it wasn't until the publication of Florence Merriam Bailey's *Birds of New Mexico* (1928) that detailed accounts and location

information for bird species were documented. The same year her husband, Vernon Bailey, published a report entitled *Animal Life of the Carlsbad Cavern* (Bailey 1928) which provided descriptions and lists of birds associated with life zones within areas that were later to become GUMO and CAVE. Some portions of the report made reference to specific areas, including at least one of our study sites (i.e., Oak Spring, see pp.20-21). An unpublished report compiled bird species detected at RASP in the mid-1980s noting that two-thirds of the bird species recorded in New Mexico had been recorded at or near the springs (West 1985). This list no doubt was compiled over a number of years and totaled an astounding 310 species (i.e., >90% of all species known from CAVE).

West (2004) mentioned the importance of RASP, despite its limited size, as a site with the greatest population of facultative riparian species for eastern New Mexico. However, habitat availability in southeastern NM for riparian associated species is increasing due to Bureau of Land Management riparian restoration projects on the Black and Delaware Rivers. Species such as Yellow-billed Cuckoo, Bell's Vireo, and Painted Bunting breeding in these riverine systems may be increasing in numbers as native vegetation recovers following the elimination of nonnative saltcedar and Russian olive (unpubl. data).

Grammer Seep

During the present study we observed 34 species at GRSP or 10% of all species known to occur at the park. Sixteen species were considered breeding or potential breeding, one species was a riparian obligate and four facultative riparian. Only 50% of the species total for this site was observed during the one formal survey. Unusual species detected at the site included Nashville Warbler and Yellow-headed Blackbird.

Riparian obligate species: Orange-crowned Warbler

Facultative riparian species: Bewick's Wren, Blue Grosbeak, House Wren, Western Wood-pewee

Birds of Conservation Concern: Black-chinned Sparrow

Federally listed species: none

State listed species: none

Additional species of interest: Black-chinned Sparrow, Cave Swallow, Golden Eagle, Nashville Warbler, Yellow-headed Blackbird

Oak Spring

We recorded the lowest number of bird species for all sites at this small spring. The 20 species detected represented 6% of all species known to occur at the park. Nine were considered breeding or potential breeding species, one was a riparian obligate, and three facultative riparian species.

Riparian obligate species: American Redstart

Facultative riparian species: Bewick's Wren, Black-chinned Hummingbird, Western Wood-pewee

Birds of Conservation: Concern: none

Federally listed species: none

State listed species: none

Additional species of interest: American Redstart, Cave Swallow

Rattlesnake Springs

During the present study we observed 133 species at Rattlesnake Springs, which represents approximately 39% of all species known to occur at the park (Carlsbad Caverns Guadalupe Mountains Association 1992, West 2004). Fifty species were considered breeding or potential breeding species. Fifteen species were riparian obligate and 23 facultative riparian. A large proportion of the species list was comprised by incidental observations and species detected during visits not associated with formal surveys.

There are no other published accounts specific to Rattlesnake Springs with which to compare our results, but we observed about 43% of the 310 species listed in an unpublished report compiled in the mid 1980's (West 1985). Most of the other species that we failed to detect were rare or accidental, many being eastern migrants. Scissor-tailed Flycatcher was described as common historically in the area but was not detected in this study and is considered a rare migrant. Eastern Bluebird, a species that recently was known to nest here was not observed. Common or regularly occurring birds not detected in this study included Great-horned Owl, Inca Dove, a number of species associated with open water and wetlands, and several species that winter in the area. However, most species that we did not detect were rare or accidental, many being eastern migrants.

The four species, Common Raven, Eurasian Collared-dove, Gray Hawk, and Greater Pewee, detected at RASP in the present study had not been previously reported. One Common Raven was seen in late April of 2005. It is considered rare in the Guadalupe Mountains. Eurasian Collared-dove invaded New Mexico in recent years and has rapidly spread throughout the southern portion of the state. Greater Pewee was observed during the spring of 2006. Gray Hawk was observed during spring surveys in both 2005 and 2006. The nearest known breeding site for this species is Limpia Creek in the Davis Mountains approximately 175 km to the south.

Other species of note included:

Cassin's Kingbird observed at fairly low elevation, and found nesting in cottonwoods, along with Western Kingbirds. Lucy's Warbler - in 2005 we observed at least 3 singing male Lucy's Warblers that appeared to be on occupied territories and were present until the first fall period survey. On one occasion we observed a male Lucy's Warbler examining potential nest locations (e.g., loose/sloughed bark and cavities) and more than once we observed this species carrying nest material to cavities. On the most recent CAVE bird checklist (West 2004) Lucy's Warbler is listed as "accidental," but we believe that since then this species has become a regular summer

resident of the Rattlesnake Springs area. Our observations likely represent the first documented breeding by Lucy's Warblers at CAVE.

Mississippi Kite - a juvenile/immature was present in fall 2005.

Northern Bobwhite - detected in spring, was at the western extreme of its range.

Northern Parula - observed in the fall of 2005.

Orioles - numerous pairs (at least 10) of Orchard Orioles breeding at this site. Also Bullock's, Scott's, and Hooded Orioles were observed. At least one pair of Hooded Orioles was seen in 2005.

Painted Bunting - at least 3-4 pairs were detected during surveys; also present into the fall.

Willow Flycatcher - present second spring period, singing "fitz-bew" from marshy area adjacent to the spring.

Riparian obligate species: Bell's Vireo, Belted Kingfisher, Common Yellowthroat, Gray Hawk, Lincoln's Sparrow, Lucy's Warbler, Orange-crowned Warbler, Orchard Oriole, Painted Bunting, Song Sparrow, Summer Tanager, Vermilion Flycatcher, Willow Flycatcher, Yellow Warbler, Yellow-billed Cuckoo, Yellow-breasted Chat

Facultative riparian species: American Goldfinch, Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, Bronzed Cowbird, Bullock's Oriole, Cooper's Hawk, Cordilleran Flycatcher, Gray Catbird, Hooded Oriole, House Wren, Indigo Bunting, Lesser Goldfinch, MacGillivray's Warbler, Mississippi Kite, Phainopepla, Red-naped Sapsucker, Swainson's Hawk, Tree Swallow, Warbling Vireo, Western Wood-pewee

Birds of Conservation Concern: Bell's Vireo, Cassin's Sparrow, Crissal Thrasher, Hooded Oriole, Lark Bunting, Loggerhead Shrike, Northern Harrier, Painted Bunting

Federally listed species: Yellow-billed Cuckoo (species of concern)- breeding documented

State listed species: Bell's Vireo (NM threatened), Peregrine Falcon (NM threatened)

Additional species of interest: Brown Thrasher, Bell's Vireo, Cassin's Kingbird, Cassin's Sparrow, Cave Swallow, Common Yellowthroat, Cooper's Hawk, Eurasian Collared-dove, Gray Catbird, Gray Hawk, Greater Pewee, Hooded Oriole, Lucy's Warbler, Mississippi Kite, Mountain Chickadee, Northern Bobwhite, Northern Parula, Orchard Oriole, Painted Bunting, Summer Tanager, Vermilion Flycatcher, Willow Flycatcher.

Walnut Canyon

We observed 81 species at Walnut Canyon which is 24% of all species known to occur at the park. Thirty-five species were considered breeding or potential breeding species, four species were riparian obligates and nine were facultative riparian species. In 2005, the area of an old landslide between Pt#'s 9 & 10 was heavily used by numerous species throughout the year due to the diversity and density of shrubs, varied topography, and proximity to the stream channel. During the fall of 2005, fruiting trees such as chokecherry, hackberry, and western soapberry

were being used by many bird species including Hermit Thrush and Northern Mockingbird. In 2006 Yellow-billed Cuckoos were observed at Pt#'s 1 & 6 during the second spring survey, and Cassin's Sparrows and 2 or 3 Gray Vireos were singing from shrub grassland slopes along the drainage.

In his review of avifaunal changes in the Guadalupe Mountains, West (2004) commented on the following species from Walnut Canyon:

Turkey Vulture - historically used to roost in large numbers (e.g., 50+), but no longer does so.
Golden Eagle - historically known as a nesting species (e.g., 5 sites), but not presently although one bird was detected during the breeding season in this study.

Yellow-billed Cuckoo - occurs in small numbers but breeding habitat is limited. We only detected it in the spring of 2006.

Varied Bunting was a more regularly-occurring species during the 1960s-1970s, but now is rare and often difficult to find – as we witnessed during the current study. The presence of the bunting may be influenced by precipitation levels, we observed more individuals in late summer following monsoon rains. During a late summer visit in August 2004, we observed a singing male Varied Bunting and female at Pt#8, and in another location a singing male at Pt#10. After a formal survey in September of the same year we encountered 1 adult feeding nestlings/recent fledglings. Varied Buntings were not confirmed as breeding in 2005, however two or three birds were observed in spring (near Pt#'s 6 & 8), and one was observed during the fall (near Pt#1).

Peregrine Falcon - a pair of Peregrine Falcons was observed at length near Pt#6 in the second spring survey of 2005. The female falcon was carrying a Common Nighthawk and the pair was being harassed by a group of Turkey Vultures apparently attempting to pirate the prey. The falcon pair eventually flew north-northeast toward the Grammer Seep area or beyond. Known only as a migrant to CAVE and the adjacent Lincoln National Forest since 1980, this species may be again breeding in the area.

Riparian obligate species: Lincoln's Sparrow, Orange-crowned Warbler, Summer Tanager, Varied Bunting, Yellow-billed Cuckoo

Facultative riparian species: Bewick's Wren, Black-chinned Hummingbird, Blue Grosbeak, House Wren, Lesser Goldfinch, MacGillivray's Warbler, Phainopepla, Western Wood-pewee

Birds of Conservation Concern: Black-chinned Sparrow, Cassin's Sparrow, Gray Vireo, Lark Bunting, Loggerhead Shrike, Peregrine Falcon, Varied Bunting, Yellow-billed Cuckoo

Federally listed species: Peregrine Falcon (species of concern), Yellow-billed Cuckoo (species of concern)

State listed species: Gray Vireo (NM threatened), Peregrine Falcon (NM threatened), Varied Bunting (NM threatened)

Additional species of interest: Black-chinned Sparrow, Brown Thrasher, Cassin's Sparrow, Cave Swallow, Golden Eagle, Gray Vireo, Magnolia Warbler, Mountain Chickadee, Peregrine

Falcon, Phainopepla, Summer Tanager, Upland Sandpiper, Varied Bunting, Yellow-billed Cuckoo

Table 4. Individual site results of the riparian bird inventory at CAVE, 2004-2006.

(Note: the 1st number listed is from survey observations and the number in parentheses is from incidental observations).

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Grammer Seep					
Bewick's Wren***		0 (4)			
Black-chinned Sparrow		2 (2)			
Black-tailed Gnatcatcher		0 (2)			
Black-throated Sparrow		3 (7)			
Blue Grosbeak***		2 (3)			
Blue-gray Gnatcatcher		1 (1)			
Cactus Wren		0 (1)			
Canyon Towhee		0 (3)			
Canyon Wren		1 (4)			
Cave Swallow		10 (2)			
Chipping Sparrow		2 (5)			
Cliff Swallow		0 (1)			
Common Poorwill		0 (1)			
Golden Eagle		0 (1)			
Hepatic Tanager		1 (2)			
House Finch		4 (3)			
House Wren***		0 (2)			
Ladder-backed Woodpecker		0 (1)			
Mourning Dove		4 (4)			
Nashville Warbler		1 (1)			
Orange-crowned Warbler**		0 (3)			
Plumbeous Vireo		0 (1)			
Red-tailed Hawk		0 (1)			
Rock Wren		5 (12)			
Rufous-crowned Sparrow		4 (8)			
Scott's Oriole		0 (2)			
Townsend's Warbler		2 (2)			
Turkey Vulture		0 (1)			
Unknown Empidonax		0 (1)			
Western Wood-pewee		1 (2)			

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
White-winged Dove		0 (1)			
Wilson's Warbler		0 (5)			
Yellow-headed Blackbird		8 (8)			
Yellow-rumped Warbler		2 (2)			
Oak Spring					
American Redstart**		1 (1)			
Bewick's Wren***		3 (4)			
Black-chinned Hummingbird***		0 (1)			
Black-throated Sparrow		0 (1)			
Canyon Wren		1 (1)			
Cave Swallow		2 (3)			
Chipping Sparrow		2 (5)			
Greater Roadrunner		1 (1)			
Hepatic Tanager		0 (1)			
Hermit Thrush		1 (1)			
Ladder-backed Woodpecker		2 (3)			
Mourning Dove		34 (34)			
Rock Wren		4 (4)			
Rufous-crowned Sparrow		0 (2)			
Townsend's Warbler		3 (3)			
Turkey Vulture		5 (2)			
Unknown Swallow		0 (2)			
Western Kingbird		1 (1)			
Western Tanager		2 (2)			
Western Wood-pewee		1 (1)			
Rattlesnake Springs					
American Goldfinch***		1 (0)	3 (5)		
Ash-throated Flycatcher	6 (2)		1 (7)	0 (5)	
Baltimore Oriole			0 (1)		
Barn Swallow	4 (6)	1 (5)	9 (27)	0 (2)	
Bell's Vireo**	6 (11)	3 (13)	19 (22)	0 (2)	
Belted Kingfisher**		0 (1)			
Bewick's Wren***	1 (0)	19 (11)	8 (14)	0 (1)	0 (1)
Black Phoebe		8 (9)			
Black-chinned	3 (2)	0 (3)	12 (15)	0 (1)	

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Hummingbird***					
Black-headed Grosbeak***		0 (1)	1 (2)		
Black-tailed Gnatcatcher		0 (1)			
Black-throated Sparrow		3 (0)	4 (1)	0 (1)	
Blue Grosbeak***	2 (7)	4 (5)	7 (8)	0 (2)	
Blue-gray Gnatcatcher		0 (1)	0 (1)		
Brewer's Blackbird		1 (2)	1 (13)		
Brewer's Sparrow		1 (3)	0 (7)		0 (1)
Broad-tailed Hummingbird			0 (1)		
Bronzed Cowbird***			0 (3)		
Brown Thrasher		4 (0)	0 (1)		
Brown-headed Cowbird	10 (11)		13 (29)	0 (1)	
Bullock's Oriole***	0 (1)		11 (7)		
Bushtit		0 (4)			
Cactus Wren		0 (1)	5 (0)		
Cassin's Kingbird	0 (2)	1 (4)	4 (13)	0 (1)	
Cassin's Sparrow		1 (1)	0 (1)	0 (1)	
Cassin's Vireo			4 (0)		
Cave Swallow	2 (1)	0 (2)	0 (2)	0 (1)	
Cedar Waxwing			0 (114)		0 (1)
Chipping Sparrow		2 (11)	7 (7)		
Clay-colored Sparrow		0 (1)			
Cliff Swallow		13 (13)	0 (1)		
Common Nighthawk	0 (1)		0 (6)	0 (1)	
Common Raven			0 (1)		
Common Yellowthroat**	0 (2)	0 (2)	5 (4)	0 (1)	
Cooper's Hawk***	0 (1)	2 (6)	0 (1)		
Cordilleran Flycatcher***			0 (1)		
Crissal Thrasher		0 (2)	0 (1)		
Dark-eyed Junco		0 (1)	0 (2)		0 (1)
Dickcissel		0 (1)			
Dusky Flycatcher			2 (1)		
Eastern Phoebe					0 (1)
Eurasian Collared Dove			0 (1)		
Gray Catbird***		0 (3)	1 (1)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Gray Hawk**			0 (2)		
Great Blue Heron		0 (2)	0 (1)		
Great Horned Owl	0 (2)	0 (5)	0 (1)		
Greater Pewee			0 (1)		
Greater Roadrunner	1 (1)	0 (1)	3 (2)		
Great-tailed Grackle	1 (1)	3 (1)	0 (2)		
Green-tailed Towhee		2 (4)			
Hepatic Tanager		0 (2)			
Hermit Thrush		1 (3)	0 (3)		0 (1)
Hooded Oriole***			1 (8)		
House Finch	11 (8)	5 (17)	45 (40)	0 (2)	
House Sparrow			0 (2)		
House Wren***		0 (5)	5 (3)		
Indigo Bunting***	0 (1)		2 (1)	0 (2)	
Killdeer	0 (2)	0 (7)	0 (5)		
Ladder-backed Woodpecker	2 (3)	1 (12)	2 (9)	0 (2)	
Lark Bunting		0 (13)			
Lark Sparrow	0 (2)	0 (1)	0 (3)	0 (3)	
Lesser Goldfinch***	13 (9)	13 (19)	10 (30)	0 (2)	0 (1)
Lesser Nighthawk	0 (1)				
Lesser Scaup					0 (1)
Lincoln's Sparrow		2 (3)	1 (0)		
Loggerhead Shrike		4 (1)			
Lucy's Warbler	2 (2)	0 (1)	4 (6)	0 (2)	
MacGillivray's Warbler		0 (1)	0 (5)		
Mallard		0 (10)			
Marsh Wren		2 (9)			
Mississippi Kite***		1 (0)			
Mountain Chickadee					0 (2)
Mourning Dove	7 (3)	18 (20)	38 (41)	0 (3)	
Northern Bobwhite		0 (1)			
Northern Cardinal	14 (8)	17 (26)	30 (34)	0 (2)	0 (1)
Northern Flicker (red-shafted)		0 (5)	2 (0)		0 (1)
Northern Harrier		0 (1)			
Northern Mockingbird	6 (6)	0 (3)	13 (25)	0 (2)	

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Northern Parula		0 (1)			
Northern Rough-winged Swallow		0 (1)	2 (0)		
Northern Waterthrush		2 (0)			
Olive-sided Flycatcher		0 (2)	0 (5)		
Orange-crowned Warbler**		2 (5)			
Orchard Oriole**	2 (4)		18 (15)	0 (2)	
Painted Bunting**	3 (4)	0 (2)	4 (7)	0 (1)	
Phainopepla***			0 (1)		
Pine Siskin	0 (1)	0 (4)	9 (20)		
Plumbeous Vireo		0 (1)	4 (3)		
Pyrrhuloxia	1 (0)	0 (1)		0 (1)	
Red-naped Sapsucker***		4 (3)	1 (2)		
Red-tailed Hawk		2 (8)	0 (1)		0 (1)
Red-winged Blackbird			0 (4)		
Ring-necked Duck*			0 (3)		
Rock Wren		1 (0)			
Rose-breasted Grosbeak			2 (0)		
Ruby-crowned Kinglet		11 (6)	2 (2)		0 (1)
Say's Phoebe	0 (4)	4 (7)	0 (14)	0 (1)	0 (1)
Scaled Quail	2 (1)	0 (6)	3 (11)		0 (1)
Sharp-shinned Hawk		2 (1)			0 (1)
Song Sparrow**			0 (2)		
Spotted Towhee		4 (2)	1 (0)		0 (1)
Summer Tanager**	10 (4)	10 (10)	18 (29)	0 (3)	
Swainson's Hawk	2 (0)	0 (3)	2 (7)		
Swainson's Thrush			0 (2)		
Townsend's Warbler		0 (1)			
Tree Swallow***			0 (2)		
Turkey Vulture	0 (2)	18 (16)	0 (33)	0 (2)	
Unknown Empidonax				0 (3)	
Unknown Heron (Tri-colored/Little-blue)*		0 (1)			
Unknown Oriole			1 (0)		
Unknown Swallow		0 (1)			
Unknown Warbler		3 (0)			

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Verdin	0 (1)	9 (4)	6 (3)	0 (1)	
Vermilion Flycatcher	5 (3)	3 (7)	14 (23)	0 (2)	
Virginia's Warbler		0 (1)			
Warbling Vireo***		0 (2)	1 (4)		
Western Kingbird	7 (8)	0 (3)	26 (31)	0 (1)	
Western Meadowlark		0 (1)			
Western Tanager		1 (5)	6 (5)	0 (1)	
Western Wood-pewee	0 (1)	1 (10)	13 (22)	0 (2)	
White-breasted Nuthatch		0 (2)			
White-crowned Sparrow		1 (2)	14 (20)		0 (1)
White-throated Swift		0 (1)	0 (2)		
White-winged Dove	4 (3)	3 (8)	39 (21)	0 (2)	
Wild Turkey	0 (2)	2 (33)	4 (3)		
Willow Flycatcher**		0 (2)		0 (1)	
Wilson's Snipe*			0 (1)		
Wilson's Warbler		6 (8)	12 (16)		
Yellow Warbler**			6 (11)	0 (1)	
Yellow-bellied Sapsucker		2 (1)			
Yellow-billed Cuckoo**	2 (5)	5 (6)	0 (8)	0 (3)	
Yellow-breasted Chat**	15 (10)	5 (7)	38 (31)	0 (2)	
Yellow-rumped Warbler		17 (15)	10 (25)		
Walnut Canyon					
American Kestrel		1 (0)			
Ash-throated Flycatcher	15 (2)	0 (1)	11 (12)		
Bewick's Wren***	8 (1)	33 (17)	9 (26)		
Black-chinned Hummingbird***	3 (1)	2 (0)	8 (9)		
Black-chinned Sparrow		2 (1)			
Black-throated Sparrow	19 (7)	41 (38)	29 (42)		
Blue Grosbeak***	15 (1)	12 (7)	12 (25)		
Blue-gray Gnatcatcher	6 (0)	1 (2)	0 (7)		
Brewer's Blackbird		0 (14)			
Brewer's Sparrow		7 (5)			
Broad-tailed Hummingbird			2 (1)		
Brown Thrasher	2 (0)				
Brown-headed Cowbird	9 (0)		15 (17)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Cactus Wren	7 (4)	15 (12)	12 (11)		
Canyon Towhee	8 (2)	29 (20)	5 (12)		
Canyon Wren	29 (5)	30 (18)	39 (34)		
Cassin's Sparrow		4 (4)			
Cave Swallow	32 (3)	0 (3)	0 (140)		
Chipping Sparrow		11 (15)			
Clay-colored Sparrow		6 (0)			
Cliff Swallow	4 (4)	0 (2)	2 (4)		
Common Poorwill		0 (1)			
Dark-eyed Junco		0 (1)			
Golden Eagle	0 (1)				
Gray Vireo	6 (0)		3 (9)		
Greater Roadrunner		0 (1)			
Green-tailed Towhee		8 (5)	2 (0)		
Hammond's Flycatcher		0 (1)			
Hepatic Tanager		1 (0)			
Hermit Thrush		10 (2)	0 (1)		
House Finch	4 (3)	5 (8)	11 (15)		
House Wren***		2 (4)	0 (2)		
Ladder-backed Woodpecker	8 (3)	12 (11)	3 (10)		
Lark Bunting		0 (1)			
Lark Sparrow			0 (1)		
Lesser Goldfinch***	0 (2)	0 (1)	5 (7)		
Lincoln's Sparrow		3 (7)			
Loggerhead Shrike		4 (5)			
MacGillivray's Warbler			4 (0)		
Magnolia Warbler		0 (1)			
Mountain Chickadee		1 (1)			
Mourning Dove	14 (3)	7 (16)	11 (10)		
Nashville Warbler		0 (1)			
Northern Cardinal	4 (0)	1 (0)			
Northern Mockingbird	28 (6)	10 (6)	24 (43)		
Olive-sided Flycatcher			1 (0)		
Orange-crowned Warbler**		2 (4)			
Peregrine Falcon	0 (2)				

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Phainopepla***	2 (0)		11 (9)		
Pine Siskin			0 (3)		
Plumbeous Vireo			0 (1)		
Pyrrhuloxia		14 (5)	4 (3)		
Red-naped Sapsucker***		0 ()			
Red-tailed Hawk	0 (1)	0 (3)	0 (2)		
Rock Wren	16 (14)	54 (31)	17 (36)		
Ruby-crowned Kinglet		8 (5)			
Rufous-crowned Sparrow	12 (3)	15 (12)	15 (33)		
Sage Thrasher		0 (2)			
Say's Phoebe	5 (0)	1 (0)	2 (2)		
Scaled Quail	17 (1)	12 (3)	22 (22)		
Scott's Oriole	21 (2)	30 (19)	12 (17)		
Spotted Towhee		2 (2)			
Summer Tanager**	4 (0)		2 (3)		
Townsend's Warbler		2 (6)			
Turkey Vulture	2 (19)	2 (10)	0 (41)		
Unknown Empidonax		0 (3)			
Unknown Swallow	1 (1)	0 (1)	3 (10)		
Unknown Warbler		0 (1)			
Upland Sandpiper		0 (3)			
Varied Bunting**		0 (1)	0 (4)		
Verdin		0 (1)	3 (2)		
Virginia's Warbler		0 (1)			
Western Kingbird			2 (3)		
Western Tanager		18 (6)	4 (3)		
Western Wood-pewee		3 (0)	0 (1)		
White-crowned Sparrow		8 (0)			
White-throated Swift	0 (1)		0 (1)		
White-winged Dove		1 (1)	3 (1)		
Wilson's Warbler		27 (7)	0 (1)		
Yellow-billed Cuckoo**	10 (0)		0 (7)		
Yellow-rumped Warbler		4 (5)			

*Wetland species

**Riparian Obligate species

***Facultative Riparian species

Fort Davis National Historic Site

A total of 80 species were detected at FODA including five species, Acorn Woodpecker, Black-crested Titmouse, Common Black Hawk, Montezuma Quail, and Zone-tailed Hawk, not detected at other parks. Included in the park list were 6 riparian obligates and 11 facultative riparian species.

There have been no previous studies related to avian communities at FODA specifically but comprehensive species lists have been compiled and updated for the Trans-Pecos and the Davis Mountain regions (Bryan et al. 1997, Peterson and Zimmer 1998) as well studies of a more limited scope in the Davis Mountains (Scudday 1973, Peterson 1978, Espy and Williams 1984 and 1991, Bryan et al. 1997, Hedges and Bryan 1999). Bryan et al. (1997) compiled a checklist of 253 species for Davis Mountains State Park and vicinity, including the town of Fort Davis and FODA. The checklist was derived from previous editions and extensive field work conducted over many years. The 80 species recorded in this study comprised 32% of that checklist with no new species added as a result of our surveys.

Cottonwood Grove/Hospital Canyon

Seventy-two of the 80 species documented in FODA were observed in the Hospital Canyon surveys. Forty-two species were considered breeding or potential breeding species for the park. Three species detected were riparian obligates and nine others were facultative riparian species. No unusual migrants or vagrants were reported during surveys. This is the only study site where Black-crested Titmouse and Montezuma Quail were detected. In recent years, Black-crested Titmouse had been seen in McKittrick Canyon some 100 miles to the north, but was not detected there in this study. Montezuma Quail historically occurred in the Guadalupe Mountains to elevations as low as Carlsbad Cavern. A pair of Western Wood-pewees was found nesting in the cottonwood grove at station 1 on July 10, 2006. There are no known records for this species nesting in Fort Davis or in the adjacent state park; the pewees typically nest at higher elevations in the pine oak forest of Davis Mountains (K. Bryan, pers. comm.). Black-headed Grosbeak - one pair in Hospital Canyon in July of 2006 may have been potential breeders at low elevation or early post breeding dispersal. This species also typically nests at higher elevations than FODA.

Riparian obligate species: Lincoln's Sparrow, Orange-crowned Warbler, Orchard Oriole, Summer Tanager, Vermilion Flycatcher

Facultative riparian species: Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, Cooper's Hawk, House Wren, Lesser Goldfinch, Phainopepla, Western Wood-pewee

Birds of Conservation Concern: Black-chinned Sparrow, Cassin's Sparrow

Federally listed species: none

State listed species: none

Additional species of interest: Black-chinned Sparrow, Black-crested Titmouse, Black-headed Grosbeak, Cassin's Sparrow, Cooper's Hawk, Eurasian Collared-dove, European Starling, Montezuma Quail, Orchard Oriole, Phainopepla, Summer Tanager, Vermilion Flycatcher

Mesquite Grassland

A total of 46 species were observed at this site during the project. Thirty-four species were considered breeding or potentially breeding species for the area. Surveys here contributed few additional species to the park list for the project. Common Black Hawk, Gray Hawk and Zone-tailed Hawk were only detected during the Mesquite Grassland surveys but are riparian associated species and were not present in the riparian survey area.

Riparian obligate species: Common Black-hawk, Gray Hawk, Lincoln's Sparrow

Facultative riparian species: Bewick's Wren, Black-chinned Hummingbird, Blue Grosbeak, Indigo Bunting, Lesser Goldfinch, Phainopepla, Western Wood-pewee, Zone-tailed Hawk

Birds of Conservation Concern: Cassin's Sparrow, Common Black-hawk, Loggerhead Shrike

Federally listed species: none

State listed species: Common Black-hawk (TX threatened), Gray Hawk (TX threatened), Zone-tailed Hawk (TX threatened)

Additional species of interest: Cassin's Sparrow, Common Black-hawk, Gray Hawk, Indigo Bunting, Phainopepla, Western Wood-pewee, Zone-tailed hawk

Bronzed cowbird - including one adult male and five of unknown age and sex were detected flying over the mesquite grassland in July 2006.

Western Kingbird – observed in spring and breeding season.

Table 5. Individual site results of the riparian bird inventory at FODA, 2004-2006.

(Note: the 1st number listed is from survey observations and the number in parentheses is from incidental observations.)

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Hospital Canyon (Point Count)					
Acorn woodpecker	4 (0)	1 (0)	5 (1)		
American Kestrel	4 (0)		1 (0)		
Ash-throated Flycatcher	7 (1)		11 (4)		
Barn Swallow	2 (6)		1 (8)		
Bewick's Wren***	10 (0)	7 (1)	24 (2)		
Black-chinned Hummingbird***	6 (3)	1 (0)	10 (2)		
Black-chinned Sparrow		2 (0)			
Black-crested Titmouse	2 (0)	1 (0)	11 (0)		
Black-headed Grosbeak***	0 (2)		3 (0)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Black-throated Sparrow	0 (1)	1 (0)	3 (3)		
Blue Grosbeak***	11 (1)	3 (0)	10 (3)		
Brewer's Blackbird		0 (1)			
Broad-tailed Hummingbird		0 (1)			
Brown-headed Cowbird	4 (2)		8 (0)		
Bushtit	23 (0)	12 (0)	11 (1)		
Cactus Wren	7 (0)	13 (0)	24 (0)		
Canyon Towhee	4 (0)	29 (0)	28 (12)		
Canyon Wren	13 (0)	17 (0)	16 (1)		
Cassin's Kingbird	20 (1)	16 (0)	38 (2)		
Cassin's Sparrow		6 (1)	0 (1)		
Chipping Sparrow		23 (0)	3 (0)		
Clay-colored Sparrow		1 (0)			
Cliff Swallow	0 (2)		0 (5)		
Common Raven		0 (2)			
Cooper's Hawk***	1 (0)	0 (1)			
Curve-billed Thrasher			8 (2)		
Dusky Flycatcher			3 (0)		
Eastern Meadowlark			2 (0)		
Eurasian Collared-dove	1 (0)		5 (0)		
European Starling		4 (0)	6 (0)		
Gray Flycatcher			2 (1)		
Greater Roadrunner	2 (0)				
Green-tailed Towhee		8 (0)	1 (1)		
Hermit Thrush		4 (0)			
House Finch	7 (3)	1 (2)	5 (3)		
House Wren***		4 (0)	0 (1)		
Killdeer		0 (1)			
Ladder-backed Woodpecker		8 (0)	9 (1)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Lark Sparrow	0 (3)		1 (6)		
Lesser Goldfinch***	17 (0)	19 (0)	1 (3)		
Lincoln's Sparrow		5 (0)	1 (0)		
Montezuma Quail			4 (1)		
Mourning Dove	1 (0)	1 (2)	9 (1)		
Northern Cardinal	6 (0)	4 (0)	10 (1)		
Northern Flicker (red-shafted)		1 (0)			
Northern Mockingbird	10 (1)	6 (0)	29 (5)		
Orange-crowned Warbler**		2 (1)			
Orchard Oriole**			3 (0)		
Phainopepla**	21 (0)	9 (0)	57 (7)		
Pine Siskin		0 (1)			
Pyrhuloxia		2 (0)	1 (0)		
Red-breasted Nuthatch			1 (0)		
Red-tailed Hawk	1 (0)	0 (1)	1 (0)		
Rock Wren	3 (1)	21 (0)	6 (3)		
Ruby-crowned Kinglet		14 (0)			
Rufous Hummingbird		6 (0)			
Rufous-crowned Sparrow	2 (0)	4 (0)	10 (1)		
Say's Phoebe	2 (0)	1 (1)	9 (1)		
Scott's Oriole	4 (0)	2 (0)	7 (1)		
Summer Tanager**	2 (0)	1 (0)	17 (0)		
Townsend's Warbler		1 (0)			
Turkey Vulture	0 (2)		0 (11)		
Verdin	4 (0)	3 (0)	9 (2)		
Vermilion Flycatcher			3 (0)		
Violet-green Swallow	1 (0)				
Western Scrub-jay	1 (0)		7 (0)		
Western Tanager		4 (0)	7 (0)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Western Wood-pewee	4 (0)		0 (1)		
White-crowned Sparrow			2 (0)		
White-winged Dove	7 (1)	0 (2)	35 (0)		
Wilson's Warbler		6 (0)	5 (2)		
Yellow-rumped Warbler		3 (0)	29 (2)		
Mesquite Grassland					
Ash-throated Flycatcher	2 (0)		5 (0)		
Barn Swallow	8 (0)	5 (0)	7 (0)		
Bewick's Wren***		2 (0)	2 (0)		
Black-chinned Hummingbird***	2 (0)		1 (0)		
Black-throated Sparrow	5 (0)	6 (0)	11 (0)		
Blue Grosbeak***	5 (0)		5 (0)		
Brewer's Sparrow		3 (0)			
Broad-tailed Hummingbird			1 (0)		
Bronzed cowbird	0 (6)				
Bushtit			1 (0)		
Cactus Wren	5 (0)	5 (0)	15 (0)		
Canyon Towhee	5 (0)	12 (0)	17 (0)		
Canyon Wren	4 (0)	1 (0)	5 (0)		
Cassin's Kingbird	7 (0)	3 (0)	6 (0)		
Cassin's Sparrow	3 (0)	16 (0)	5 (0)		
Chipping Sparrow		23 (0)			
Clay-colored Sparrow		6 (0)			
Cliff Swallow			1 (0)		
Common Black-hawk**			1 (0)		
Curve-billed Thrasher		1 (0)	2 (0)		
Eastern Meadowlark			1 (0)		
Gray Hawk**			1 (0)		
Greater Roadrunner			1 (0)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
House Finch	5 (0)	4 (0)	19 (0)		
Indigo Bunting***	1 (0)				
Ladder-backed Woodpecker	1 (0)				
Lark Sparrow	1 (0)		2 (0)		
Lesser Goldfinch***	4 (0)	2 (0)			
Lincoln's Sparrow		2 (0)			
Loggerhead Shrike		1 (0)			
Mourning Dove	1 (0)	2 (0)	3 (0)		
Northern Cardinal	2 (0)				
Northern Mockingbird	7 (0)	3 (0)	16 (0)		
Phainopepla***			1 (0)		
Pyrhuloxia		7 (0)			
Rock Wren		12 (0)	1 (0)		
Rufous-crowned Sparrow			1 (0)		
Say's Phoebe	3 (0)				
Scott's Oriole	3 (0)		3 (0)		
Turkey Vulture	7 (0)	10 (0)	12 (0)		
Vesper Sparrow		3 (0)			
Western Kingbird.	1 (0)		2 (0)		
Western Wood-pewee			1 (0)		
White-winged Dove	1 (0)	1 (0)	7 (0)		
Wilson's Warbler			1 (0)		
Yellow-rumped Warbler		10 (0)	10 (0)		
Zone-tailed Hawk***			1 (0)		

* Wetland species

** Riparian Obligate species

*** Facultative Riparian species

Guadalupe Mountains National Park

We observed a total of 121 species at the five survey areas in this park including six riparian obligates and 20 facultative riparian species. Twenty-one species of the birds detected at GUMO were not detected at any of the other parks in this study. Most of the unique species were birds

that resided at higher elevations including Band-tailed Pigeon, Blue-throated Hummingbird, Hairy Woodpecker, Hutton's Vireo, Juniper Titmouse, Magnificent Hummingbird, Mountain Chickadee, Red-breasted Nuthatch, Red Crossbill, and Sharp-shinned Hawk, as well as some migrants that occasionally occur in the area such as Blue-headed Vireo, Carolina Wren, Hooded Warbler, Ruby-throated Hummingbird, and Swainson's Thrush.

According to the most recent report (West 2004) GUMO's bird list includes 295 species. The present study's total of 121 species represents 41% of all species known to occur at the park. We observed 4 species, Blue-headed Vireo, Carolina Wren, Hermit Warbler, and Yellow-breasted Chat not included on the most recent park bird checklists (Carlsbad Caverns Guadalupe Mountains Association 1997, West 2004). The avian community in McKittrick Canyon was a unique collection of higher elevation species including Hairy Woodpecker, Mountain Chickadee, Red-breasted Nuthatch and White-breasted Nuthatch; lower elevation riparian birds such as Bewick's Wren, Hutton's Vireo, and Summer Tanager; montane shrub species including Blue-gray Gnatcatcher, Bushtit, and Rufous-crowned Sparrow. Species historically present in the canyon that we did not observe included Acorn Woodpecker, Montezuma Quail, Western Scrub Jay, and Yellow-billed Cuckoo. Montezuma Quail historically was widespread in the Guadalupe Mountains. Despite reintroduction efforts in the mid 1980's, only occasional sightings in higher elevations have been made in recent years (F. Armstrong, pers. comm.).

More recently, Black-crested Titmouse had been reported in McKittrick Canyon (West 2004) but we did not see any individuals. The closest population is located in the Davis Mountains some 100 miles to the south.

Bailey (1928) provided some detailed accounts and location information for bird species she recorded or collected in areas later included within GUMO boundaries (e.g., Dog Canyon and Salt Flat). Later, researchers from the U.S. Fish and Wildlife Service and the Louisiana State University Museum of Zoology and others, collected bird specimens at several locations in the Guadalupe Mountains and reported on other specimens collected from the area (Burleigh and Lowery 1940). Burleigh and Lowery discussed birds mostly from areas along the Guadalupe Escarpment (e.g., Salt Flat, Pine Springs, Frijole Ranch, and Black River), but also visited areas such as The Bowl and McKittrick Canyon. Many specimens were collected from McKittrick Canyon, and some of these we did not record at our sites including species believed to no longer occur in the general area such as Whip-poor-will. They failed to observe or collect some common or regularly-occurring species from our study sites such as Black-chinned Hummingbird and Red-breasted Nuthatch. Their comments regarding the occurrence of the Gray Vireo in the Guadalupe Mountains, "The gray vireo was characteristically a bird of the lower canyons, and while this limited its distribution in this region, it was locally fairly common during the summer months", remains the current state of knowledge for the species in the area.

As part of a larger study of the composition of the breeding avifauna in woodland areas at GUMO, Newman (1979) conducted surveys at 3 sites in McKittrick Canyon during the breeding seasons of 1972, 1973, and 1974. The location and extent of our survey areas in McKittrick Canyon were nearly identical to Newman's, and while we used different survey methods, we can make inferences and comparisons regarding similarities and potential changes in the breeding bird community there since the early 1970s. A species list for GUMO was compiled in 1997

(Carlsbad Caverns Guadalupe Mountains Association 1997), and more recently West (2004) commented on changes in the avifauna at the park.

Choza Spring

During the present study we observed 66 species at this spring, 36 of which were considered breeding or potential breeding species. Four species were riparian obligates and 13 were facultative riparian species. We surveyed this site during the spring, summer, and fall of 2005. During surveys there were relatively low numbers of individuals and low diversity of species inconsistent with structural complexity and vegetation diversity. Its isolation, small size, and fragmentation by a major 4-lane highway (Highway 180/62) may be limiting factors in bird use of the area. However, we observed overall low numbers of migrants in most riparian areas surveyed in 2005.

The 66 species detected at CHSP represents 22% of all species known to occur at the park. Using a similar survey strategy (i.e., area search) between 10 Feb and 23 Dec 2002, Andersen and Mueller (2003) observed a total of 69 species at this spring. They surveyed roughly the same area over a greater seasonal extent than we did and made a total of 26 visits, while we made only 4 visits. We observed 17 species not reported by Andersen and Muller, and they recorded 21 species that we did not document. Six of those 21 species they considered to be possible breeding residents at the spring, such as Cooper's Hawk (which indeed had nested in the season prior to this study) and Band-tailed Pigeon. Andersen and Muller recorded greater species richness and relative abundance during the spring migration period (>50 spp), than during Summer (<20 spp), Fall (~25 spp) or Winter (20 spp). They stated that "The Choza Spring riparian area is likely one of the most biologically diverse sites in Guadalupe Mountains National Park" and they cautioned that Choza Spring is, "...in great danger of being impacted by a crown fire. Fuel levels are very high and thick understory vegetation, especially *Juniperus pinchotii*, would enable fire to easily spread into the woodland canopy." Birds of interest at Choza Spring included Black Phoebe (one of the few places this species breeds at GUMO); a pair of Hepatic Tanagers present from spring through fall and likely breeding at the site; a singing male Indigo Bunting observed in two successive spring surveys; Swainson's Thrush which was detected only at this site; and Yellow-breasted Chat which was is not included in the most recent park checklist.

Riparian obligate species: Lincoln's Sparrow, Orange-crowned Warbler, Song Sparrow, Summer Tanager, Yellow-breasted Chat

Facultative riparian species: American Goldfinch, Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, House Wren, Indigo Bunting, Phainopepla, Warbling Vireo, Western Wood-pewee

Birds of Conservation Concern: Cassin's Sparrow

Federally listed species: none

State listed species: none

Additional species of interest: Black Phoebe, Black-throated Gray Warbler, Cassin's Sparrow, Hepatic Tanager, Indigo Bunting, Phainopepla, Summer Tanager, Swainson's Thrush, Yellow-breasted Chat

Guadalupe Canyon/Spring

A total of 40 species (about 14% of the park species list) including 10 facultative riparian species were detected at this site. Approximately 30% of all species observed were "passage" migrants, indicating that despite its isolation and small size, it draws a fairly significant avian community. Five migrant species of Tyrannids were observed during visits. The presence of Crissal Thrasher and Verdin at this site is interesting and rather unusual in this habitat and elevation. No specific study or mention of this area was found in literature regarding the avifauna of GUMO.

Riparian obligate species: none

Facultative riparian species: Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, Calliope Hummingbird, Cordilleran Flycatcher, Lesser Goldfinch, MacGillivray's Warbler, Phainopepla, Western Wood-pewee

Federally listed species: none

State listed species: none

Birds of Conservation Concern: Black-chinned Sparrow, Crissal Thrasher

Additional species of interest: Black-chinned Sparrow, Calliope Hummingbird, Cordilleran Flycatcher, Crissal Thrasher, Dusky Flycatcher, Gray Flycatcher, Hammond's Flycatcher, Olive-sided Flycatcher, Phainopepla, Verdin

East McKittrick Canyon

During the present study we observed 102 species at EMCK, or 35% of all species known to occur at the park. Forty-five of these species were considered breeding or potential breeding species. Six riparian obligate species and 17 facultative riparian species were included in the list of species detected at EMCK. Our surveys during migration indicated that this site was less used by migrant species than might be concluded based on the habitat characteristics. This may be due to the depth and narrowness of the canyon. Also, the well-developed, diverse riparian vegetation does not extend to the mouth of the canyon. Casual observations indicated that more migrants may be moving along the base of the Guadalupe Mountains than interior canyons. However, EMCK should be considered important in terms of the breeding community that includes approximately 58 species using the diverse habitats and ecotones of riparian, oak-pine forest and desert scrub communities.

Newman (1979) reported 34 breeding species from the same general area including one species, Western Scrub-jay, which we did not record in the canyon. We observed 15 additional species not reported by Newman. Some of these are relatively common and may have been overlooked such as Black-throated Sparrow, Pyrrhuloxia, and Cactus Wren; others are scarce or of rare occurrence such as American Kestrel and Juniper Titmouse, while others such as White-winged Dove, were likely not present during Newman's study and have expanded their range into GUMO (and other areas) since the early 1970s (West 2004). Birds of interest included Belted

Kingfisher, Black-chinned Sparrow, Black Phoebe, Blue-headed Vireo, Cassin's Vireo, Cooper's Hawk, Elf Owl, Golden Eagle, Grace's Warbler, Gray Vireo, Hairy Woodpecker, Hermit Warbler, Hooded Warbler, Hutton's Vireo, Indigo Bunting, Juniper Titmouse, Magnificent Hummingbird, Red Crossbill, Red-breasted Nuthatch, Sharp-shinned Hawk, Summer Tanager, Warbling Vireo, and Yellow Warbler. Calliope Hummingbird was found to be common in both 2005 and 2006 fall migrations. This species is listed as rare or accidental (Carlsbad Caverns Guadalupe Mountains Association 1997, West 2004). Crissal Thrasher detected incidentally in September near the McKittrick Canyon parking lot represents a relatively high elevation record. Lazuli Bunting was observed in spring 2005 migration. Two observations of Ruby-throated Hummingbird were made during fall migration. Yellow-breasted Chat was not listed for GUMO previously and is a fairly high elevation record.

Riparian obligate species: Belted Kingfisher, Lincoln's Sparrow, Orange-crowned Warbler, Song Sparrow, Summer Tanager, Yellow-breasted Chat

Facultative riparian species: American Goldfinch, Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, Calliope Hummingbird, Cooper's Hawk, Cordilleran Flycatcher, Elf Owl, House Wren, Indigo Bunting, Lazuli Bunting, Lesser Goldfinch, MacGillivray's Warbler, Red-naped Sapsucker, Warbling Vireo, Western Wood-pewee

Federally listed species: none

State listed species: none

Birds of Conservation Concern: Black-chinned Sparrow, Crissal Thrasher, Elf Owl, Grace's Warbler, Gray Vireo

Additional species of interest: Belted Kingfisher, Black Phoebe, Black-chinned Sparrow, Blue-headed Vireo, Calliope Hummingbird, Cassin's Vireo, Cooper's Hawk, Crissal Thrasher, Elf Owl, Golden Eagle, Grace's Warbler, Gray Vireo, Hairy Woodpecker, Hermit Warbler, Hooded Warbler, Hutton's Vireo, Indigo Bunting, Juniper Titmouse, Lazuli Bunting, Magnificent Hummingbird, Red Crossbill, Red-breasted Nuthatch, Ruby-throated Hummingbird, Sharp-shinned Hawk, Summer Tanager, Warbling Vireo, Yellow-breasted Chat, Yellow Warbler, Yellow-bellied Sapsucker

North McKittrick Canyon

During the present study we observed 50 species at North McKittrick Canyon, or 17% of species known to occur at the park. Thirty-four of these species were considered breeding or potential breeding species. As with the other McKittrick Canyon sites, we did not detect large movements of migratory birds during spring and fall. However, this branch of the canyon does provide habitat for a number of breeding species albeit less than the other larger, more diverse sections of the McKittrick canyon. Newman (1979) reported 27 breeding species from the same general area including 3 species, Bushtit, Elf Owl, and Magnificent Hummingbird, that we did not record. We observed 9 additional species not reported by Newman. Birds of interest included Band-tailed Pigeon, Black-chinned Sparrow, Cooper's Hawk, Cordilleran Flycatcher, Grace's Warbler, Hairy Woodpecker, Phainopepla, and Warbling Vireo.

Riparian obligate species: none

Facultative riparian species: American Goldfinch, Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, Cooper's Hawk, Cordilleran Flycatcher, House Wren, Lesser Goldfinch, Phainopepla, Red-naped Sapsucker, Warbling Vireo, Western Wood-pewee

Federally listed species: none

State listed species: none

Birds of Conservation Concern: Black-chinned Sparrow, Grace's Warbler

Additional species of interest: Band-tailed Pigeon, Black-chinned Sparrow, Cooper's hawk, Cordilleran Flycatcher, Grace's Warbler, Hairy Woodpecker, Phainopepla, Warbling Vireo

South McKittrick Canyon

During the present study we observed 68 species at SMCK, or 23% of all species known to occur at the park. Thirty-eight of these species were considered breeding or potential breeding species. As with the other McKittrick Canyon sites, surveys during migration periods at SMCK did not indicate this site as a major migratory corridor (based on physical geography and location). However, because of presence of water and dense and diverse vegetation it is important as breeding habitat for at least 40 oak-pine/montane species.

Newman (1979) reported 32 breeding species from SMCK including Magnificent Hummingbird which we did not record at this site but did see in EMCK. We observed 10 additional species not reported by Newman. Birds of interest included Band-tailed Pigeon, Black-chinned Sparrow, Black-throated Gray Warbler, Blue Grosbeak, Calliope Hummingbird, Cooper's Hawk, Cordilleran Flycatcher, Elf Owl, Grace's Warbler, Gray Vireo, Hairy Woodpecker, Hooded Warbler, Red-breasted Nuthatch, Sharp-shinned Hawk, and Warbling Vireo. Carolina Wren was seen during the fall 2005 migration. Cooper's Hawk was found nesting near MCKS Pt #3.

Riparian obligate species: Lincoln's Sparrow, Orange-crowned Warbler

Facultative riparian species: Bewick's Wren, Black-chinned Hummingbird, Black-headed Grosbeak, Blue Grosbeak, Calliope Hummingbird, Cooper's Hawk, Cordilleran Flycatcher, House Wren, Lazuli Bunting, Lesser Goldfinch, Red-naped Sapsucker, Warbling Vireo, Western Wood-pewee

Federally listed birds: Mexican Spotted Owl (threatened)

State listed birds: Mexican Spotted Owl (TX threatened)

Birds of Conservation Concern: Black-chinned Sparrow, Elf Owl, Grace's Warbler, Gray Vireo

Additional species of interest: Band-tailed Pigeon, Black-chinned Sparrow, Black-throated Gray Warbler, Blue-throated Hummingbird, Calliope Hummingbird, Carolina Wren, Cooper's

Hawk, Cordilleran Flycatcher, Elf Owl, Grace's Warbler, Gray Vireo, Hairy Woodpecker, Hooded Warbler, Mexican Spotted Owl, Red-breasted Nuthatch, Sharp-shinned Hawk, Warbling Vireo

Table 6. Individual site results of the riparian bird inventory at GUMO, 2004-2006.

(Note: the 1st number listed is from survey observations and the number in parentheses is from incidental observations.)

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Choza Spring					
American Goldfinch***			1 (0)		
Ash-throated Flycatcher	1 (0)		4 (0)		
Barn Swallow			1 (0)		
Bewick's Wren***	8 (0)	9 (1)	6 (0)		
Black Phoebe	2 (0)	0 (1)	2 (0)		
Black-chinned Hummingbird***	4 (0)	1 (1)	5 (0)		
Black-headed Grosbeak***		1 (0)			
Black-tailed Gnatcatcher		1 (0)			
Black-throated Sparrow	6 (0)	0 (1)	1 (0)		
Blue Grosbeak***	4 (0)	1 (1)	5 (0)		
Blue-gray Gnatcatcher			1 (0)		
Brewer's Sparrow		14 (0)			
Broad-tailed Hummingbird			1 (0)		
Brown-headed Cowbird	1 (0)		1 (0)		
Bushtit	9 (0)		8 (0)		
Canyon Towhee	2 (0)	3 (0)	2 (0)		
Cassin's Kingbird	1 (0)		2 (0)		
Cassin's Sparrow		1 (0)			
Cassin's Vireo		0 (1)			
Cedar Waxwing		1 (0)	7 (0)		
Chipping Sparrow		33 (0)			
Cliff Swallow		1 (0)			
Common Raven	2 (0)	1 (1)			
Eastern Meadowlark			1 (0)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Greater Roadrunner		1 (0)			
Hepatic Tanager		3 (0)	2 (0)		
Hermit Thrush		3 (0)			
House Finch	4 (0)	2 (0)	8 (0)		
House Wren***		2 (0)			
Indigo Bunting***	1 (0)		1 (0)		
Ladder-backed Woodpecker	2 (0)	1 (1)			
Lesser Goldfinch***		9 (0)			
Lincoln's Sparrow		1 (0)			
MacGillivray's Warbler		1 (0)			
Mountain Chickadee		1 (0)			
Mourning Dove	6 (0)		2 (0)		
Northern Cardinal		1 (0)			
Northern Flicker (red-shafted)		1 (0)			
Northern Mockingbird	3 (0)		2 (0)		
Orange-crowned Warbler**		6 (0)			
Phainopepla***	1 (0)				
Pine Siskin		3 (0)			
Plumbeous Vireo		1 (0)			
Red-tailed Hawk		2 (1)			
Rock Wren		0 (1)			
Ruby-crowned Kinglet		10 (0)			
Rufous-crowned Sparrow		1 (0)			
Scaled Quail	1 (0)				
Scott's Oriole	1 (0)	1 (0)			
Song Sparrow**		8 (0)			
Spotted Towhee		5 (0)			
Summer Tanager**	2 (0)				
Swainson's Thrush		4 (0)	1 (0)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Townsend's Warbler		9 (0)			
Turkey Vulture	1 (0)	1 (1)			
Unknown Hummingbird		1 (0)			
Virginia's Warbler		1 (1)			
Warbling Vireo***		0 (1)	1 (0)		
Western Scrub-jay		0 (1)			
Western Tanager		6 (1)			
Western Wood-pewee		0 (1)	1 (0)		
White-throated Swift		1 (0)	1 (0)		
White-winged Dove	4 (0)	18 (0)	2 (0)		
Wilson's Warbler		2 (0)	1 (0)		
Yellow-breasted Chat**	1 (0)		1 (0)		
Yellow-rumped Warbler		18 (0)			
Guadalupe Spring/Guadalupe Canyon					
Ash-throated Flycatcher	5 (0)		2 (0)		
Bewick's Wren***		0 (1)			
Black-chinned Hummingbird***	1 (0)		4 (0)		
Black-chinned Sparrow		0 (1)			
Black-headed Grosbeak***			1 (0)		
Black-throated Sparrow	5 (0)	0 (1)	3 (0)		
Blue Grosbeak***	2 (0)	0 (1)	11 (0)		
Bushtit		0 (1)			
Cactus Wren	2 (0)	0 (1)	1 (0)		
Calliope Hummingbird***		0 (1)			
Canyon Towhee	2 (0)		1 (0)		
Canyon Wren		0 (1)	1 (0)		
Common Raven	2 (0)				
Cordilleran Flycatcher***			1 (0)		
Crissal Thrasher	2 (0)	0 (1)			

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Dusky Flycatcher			1 (0)		
Gray Flycatcher			3 (0)		
Greater Roadrunner		0 (1)			
Hammond's Flycatcher			1 (0)		
House Finch	15 (0)	0 (1)	14 (0)		
Ladder-backed Woodpecker	4 (0)	0 (1)	2 (0)		
Lark Sparrow		0 (1)	2 (0)		
Lesser Goldfinch***	7 (0)		4 (0)		
MacGillivray's Warbler			2 (0)		
Mourning Dove	5 (0)	0 (1)	5 (0)		
Northern Mockingbird	5 (0)		4 (0)		
Olive-sided Flycatcher			1 (0)		
Phainopepla***		0 (1)			
Plumbeous Vireo			3 (0)		
Rock Wren	3 (0)	0 (1)	6 (0)		
Rufous-crowned Sparrow	4 (0)	0 (1)	3 (0)		
Scaled Quail	1 (0)		1 (0)		
Scott's Oriole	1 (0)		5 (0)		
Turkey Vulture		0 (1)			
Verdin	3 (0)	0 (1)	1 (0)		
Violet-green Swallow	1 (0)				
Western Tanager		0 (1)	1 (0)		
Western Wood-pewee		0 (1)	2 (0)		
White-throated Swift	2 (0)	0 (1)			
Wilson's Warbler			1 (0)		
East McKittrick Canyon					
American Goldfinch***		0 (2)			
American Kestrel		1 (4)			
Ash-throated Flycatcher	16 (15)		5 (20)	0 (1)	

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Belted Kingfisher**		1 (1)			
Bewick's Wren***	19 (12)	15 (18)	22 (27)	0 (1)	0 (1)
Black Phoebe		1 (0)			
Black-chinned Hummingbird***	12 (4)	0 (4)	10 (11)		
Black-chinned Sparrow	14 (12)	3 (5)	17 (21)	0 (1)	
Black-headed Grosbeak***	9 (5)	1 (1)	19 (20)		
Black-throated Gray Warbler			0 (1)		
Black-throated Sparrow	1 (0)	0 (2)	0 (7)		
Blue Grosbeak***	16 (9)	0 (7)	23 (14)		
Blue-gray Gnatcatcher	14 (12)	6 (6)	18 (24)		
Blue-headed Vireo		0 (1)			
Brewer's Sparrow		0 (1)			0 (1)
Broad-tailed Hummingbird	5 (5)	4 (1)	9 (27)	0 (1)	
Brown-headed Cowbird	5 (5)		3 (12)		
Bushtit		0 (13)	6 (18)		
Cactus Wren		2 (0)		0 (1)	
Calliope Hummingbird***		19 (10)	0 (1)		
Canyon Towhee		2 (6)	4 (4)	0 (1)	
Canyon Wren	6 (8)	19 (14)	16 (21)		0 (1)
Cassin's Kingbird			0 (5)		
Cassin's Vireo		0 (1)			
Cedar Waxwing			0 (5)		
Chipping Sparrow		36 (35)	3 (7)		0 (1)
Cliff Swallow		0 (1)	0 (4)		
Common Nighthawk			0 (1)		
Common Poorwill			0 (2)	0 (1)	
Cooper's Hawk***		0 (1)	0 (1)		0 (1)
Cordilleran Flycatcher***		0 (1)			
Crissal Thrasher		0 (2)			

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Curve-billed Thrasher		0 (2)			
Dark-eyed Junco		0 (6)			0 (1)
Dusky Flycatcher			0 (2)		
Elf Owl***			0 (1)		
Golden Eagle		0 (1)	0 (3)	0 (1)	
Grace's Warbler			0 (6)		
Gray Flycatcher		0 (1)			
Gray Vireo	2 (4)	0 (1)	5 (9)		
Green-tailed Towhee		2 (2)			
Hairy Woodpecker		3 (2)			
Hepatic Tanager	10 (7)	3 (10)	10 (9)		
Hermit Thrush		6 (6)	4 (3)		0 (1)
Hermit Warbler		2 (0)			
Hooded Warbler		2 (0)			
House Finch	2 (1)	0 (4)	1 (12)	0 (1)	0 (1)
House Wren***		2 (2)	2 (4)		
Hutton's Vireo		0 (3)			
Indigo Bunting***		1 (0)			
Juniper Titmouse			2 (0)		
Ladder-backed Woodpecker	9 (5)	10 (14)	9 (14)	0 (1)	0 (1)
Lazuli Bunting***			0 (4)		
Lesser Goldfinch***	8 (5)	15 (14)	9 (20)		0 (1)
Lincoln's Sparrow		0 (2)			
MacGillivray's Warbler			2 (1)		
Magnificent Hummingbird		0 (1)			
Mountain Chickadee		2 (11)	0 (2)		
Mourning Dove	0 (2)	1 (5)	0 (10)	0 (1)	
Northern Flicker (red-shafted)		2 (5)			
Northern Mockingbird	1 (1)	0 (1)	1 (6)	0 (1)	

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Olive-sided Flycatcher		1 (0)			
Orange-crowned Warbler**		1 (0)			
Pine Siskin		0 (1)			0 (1)
Plumbeous Vireo	28 (18)	20 (16)	29 (31)		
Pyrrhuloxia		0 (2)			
Red Crossbill	2 (0)	1 (0)			
Red-breasted Nuthatch		0 (1)			
Red-naped Sapsucker***		0 (13)			
Red-tailed Hawk		1 (0)	0 (2)		
Rock Wren	1 (1)	14 (19)	8 (7)	0 (1)	0 (1)
Ruby-crowned Kinglet		18 (9)	2 (0)		
Ruby-throated Hummingbird		0 (4)			
Rufous Hummingbird		8 (6)			
Rufous-crowned Sparrow	13 (6)	11 (17)	32 (33)	0 (1)	0 (1)
Say's Phoebe	0 (1)		0 (2)		
Scott's Oriole	12 (6)	4 (4)	9 (14)	0 (1)	
Sharp-shinned Hawk		1 (1)			
Song Sparrow**		0 (1)			
Spotted Towhee	35 (17)	50 (31)	19 (24)		0 (1)
Summer Tanager**		2 (0)	3 (7)		
Townsend's Warbler		9 (6)			
Turkey Vulture		0 (2)	1 (9)		
Unknown Empidonax		2 (3)			
Unknown Hummingbird		1 (0)			
Unknown Swallow			0 (1)		
Unknown Vireo		0 (2)			
Unknown Warbler			1 (2)		
Violet-green Swallow	23 (8)		1 (11)	0 (1)	
Virginia's Warbler		0 (1)	3 (3)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Warbling Vireo***	14 (7)	0 (1)	17 (15)		
Western Kingbird			0 (4)		
Western Scrub-jay		0 (2)	0 (1)		
Western Tanager	22 (17)	13 (16)	24 (21)		
Western Wood-pewee	13 (15)	5 (7)	16 (12)		
White-breasted Nuthatch		1 (0)	0 (1)		
White-crowned Sparrow		0 (2)			0 (1)
White-throated Swift	0 (14)	0 (106)	1 (33)	0 (1)	
White-winged Dove	27 (14)	8 (7)	31 (23)	0 (1)	
Wilson's Warbler		13 (12)	4 (4)		
Yellow Warbler**		0 (1)			
Yellow-breasted Chat**			0 (2)		
Yellow-rumped Warbler		2 (13)	0 (1)		
North McKittrick Canyon					
American Goldfinch***		26 (1)			
American Kestrel	0 (1)	0 (1)	0 (1)		
Ash-throated Flycatcher	5 (4)		5 (3)		
Band-tailed Pigeon			0 (1)		
Bewick's Wren***	5 (2)	11 (4)	7 (5)		
Black-chinned Hummingbird***	2 (1)	0 (3)	6 (3)		
Black-chinned Sparrow	2 (1)	0 (2)	6 (1)		
Black-headed Grosbeak***	0 (1)	2 (0)	4 (3)		
Blue Grosbeak***	1 (1)				
Blue-gray Gnatcatcher	17 (3)	4 (2)	13 (11)		
Broad-tailed Hummingbird	1 (0)		9 (8)		
Brown-headed Cowbird	2 (0)		4 (2)		
Canyon Wren	1 (3)	7 (10)	9 (6)		
Cassin's Kingbird			1 (0)		
Chipping Sparrow		3 (8)			

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Cooper's Hawk***			0 (1)		
Cordilleran Flycatcher***		2 (1)			
Dark-eyed Junco		0 (4)			
Grace's Warbler			0 (2)		
Hairy Woodpecker		2 (2)			
Hepatic Tanager	5 (3)	4 (4)	6 (3)		
Hermit Thrush		2 (2)	0 (1)		
House Wren***		1 (1)	0 (1)		
Ladder-backed Woodpecker	5 (1)	8 (5)	2 (3)		
Lesser Goldfinch***	1 (4)	10 (8)	3 (0)		
Mountain Chickadee		0 (4)			
Northern Flicker (red-shafted)		1 (4)			
Phainopepla***	2 (0)				
Plumbeous Vireo	8 (6)	0 (3)	18 (7)		
Red-naped Sapsucker***		4 (4)			
Red-tailed Hawk		0 (1)			
Rock Wren		10 (5)			
Ruby-crowned Kinglet		4 (7)			
Rufous-crowned Sparrow	7 (2)	8 (3)	2 (2)		
Say's Phoebe		0 (1)			
Scott's Oriole	2 (1)	0 (1)	6 (1)		
Spotted Towhee	20 (9)	17 (13)	26 (12)		
Townsend's Warbler		2 (1)			
Turkey Vulture	0 (1)				
Unknown Empidonax			0 (1)		
Unknown Hummingbird			1 (0)		
Violet-green Swallow	10 (5)		6 (1)		
Virginia's Warbler			1 (1)		
Warbling Vireo***	4 (5)	0 (2)	14 (11)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Western Tanager	6 (3)	0 (7)	7 (8)		
Western Wood-pewee	8 (4)	2 (1)	13 (8)		
White-breasted Nuthatch		3 (1)			
White-throated Swift	0 (10)	0 (1)	4 (4)		
White-winged Dove	2 (1)		6 (3)		
Wilson's Warbler		3 (2)			
South McKittrick Canyon					
American Kestrel	0 (1)	0 (4)	0 (2)		
Ash-throated Flycatcher	7 (6)		8 (11)		
Band-tailed Pigeon	3 (3)		3 (4)		
Bewick's Wren***	13 (8)	6 (4)	16 (14)		
Black-chinned Hummingbird***	12 (8)	0 (1)	8 (9)		
Black-chinned Sparrow	2 (2)		6 (5)		
Black-headed Grosbeak***	3 (2)	0 (1)	24 (15)		
Blue Grosbeak***	8 (2)		0 (2)		
Blue-gray Gnatcatcher	4 (10)	0 (1)	8 (12)		
Blue-throated Hummingbird			4 (0)		
Broad-tailed Hummingbird	6 (3)		9 (10)		
Brown-headed Cowbird	2 (1)		1 (5)		
Bushtit	4 (1)		2 (9)		
Calliope Hummingbird***		12 (6)			
Canyon Wren	0 (2)	16 (19)	4 (3)		
Carolina Wren		0 (1)			
Cassin's Kingbird			2 (0)		
Chipping Sparrow		2 (6)	0 (6)		
Cooper's Hawk***	1 (1)	0 (3)			
Cordilleran Flycatcher***	2 (4)		0 (2)		
Dark-eyed Junco		0 (1)			
Grace's Warbler	4 (2)		19 (15)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Gray Flycatcher			0 (1)		
Gray Vireo		1 (1)			
Hairy Woodpecker		2 (1)	1 (0)		
Hammond's Flycatcher		0 (1)			
Hepatic Tanager	11 (11)	3 (2)	18 (15)		
Hermit Thrush		5 (9)	1 (2)		
Hooded Warbler		0 (2)			
House Finch	0 (1)		0 (1)		
House Wren***		6 (1)			
Ladder-backed Woodpecker	1 (10)	7 (6)	4 (9)		
Lazuli Bunting***			1 (0)		
Lesser Goldfinch***	8 (2)	11 (20)	8 (4)		
Lincoln's Sparrow		2 (1)			
Mountain Chickadee	0 (2)	9 (7)	0 (2)		
Mourning Dove	0 (1)	0 (5)	0 (4)		
Northern Flicker (red-shafted)		7 (7)			
Orange-crowned Warbler**		0 (1)			
Pine Siskin			10 (1)		
Plumbeous Vireo	25 (17)	8 (15)	34 (26)		
Red-breasted Nuthatch		1 (0)	3 (3)		
Red-naped Sapsucker****		1 (0)			
Red-winged Blackbird	2 (0)				
Rock Wren		6 (3)			
Ruby-crowned Kinglet		12 (7)	0 (1)		
Rufous-crowned Sparrow		6 (1)	2 (4)		
Scott's Oriole	0 (1)	2 (0)	3 (8)		
Sharp-shinned Hawk			0 (1)		
Spotted Towhee	35 (18)	10 (15)	25 (32)		
Townsend's Solitaire			0 (1)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Townsend's Warbler		0 (1)			
Turkey Vulture	0 (1)		0 (4)		
Unknown Empidonax			2 (1)		
Unknown Hawk		1 (0)			
Unknown Hummingbird		2 (4)			
Unknown Warbler		3 (0)			
Violet-green Swallow	16 (11)		17 (15)		
Virginia's Warbler	1 (0)		2 (5)		
Warbling Vireo***	18 (20)	0 (1)	25 (33)		
Western Tanager	10 (6)	2 (2)	38 (25)		
Western Wood-pewee	31 (18)	5 (3)	29 (27)		
White-breasted Nuthatch	0 (2)	5 (2)			
White-throated Swift	3 (2)	0 (2)	0 (12)		
White-winged Dove	5 (8)	0 (1)	24 (21)		
Wilson's Warbler		7 (3)	3 (1)		
Yellow-rumped Warbler		1 (1)			

*Wetland species

**Riparian Obligate species

*** Facultative Riparian species

White Sands National Monument

WNSA the only park where we observed all four non-native/naturalized bird species: Rock Pigeon, Eurasian Collared-dove, European Starling and House Sparrow. These species were all found at the WNSA Headquarters & Visitor Center site which is a heavily manipulated area and lacks true riparian habitat. The most recent WNSA checklist of birds includes 210 species that have been reported within monument boundaries (Southwest Parks and Monuments Association 1993). During the current study we recorded 86 species, or about 41% of all species known to occur at the monument. We observed 9 species that were not included on the most recent WNSA checklist of birds. However between the time of the publication of the checklist and the current study, a number of these species, including Dusky Flycatcher, Warbling Vireo, Black-tailed Gnatcatcher, and Bronzed Cowbird, have been reported by other observers (unpubl. data J. Mangimeli). Therefore species newly detected during the present study include Eurasian Collared-dove, Gray and Cordilleran Flycatchers, Phainopepla, and Chestnut-collared Longspur.

The following 12 species were unique to WNSA and not observed at other parks: Gambel's Quail, American Avocet, Rock Pigeon, Burrowing Owl, American Robin, Savannah Sparrow,

Chestnut-collared Longspur, Dickcissel, and Common Grackle. Species of interest included Burrowing Owl, Gray Flycatcher, Dusky Flycatcher, Cordilleran Flycatcher, Loggerhead Shrike, American Robin, and Common Grackle.

Andrecito Creek

During the present study we observed 66 species at Andrecito Creek (or 31% of all species known to occur at the monument), 22 of which were considered breeding or potential breeding species. Birds of interest include an assortment of species during migration despite the limited amount of riparian habitat. Andrecito Creek drains from west to east and perhaps this west-east strip of tall, relatively lush vegetation, in an otherwise vast, low-statured open desert scrub community, attracts migrants that use it as stopover habitat during migration.

Riparian obligate species: Orange-crowned Warbler, Orchard Oriole, Yellow Warbler

Facultative riparian species: Bewick's Wren, Blue Grosbeak, Bronzed Cowbird, Bullock's Oriole, House Wren, Lesser Goldfinch, MacGillivray's Warbler, Phainopepla, Red-naped Sapsucker, Swainson's Hawk, Warbling Vireo, Western Wood-pewee

Birds of Conservation Concern: Cassin's Sparrow, Chestnut-collared Longspur, Crissal Thrasher, Loggerhead Shrike

Federally listed species: none

State listed species: none

Additional species of interest: Bronzed Cowbird, Cassin's Sparrow, Common Grackle, Yellow-headed Blackbird

WHSA Headquarters & Visitor Center

We observed 59 species at the WHSA Headquarters & Visitor Center during this study (or 28% of all species known to occur at the monument); 20 of which were considered breeding or potential breeding species. Birds of interest included an assortment of species during migration despite the limited habitat. Species observed included Cordilleran Flycatcher, Western Wood-pewee, Red-naped Sapsucker, Spizella sparrows, Wilson's, Yellow, MacGillivray's, and Yellow-rumped Warblers, and Icterids.

Riparian obligate species: Lincoln's Sparrow, Yellow Warbler

Facultative riparian species: Black-headed Grosbeak, Blue Grosbeak, Bullock's Oriole, Cordilleran Flycatcher, Lesser Goldfinch, MacGillivray's Warbler, Red-naped Sapsucker, Swainson's Hawk, Warbling Vireo, Western Wood-pewee

Birds of Conservation Concern: Loggerhead Shrike, Northern Harrier

Federally listed species: none

State listed species: none

Birds of special interest: Eurasian Collared-dove, European Starling, Great-tailed Grackle, Yellow-headed Blackbird

Table 7. Individual site results of the riparian bird inventory at WHSA, 2004-2006.

(Note: the 1st number listed is from survey observations and the number in parentheses is from incidental observations.)

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Andrecito Creek					
American Robin		0 (1)			
Ash-throated Flycatcher	27 (4)	1 (2)	1 (2)		
Barn Swallow			0 (1)		
Bewick's Wren***		8 (8)	2 (1)		
Black-tailed Gnatcatcher	28 (8)	21 (14)	10 (4)		
Black-throated Sparrow	63 (11)	9 (12)	40 (6)		
Blue Grosbeak***	8 (6)		4 (2)		
Blue-gray Gnatcatcher		6 (6)			
Brewer's Sparrow		0 (11)	1 (6)		
Broad-tailed Hummingbird			0 (3)		
Bronzed Cowbird***	0 (1)				
Brown-headed Cowbird	1 (8)		0 (7)		
Bullock's Oriole***			1 (0)		
Burrowing Owl		0 (1)			
Cactus Wren	15 (4)	8 (1)	1 (0)		
Cassin's Kingbird		0 (1)			
Cassin's Sparrow	2 (0)				
Chestnut-collared Longspur		0 (9)			
Chipping Sparrow		14 (71)	5 (5)		
Clay-colored Sparrow		0 (3)			
Common Grackle		0 (4)			
Common Raven	0 (1)				
Crissal Thrasher	2 (0)	6 (7)	2 (3)		
Curve-billed Thrasher			0 (1)		

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Dusky Flycatcher			2 (1)		
Gambel's Quail	2 (1)				
Gray Flycatcher			3 (1)		
Greater Roadrunner	3 (0)				
Green-tailed Towhee		19 (20)			
House Finch		0 (9)			
House Wren***		2 (1)			
Ladder-backed Woodpecker	0 (2)	6 (6)	1 (1)		
Lesser Goldfinch***		0 (8)			
Lesser Nighthawk	19 (13)				
Loggerhead Shrike	9 (6)	4 (1)	1 (4)		
MacGillivray's Warbler		2 (3)	1 (1)		
Mourning Dove	11 (8)	2 (6)	8 (7)		
Northern Flicker (red-shafted)		0 (0)			
Northern Mockingbird	6 (1)	0 (1)	2 (1)		
Orange-crowned Warbler**		0 (4)			
Orchard Oriole**	0 (1)				
Phainopepla***	0 (1)				
Pine Siskin			0 (4)		
Pyrrhuloxia	16 (0)	2 (3)	4 (3)		
Red-naped Sapsucker***		2 (0)			
Rock Wren		5 (3)	1 (0)		
Ruby-crowned Kinglet		2 (6)			
Sage Thrasher		2 (0)			
Say's Phoebe	1 (0)	2 (1)			
Scott's Oriole	4 (4)		5 (2)		
Sharp-shinned Hawk		0 (1)			
Swainson's Hawk	0 (2)		1 (0)		
Turkey Vulture	0 (5)				

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Unknown Meadowlark		0 (4)			
Unknown Raven	0 (1)				
Verdin	22 (4)	9 (12)	9 (0)		
Vesper Sparrow		1 (0)			
Warbling Vireo***			2 (1)		
Western Kingbird	4 (6)		2 (4)		
Western Wood-pewee			2 (2)		
White-crowned Sparrow		1 (3)	0 (1)		
Wilson's Warbler		8 (26)	7 (2)		
Yellow Warbler**			0 (1)		
Yellow-headed Blackbird		0 (20)			
Yellow-rumped Warbler		3 (12)	0 (2)		
Headquarters & Visitor's Center					
American Avocet*			0 (1)		
American Kestrel		0 (1)			
American Robin		1 (0)			
Ash-throated Flycatcher	0 (0)		0 (1)		
Barn Swallow		14 (0)	1 (0)		
Black-headed Grosbeak***			2 (0)		
Blue Grosbeak***		2 (0)			
Blue-gray Gnatcatcher		1 (0)			
Brewer's Blackbird		11 (0)			
Brewer's Sparrow		12 (0)			
Brown-headed Cowbird	0 (0)	1 (0)	2 (2)		
Bullock's Oriole***	2 (0)		2 (0)		
Cassin's Kingbird		1 (0)			
Chipping Sparrow		14 (0)			
Clay-colored Sparrow		5 (0)			
Cordilleran Flycatcher***		1 (0)			

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Curve-billed Thrasher		1 (0)			
Eurasian Collared-dove	1 (0)	2 (0)			
European Starling		0 (2)			
Greater Roadrunner		1 (0)			
Great-tailed Grackle	0 (0)				
Green-tailed Towhee		1 (0)			
Hermit Thrush		1 (0)			
House Finch	19 (0)	37 (0)	12 (6)		
House Sparrow	14 (0)	15 (0)	6 (0)		
Killdeer	0 (0)	0 (1)			
Ladder-backed Woodpecker		1 (0)			
Lark Sparrow		3 (0)			
Lesser Goldfinch***		3 (0)	2 (0)		
Lincoln's Sparrow		2 (0)			
Loggerhead Shrike			0 (1)		
MacGillivray's Warbler		2 (0)			
Mourning Dove	0 (0)	3 (0)			
Northern Flicker (red-shafted)		1 (0)			
Northern Harrier		0 (1)			
Northern Mockingbird	1 (0)		0 (0)		
Pine Siskin			4 (0)		
Red-naped Sapsucker***		2 (0)			
Red-winged Blackbird		0 (1)	1 (0)		
Rock Pigeon			1		
Ruby-crowned Kinglet		1 (0)			
Savannah Sparrow		1 (0)			
Say's Phoebe	1 (0)	3 (0)	3 (0)		
Scott's Oriole		1 (0)			
Swainson's Hawk		0 (3)			

Species	Breeding Season	Fall Season	Spring Season	Summer Season	Winter Season
Verdin		4 (0)			
Vesper Sparrow		7 (0)			
Warbling Vireo***			2 (0)		
Western Kingbird	4 (2)		4 (1)		
Western Wood-pewee	1 (0)	1 (0)			
White-crowned Sparrow		9 (0)	4 (0)		
White-winged Dove	2 (0)	1 (0)	8 (0)		
Wilson's Warbler		16 (0)	1 (0)		
Yellow Warbler**		3 (0)	3 (0)		
Yellow-headed Blackbird		203 (0)			
Yellow-rumped Warbler		10 (0)	3 (0)		

*Wetland species

**Riparian Obligate species

*** Facultative Riparian species

Point Count Transects

Greatest species richness and bird relative abundances for individual point count stations were recorded in spring surveys (Tables 8 and 9). The highest species richness and greatest mean species richness were recorded at RASP in 2006 (Table 8). Mean species richness was consistently high at RASP and HOCA. High mean species richness was also recorded for the three McKittrick sites during the 2nd spring survey in 2005 survey and the spring 2006 survey at SMCK. Lowest numbers of species at individual points were recorded at the EMCK and ANCR sites and the lowest mean richness per survey occurred at the ANCR transect.

Typical detections of birds at point stations ranged from two to 48 birds in spring surveys (Table 9). Mean bird relative abundance at survey points was greatest in the RASP and HOCA sites where mean relative abundances were consistently high at RASP and HOCA in spring. Lowest mean bird counts were recorded at NMCK and ANCR.

Table 8. Mean species richness (range) of typical detections for point count stations on transects in low elevation riparian systems.

Year	Season	CAVE		FODA		GUMO		WHSA
		RASP	WACA	HOCA	EMCK	NMCK	SMCK	ANCR
Spring								
2005	Spring 1	8.8 (3-14)		7.7 (5-11)	5.1 (2-8)	5.0 (3-8)	5.4 (4-7)	
	Spring 2	8.1 (5-11)	6.1 (4-10)	9.1 (5-13)	9 (6-12)	8.2 (6-9)	9.0 (6-12)	4.8 (2-10)

Year	Season	CAVE		FODA	GUMO			WHSA
		RASP	WACA	HOCA	EMCK	NMCK	SMCK	ANCR
2006	Spring 1			11.4 (10-13)				
	Spring 2	14.0 (8-22)	6.4 (4-12)	10.1 (8-13)	6.8 (5-9)	5.6 (4-7)	8.5 (4-12)	
Summer								
2004								4.3 (2-7)
2005		7.6 (4-11)	5.4 (3-9)	6.9 (3-9)	7.4 (4-10)	7.0 (5-9)	6.6 (5-9)	6.1 (4-8)
2006			6.5 (3-10)	7.1 (4-10)	7.3 (4-12)	4.8 (2-6)	6.5 (4-11)	
Fall								
2004			5.7 (3-9)	6.4 (4-8)	6.7 (2-12)	4.2 (2-6)	5.8 (2-9)	2.8 (1-5)
2005	Fall 1	6.1 (2-10)	6.4 (4-10)	6.6 (3-9)	5.8 (2-10)	4.2 (2-6)	4.0 (1-6)	
	Fall 2	6.0 (3-10)	7.1 (3-13)	8.3 (5-10)	3.6 (2-6)	4.8 (2-9)	2.4 (1-3)	4.2 (3-8)

During summer surveys, mean species richness per transect survey did not vary greatly among sites and years, ranging from 4.3-7.6. The lowest mean richness occurred at ANCR and NMCK. Similarly, mean relative abundances of birds in summer surveys did not vary greatly among the sites, ranging from 5.9 to 11.6 birds. The highest mean count was recorded at HOCA in 2005 while the lowest occurred at ANCR in the fall 2004 survey.

Table 9. Mean relative abundances (range) of typical bird detections for point count stations on transects in low elevation riparian systems.

Year	Season	CAVE		FODA	GUMO			WHSA
		RASP	WACA	HOCA	EMCK	NMCK	SMCK	ANCR
Spring								
2005	Spring 1	14.7 (3-34)		9.6 (5-13)	6.5 (2-19)	6.6 (5-8)	9.2 (4-22)	
	Spring 2	11.3 (8-15)	7.9 (5-12)	12.8 (9-19)	10.5 (8-14)	10.8 (8-13)	11.2 (8-17)	7.4 (4-13)
2006	Spring 1			16.8 (13-20)				
	Spring 2	22.3 (12-36)	9.9 (6-16)	20.4 (11-48)	9.4 (6-15)	6.8 (5-10)	11.8 (6-20)	
Summer								
2004								5.9 (3-8)
2005		11.2 (8-16)	7.8 (3-11)	11.6 (4-16)	9.5 (5-15)	8.2 (6-10)	9.6 (7-13)	9.1 (6-13)
2006			9.6 (4-20)	11.1 (4-23)	10.7 (5-19)	7.0 (3-11)	9.4 (5-15)	

Year	Season	CAVE		FODA	GUMO			WHSA
		RASP	WACA	HOCA	EMCK	NMCK	SMCK	ANCR
Fall								
2004	Fall 1		8.1 (4-14)	8.7 (4-11)	8.0 (2-16)	6.2 (4-9)	6.9 (2-11)	3.3 (1-6)
2005			10.6 (3-26)	9.1 (4-17)	10.4 (3-20)	7.3 (4-14)	4.6 (2-6)	5.2 (1-8)
	Fall 2		9.6 (3-14)	10.4 (5-18)	12.0 (7-15)	6.0 (3-21)	8.4 (3-20)	3.0 (2-5)
								4.9 (3-9)

Species richness varied among fall point surveys ranging from one at SMCK and ANCR to 13 at WACA. The highest mean richness on a transect survey was recorded at HOCA in the second fall survey in 2005. Mean richness was consistently high at HOCA. Low mean richness was recorded at the ANCR site in 2004 and at SMCK in the 2nd fall survey of 2005. Fall mean relative abundances of birds were consistently high at RASP, WACA, and HOCA sites. The mean relative abundance was low during 2004 at ANCR and at SMCK in the 2nd fall 2005 survey.

Evidence ratios, the likelihood ratios between competing models, were used to ‘test’ various effects on species richness and relative abundance at sites. The analysis indicated that intraseasonal, interseasonal, and interannual differences in species richness and relative abundance occurred at various survey sites. In general, there were no consistent differences in species richness and relative abundance between years at the sampling sites. However, there was a strong indication of difference in spring species richness and relative abundance between years at RASP. During the same season there was a difference in relative abundance but only a marginally significant difference in species richness at HOCA. Breeding season showed the least interannual variability in bird species richness and relative abundances at the sites. The only difference in the two bird variables for the breeding season occurred at ANCR where there was a marginally significant difference in relative abundance between 2004 and 2005. SMCK showed strong evidence of a difference in fall species richness and relative abundance between 2004 and 2005 while at EMCK there only was a marginal difference in species richness between the same years.

In spring and fall intraseasonal comparisons of species richness and relative abundance, differences were detected mostly at the McKittrick Canyon sites. EMCK showed strong differences in species richness and relative abundance for spring 2005. The same trend occurred at NMCK but was statistically weaker. A difference was apparent in species richness at SMCK during the 2005 spring. Weaker evidence was observed for differences in species richness and relative abundances between the fall surveys than for spring surveys. Differences in relative abundance between the first and second fall surveys at RASP, NMCK and SMCK sites in 2005 was marginally supported by the analyses. The only likely fall intraseasonal difference in species richness occurred at the EMCK site.

There were differences in relative abundance and species richness among sites during the spring and fall seasons suggested by extreme *P* values (Tables 8, 9, and 10). The only indication of probable differences among sites in the breeding season was in 2005 species richness. Strict statistical tests of specific patterns among sites were beyond the scope of the analyses. Statistical

comparisons of bird community metrics among sites was briefly considered in the project design and setup, but limited size and habitat conditions at sampling sites ruled out the potential for this. The lack of strong evidence of differences in breeding season avian communities among the sites may be somewhat surprising considering the dramatic differences in habitat characteristics among sites. However, as previously mentioned, the limitations posed by the sampling sites and the study design did not allow for effective intersite comparisons (see below for discussion of appropriate sample sizes).

Table 10. Tests for differences in relative abundance and species richness among point count sampling areas.

	Year	n	df	Bird count		Species richness	
				Deviance	P	Deviance	P
Spring	2005	103	6	36.96	1.79E-06	19.44	1.04E-05
	2006	58	5	116.11	2.09E-23	48.79	2.85E-12
Breeding	2005	63	6	10.26	0.114004	5.53	0.018662
	2006	42	4	6.80	0.147104	3.76	0.05239
Fall	2004	54	5	34.62	1.79E-06	23.94	9.93E-07
	2005	111	6	93.88	4.73E-18	41.72	1.05E-10

Nevertheless, we found what we interpreted as biologically meaningful differences in breeding season avifauna among the sites in the total species detected and in numbers of species associated with riparian habitats. RASP, EMCK, and HOCA held the greatest number of species detected and the greatest mean species richness and relative abundances. RASP and EMCK were true riparian habitats with open water, wetlands and diverse vegetation and complex structure. HOCA was a unique site in that the sampling transect traversed a diversity of habitats including cottonwood park, grassland, shrublands, and riparian. While actual riparian habitat was limited at the site, the juxtaposition of these varied habitats likely contributed to the diversity and abundance of the avian communities using it. Further, on a landscape level, the habitat value of HOCA for birds, especially during migration, was enhanced by the adjacent Limpia Creek, a large and biologically diverse riparian area that attracts a large number of bird species (Hedges and Bryan 1999).

Efficacy of Point Count Surveys

We found that the point count transect method was better suited for the breeding season when bird detectability is greater (at least males) and species presence and densities are more consistent. The point count method is the most accepted and widely used methodology for breeding bird monitoring (Ralph et al. 1995a). It is useful for species detection, density estimation, and population monitoring. During migration seasons, this method may not be the most efficient or effective for detecting species. Our results indicated that variation in detection rates of bird species and abundances was greatest in the migration seasons, especially spring. There was significant intraseasonal variation at sites where early and late surveys were conducted, indicating that significant effort is needed to cope with the variability in bird communities during migration seasons. Bird migration is not a consistent event over the course of a season, rather it occurs in irregular pulses as individuals and mixed flocks move across the landscape.

The amount of survey time, and therefore, detection time is less with point counts than other survey methods. Fixed survey stations situated 250m apart only represent a sample of the area, and therefore, do not allow for complete survey coverage and may miss significant areas within a targeted habitat patch. This may be important in small habitat patches, as in the case of RASP, or in areas with patchy vegetation as in the case of WACA.

Studies found that about 15 stations were necessary to detect species present in a given area (Ralph et al. 1995a). Bird density estimates stabilized when 20 or more five minute point counts were performed (Morrison et al. 1981, Smith et al. 1995). In general, a minimum of 30 point count stations is recommended in the absence of a pilot study to characterize the birds of a given area, but analyses would be possible for only the common species (Ralph et al. 1995a). With limited area to sample, more repetitions of counts at points will increase the precision of bird population estimates. Also, longer count duration and greater survey radius distance will increase the reliability of occurrence rates and density estimates (Buskirk and McDonald 1995, Lynch 1995). These potential improvements to reliability must be balanced with issues of double counting (as bird movements become more difficult to track across a longer time frame), and accounting for detectability in analyses such as program DISTANCE provides.

The proportion of species detected during the actual point count surveys relative to the total species observed at sites varied from 73.2% at EMCK to 98.6% at HOCA (Table 11). At ANCR, EMCK, and RASP only about 75% of species were detected during point count surveys. The incidental species lists, derived from observations of birds between points, in the return transect survey, and site visits not associated with a survey, were substantial at EMCK and RASP. Most species detected only incidentally were migrants or summer resident birds that bred in other habitat types. Point count surveys conducted during summer detected almost all potential breeding species. The disparity between survey and incidental lists appeared to depend on the size of the survey area, the vegetation complexity, and the amount of effort devoted to incidental surveys. Large numbers of species were detected at EMCK and RASP because of a greater number of site visits unassociated with surveys. A surprisingly large number of species was encountered during migration at ANCR which is mostly desert shrub/arroyo vegetation (Thompson et al. 1999). We observed a number of additional species flying over during surveys but many species were also using the shrubland habitat. The high species detection rate for point count stations at HOCA was due to the fact that return surveys of the transect were not performed after the point count surveys as in other sites.

Table 11. Species detections at point count stations, incidentally during surveys, and incidentally in site visits unassociated with surveys.

	Number of species						
	CAVE		FODA	GUMO			WWSA
	RASP	WACA	HOCA	EMCK	NMCK	SMCK	ANCR
Total detections	130	78	71	97	53	64	64
Survey detections	85	61	70	63	42	55	48
% of spp. detected at stations	75.2	79.2	98.6	73.2	85.7	89.1	75.0
Unique incidental survey spp. ¹	28	16	1	23	7	9	16
Nonsurvey incidental detections ²	17	1	0	11	4	0	0
Only detected incidentally	45	17	1	34	11	9	16

¹ species only detected between stations or during the return transect survey.

² species only detected during site visits not associated with surveys.

There are certain disadvantages to point count surveys. One shortcoming of this methodology is that the actual survey time can be small relative to the effort in cases where there is a large amount of travel time between points. This was the case for the McKittrick Canyon sites. Paths were present in the canyons but often ran along the edge of the canyon bottom whereas we chose to situate the survey stations in the middle of the riparian vegetation. Especially for migration surveys, the amount of survey time is important to detect a high proportion of the species present. For simple species detection, the advantages of less structured surveys, particularly in migration seasons, is the freedom for the observer to adjust the route and the amount of time spent in particular areas based on the presence and movements of birds. Another aspect of the point count system that affected survey results was the locations of points and the heterogeneity of a number of the sites, in particular, Walnut Canyon and McKittrick Canyon sites. Because of the limited habitats and necessary distance between points, count stations were not always located in representative habitats. The effects of this were especially noticeable in migration seasons when mixed flocks of birds would be encountered between survey points and incidental detections between count stations were significant.

We found that the additional 2 minutes of survey time at points generally contributed few additional species and individuals to the initial 3 minute survey interval (Table 12). The average numbers of species added to the totals for counts in the three seasons were less than one, but as many as five additional species were counted at single stations. Additional bird abundance in the last two minutes averaged approximately one bird per point survey for each season, but as many as eight additional individuals were counted at stations. Interestingly, the averages and ranges of additional species and bird numbers per station survey did not differ greatly among the seasons.

Table 12. Mean number (range) of additional species and individuals detected during the 3-5 minute interval that were not detected in the initial 3 minute survey period for individual point counts at the 7 sampling sites.

	Spring	Summer	Fall
Species	0.82 (0-5)	0.79 (0-5)	0.64 (0-4)
Individuals	1.1 (0-6)	1.2 (0-6)	0.88 (0-8)

The 3 minute observation time at stations detected the majority of species and individuals present in the area. However, there were exceptions where significant additions were made which legitimized the extra two minute effort. Although additional time only increased species richness by less than one and bird abundance by about one individual at stations, cumulatively, the additional time spent at stations was significant in accumulating additional species and individuals. Other studies recommend at least a 5 minute count duration to increase the reliability of occurrence rates and density estimates, and longer periods of up to 10 minutes when the travel time between sites is significant (Buskirk and McDonald 1995, Lynch 1995).

Conclusions and Recommendations

We documented a total of 187 species at the seven survey sites in the four CHDN park units from the summer of 2004 through the summer of 2006. We added several species to the GUMO and WHSA park lists and documented observations of species for initiating a formal bird checklist for FODA.

Most species were detected at the CAVE and GUMO parks, and specifically at the RASP and McKittrick Canyon (MCKC) areas. Both RASP and MCKC have exceptional bird life, but also play important interpretive roles for the parks because of the focused human use of the sites. Other than these two areas, the extent of low elevation riparian habitat in the four parks is very limited. The FODA, GUMO and CAVE areas are unique in a number of aspects. On a regional level these sites are associated with “Sky Island” mountain ranges occurring at the convergence of the Chihuahuan Desert and prairie ecoregions. The range limits for a number of bird species, such as Black-crested Titmouse, Montezuma Quail, Northern Bobwhite, Orchard Oriole, and

Varied Bunting exist in this general area. In migration, many eastern migrant species occur regularly at the parks.

RASP is the one true low elevation riparian system of significance in this study, and is an important site to continue monitoring efforts of birds including migratory and residents (summer and winter). The presence of large amounts of water and riparian vegetation in an “ocean” of desert scrub vegetation create an oasis that attracts birds (especially during migration). RASP is part of a larger habitat complex that represents a significant area for birds. The habitat complex consists of a mosaic of riparian woodlands, wetlands, desert scrub, grasslands, park, and agricultural lands owned and managed by federal, agencies, New Mexico, and private entities. Abundance and diversity of birds in this complex is very high with a very large number of migrants documented in this study, as well as, in compiled species lists from observations by park employees and visitors. The Rattlesnake Springs area is managed by The Nature Conservancy and NPS while surrounding lands are mostly private, but also contain valuable bird habitats. The nearby Black River Recreation Area, administered by the Bureau of Land Management, is an extensive riparian system that is actively managed to enhance the habitat for native riparian species including birds. Cooperative agreements among stakeholders in this unique area to manage habitats on a wider level would be very valuable.

West (2004) mentioned the importance of RASP, despite its limited size, as a site with the greatest population of riparian dependent species for eastern New Mexico. However, habitat availability in southeastern New Mexico for riparian associated species is increasing due to Bureau of Land Management riparian restoration projects on the Black and Delaware Rivers. Species such as Yellow-billed Cuckoo, Bell’s Vireo, and Painted Bunting found breeding in these riverine systems may be increasing in numbers as native vegetation recovers following the elimination of nonnative vegetation (unpubl. data).

McKittrick Canyon which includes our East, North, and South sites, represents the most extensive riparian system in our project with the greatest potential as a local breeding bird population monitoring site that may be of sufficient size to provide an adequate sample for characterization and population trend analysis. However, the canyon is not uniform in habitat characteristics, rather it comprises a gradient from low elevation riparian in the lower East McKittrick Canyon portion (without the typical cottonwood and tree willow component), to mid-elevation vegetation communities in the upper reaches of North and South Canyons. This gradient difference may limit the potential for comparisons with bird community data from riparian areas elsewhere in the region. McKittrick Canyon lacked many of the low elevation breeding birds found at RASP including Bell’s Vireo, Lucy’s Warbler, Painted Bunting, and Yellow-billed Cuckoo.

For a monitoring program, the specific objectives and desired levels of statistical power will greatly influence the sampling strategy and the setting and conditions of a particular site will have to be considered (Ralph et al. 1995b). The results of this study may be used for analysis to determine necessary sample sizes and repetitions for the specific objectives of a monitoring program. A monitoring program should use the accumulated experience of ongoing and past efforts by other parks and organizations in the planning process (Panjabi 2003, Ralph et al. 1995, <http://science.nature.nps.gov/im/monitor/monitoringPlans.cfm>, <http://www.fs.fed.us/psw/topics/wildlife/birdmon>). We found the point count method to be efficient and successful in detecting

most species during the breeding season. However, for detecting specific species such as very rare or elusive birds, other methods may be more effective. Also, for species detection during migration, intensive searching and mist-netting may be more appropriate. The area search method was adequate for the smaller, isolated riparian sites where the focus was on detection of species, especially during migration. The methodology allows for searching in dense vegetation and pursuing elusive species. However, the area search method does not allow for density estimation or viable comparisons with other sites (Ralph et al. 1993).

Because of the lower quality of riparian habitat or limited size, there is limited value in establishing general, long term monitoring programs for bird populations at the remaining study sites. Of the remaining sites, CHSP at GUMO is the largest with true riparian habitat. The inventoried area of this drainage was approximately 900 m in length with perennial water and diverse and complex vegetation structure, yet we did not detect the species diversity expected of a riparian area with these attributes. The presence of above-ground flowing water, closed canopy and open marshy habitat make this site a true riparian oasis in an area otherwise dominated by desert scrub and grasslands. As such, the park should consider this an important area and continue surveys at CHSP in the future to clarify the importance of this specific area for birds and other taxon. This area may be threatened by fire (Andersen and Mueller 2003).

WACA is substantial in size but is mostly arroyo or dry wash with scattered patches of riparian trees and shrubs. Nevertheless, diversity was fairly high at this site especially during migration. Varied Buntings, at least periodically, breed there and large concentrations of hummingbirds have been found in the canyon during migration. For purposes of the park, WACA is an important site to continue bird monitoring efforts, including migratory and residents (summer and winter).

HOCA at FODA was a significant area for birds, but not riparian obligate or facultative riparian species. Bird relative abundance and diversity were consistently high relative to other sites. Continued monitoring of this site may be useful for the park to develop and refine the initial species list derived from this project as well as to track changes in avian communities and assess impacts of fire or other disturbance. Periodic surveys would require minimal effort at this easily accessible site. Surveys of the mesquite grassland area were included in this project to increase survey coverage of the park and provide a more comprehensive list of bird species using the area. At times, the mesquite grasslands can be productive and used by a variety of migrants.

GUCS at GUMO and OASP and GRSE at CAVE were very small in size with limited vegetation structure. Although the species lists were relatively small, they must be regarded as important as a source of water and cover in the desert setting. At GUCS, the spring itself was not as important an area as the Middle/Lower Canyon area where above-ground flowing water, true riparian plants, and adequate vegetative cover for nesting/breeding birds exists. The site's geographic context might be that of a natural "funnel point" of the Guadalupe Escarpment/El Capitan Mountain for migrating birds. In WHSA, riparian habitat did not exist at the HEQU and ANCR site was mostly desert shrub and arroyo shrub vegetation. Other habitats are more significant at this park.

NPS also should consider specific studies of Birds of Conservation Concern and other species of local or regional special interest. For instance, population studies of Gray Vireo in the GUMO

and CAVE parks would be a worthwhile undertaking. There is no quantitative information regarding the abundances and specific occurrence for this species in the parks. West (2004) lists the Gray Vireo as fairly common in CAVE and fairly common to uncommon in GUMO. It was not detected at FODA and its status in the Davis Mountains is unknown (Bryan 2000). Montezuma Quail is another species that requires attention. It was once found throughout the region including CAVE and GUMO, but lately has been detected only in FODA and occasionally at GUMO.

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Appendices

Appendix A. Project Study Sites in the Four Chihuahuan Desert Network Park Units.

Carlsbad Caverns National Park

1. Rattlesnake Springs (RASP)

The RASP site (Figure 1) is located within the 25 ha Rattlesnake Springs recreation area isolated from the main portion of Carlsbad Caverns NP located 5 km to the west. RASP traverses a relatively level west to east draining floodplain between Black River and Rattlesnake Canyon, about 7.5 km south-southwest of the Carlsbad Caverns Visitor Center at an elevation ranging from 1,123 to 1,141 meters. The site consists of a large permanent spring and pond, with associated wetlands and mature riparian vegetation. Native trees such as willow (*Salix* spp.) and net-leaf/canyon hackberry, mesquite, and soapberry form a tall, dense but fairly narrow riparian corridor. The majority of the length of the riparian area is divided ownership between NPS and The Nature Conservancy. The riparian area is surrounded mostly by agricultural fields and Chihuahuan Desert shrublands with valley-bottom vegetation such as little-leaf sumac, mesquite, mariola (*Parthenium incanum*), and perennial grasses. However, stands of trees and other riparian associated vegetation to a lesser degree, are present further upslope to the west of the spring. Adjacent to the riparian corridor is a day use park area with a series of widely spaced large cottonwood trees (*Populus* spp.) planted during the 1930s and 1940s with mowed grass ground cover. Many non-native trees occur at the site, some of which were planted near the residence and others that have invaded the riparian area. These non-natives include Russian olive, Siberian elm, weeping willow, mulberry, and fruit and nut trees. Because of the nearly level terrain, water moves as a shallow, slow-flowing stream and in some portions of the site broadens into marshes with emergent wetland vegetation such as sedges and cattail. Flood-irrigated areas at the site include an old residence that supports fruit and nut trees and the large cottonwood park area adjacent to the riparian corridor. The sampling transect consists of nine 50-meter radius point counts spaced evenly along a 1.8km distance that spans the length of the Rattlesnake Springs unit. Each survey point covered approximately 7,854 m² along the drainage and portions of the shrublands associated with each point. RASP is well-known to bird watchers from all over the west-central portion of North America and receives a regular number of visitors, but human use typically peaks during spring and fall migration periods. The site has also been a well-known picnic area for local residents for many years. Management and maintenance of the park area coupled with visitor use probably have some negative effects on the bird community using the area.



Figure 1. Rattlesnake Springs sampling site, Carlsbad Caverns National Park, consisting of nine point count stations in consecutive order from east to west.

2. Walnut Canyon (WACA)

The WACA site (Figure 2) is located along the middle portion of the major west to east drainage in the park about 1.5 to 2.5 km north-northeast of the Carlsbad Caverns Visitor Center at an elevation ranging from 1,196 to 1,254 meters. The site consists of an ephemeral stream with a few bedrock pools in a steep-walled canyon. The streambed is made up mostly of large cobbles and boulders, but also contains smaller gravels and sandy areas. There are no permanent springs or seeps located in this portion of WACA, although following heavy summer rains in 1995, a small seep was located about mid-way along the transect. Also, a large bedrock pool occurs near Point #1 (the “Rock Shelter” site). Following rain events, this pool held water during about half of our visits, and when full, contained fairy shrimp, tadpole shrimp, and red-spotted toads (*Bufo punctatus*). The vegetation composition along the transect was generally uniform, although in certain areas against steep cliffs, or at lower elevations, larger specimens of individuals and denser concentrations of trees and shrubs occurred and provided more substantial “riparian” vegetation. Trees and shrubs along the streambed included little walnut, (*Juglans microcarpa*), desert willow (*Chilopsis linearis*), alligator juniper, netleaf/canyon hackberry (*Celtis reticulata*), mesquite (*Prosopis glandulosa*), chokecherry (*Prunus serotina*), and soapberry (*Sapindus saponaria*), with shrubs such as mimosa (*Mimosa* spp.), acacia (*Acacia* spp.), Apache plume (*Fallugia paradoxa*), sumac (*Rhus* spp.), mescal bean (*Sophora secundiflora*), skeleton-leaf goldeneye (*Viguiera stenoloba*), Mexican buckeye (*Ungnadia speciosa*), and creosotebush (*Larrea tridentata*). The vegetation of the adjacent uplands was mostly a mix of desert scrub and grasslands represented by grama grasses (*Bouteloua* spp.), little-leaf sumac (*R. microphylla*), Pinchot juniper (*J. pinchotii*), green sotol (*Dasyllirion leiophyllum*), lechuguilla (*Agave lechuguilla*) and cactus (*Opuntia* spp.), with small stands (or “coves”) of arborescent species consisting of Texas madrone, gray oak (*Quercus grisea*), and juniper (*J. deppeana*). The sampling transect consisted of 11 50-meter radius point counts spaced evenly along a 2.5km line. Each survey point covered approximately 7,854 m² along the canyon bottom and portions of the slopes associated with the vegetation at each point. The most obvious sign of human development near the site was the paved park access road (State highway 7) and associated vehicle pull-outs, parking areas with interpretive trails, a small corral and fence at the Scenic Loop Drive exit, and some small, insignificant remnants from road construction. Remarkably, although the WACA site is located along the busiest vehicle route in the park, it appeared that the majority of this stretch of the canyon receives very little to no use from park visitors, and other than possible avian-vehicle collisions and traffic noise, overall human disturbance to the avian community is relatively low.

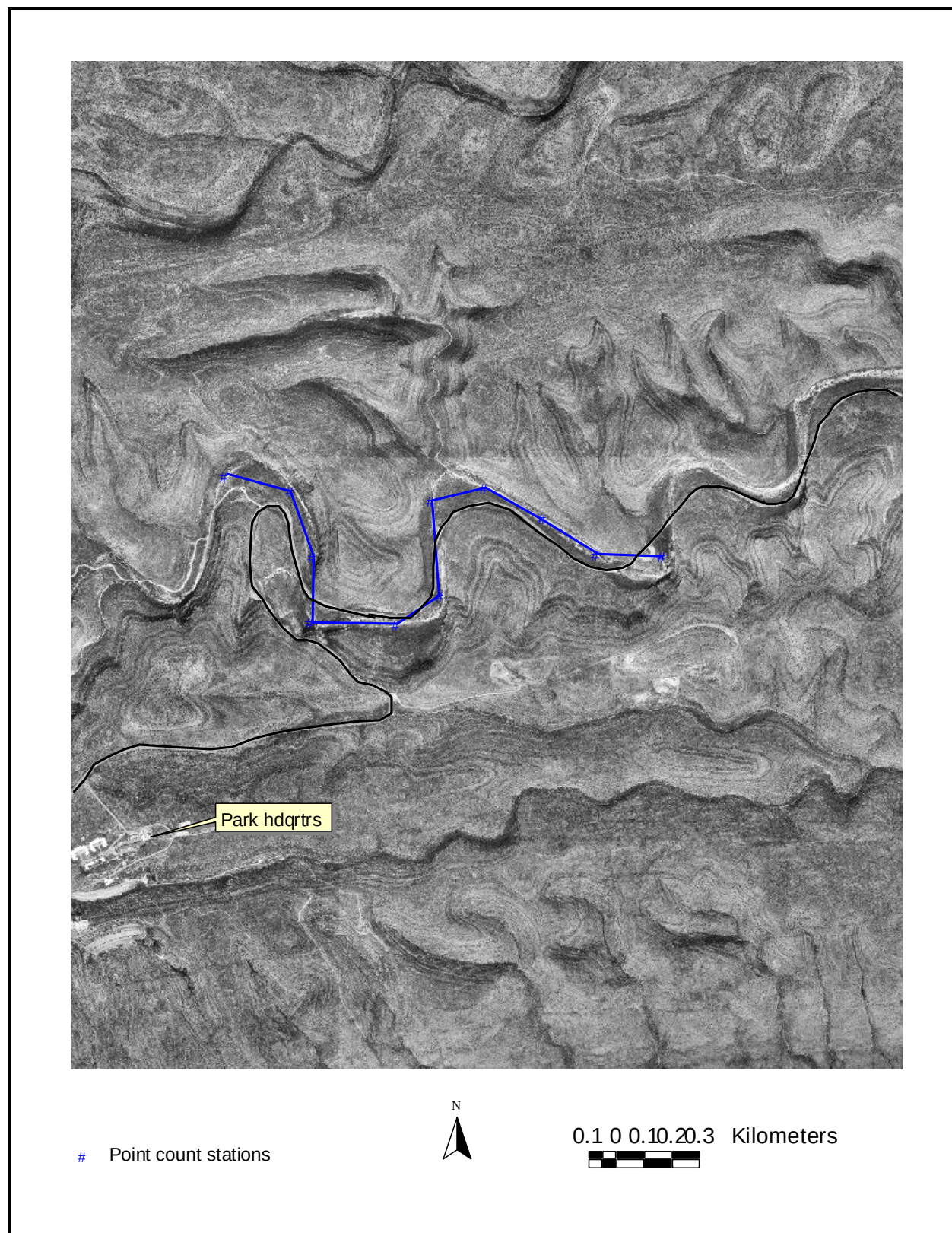


Figure 2. Walnut Canyon sampling site, Carlsbad Caverns National Park, consisting of 11 point count stations in consecutive order from east to west.

Fort Davis National Historic Site

1. Hospital Canyon (HOCA)

The HOCA site (Figure 3) is located near the Fort Davis National Historical Site Visitor's Center at an elevation of approximately 1,490 meters. The sampling transect was 1.9km in length with seven equally spaced 50m point count stations. Each survey point comprised an area of approximately 7,854 m² of the surroundings. The initial survey point was located in the midst of a group of very large cottonwood trees at the entrance of the park. The remaining sites were located in Hospital Canyon with the last point near the box end of the canyon. The canyon is steep walled with cliffs rising 100-200m above the bottom. Vegetation at the canyon sample sites was classified as grasslands with scattered trees and shrublands. Native woody species in the canyon included canyon hackberry, oaks, mesquite, and little walnut. There was no perennial water in the canyon save for a small pool at the end of the canyon. Canyon slopes were vegetated with primarily shrubs with some clusters of oak trees. Visitors normally remain in the area of the restored fort and visitor center. However, there was a small road, buildings, and work area in the canyon bottom which were used in maintenance and restoration activities so fairly frequent human presence in the middle of the canyon did occur.

An additional area of HOCA was surveyed using a timed area search of a 2 km transect that with a survey area of approximately 8.63ha. Human developments nearby include the visitor center, administrative offices, and a parking lot.

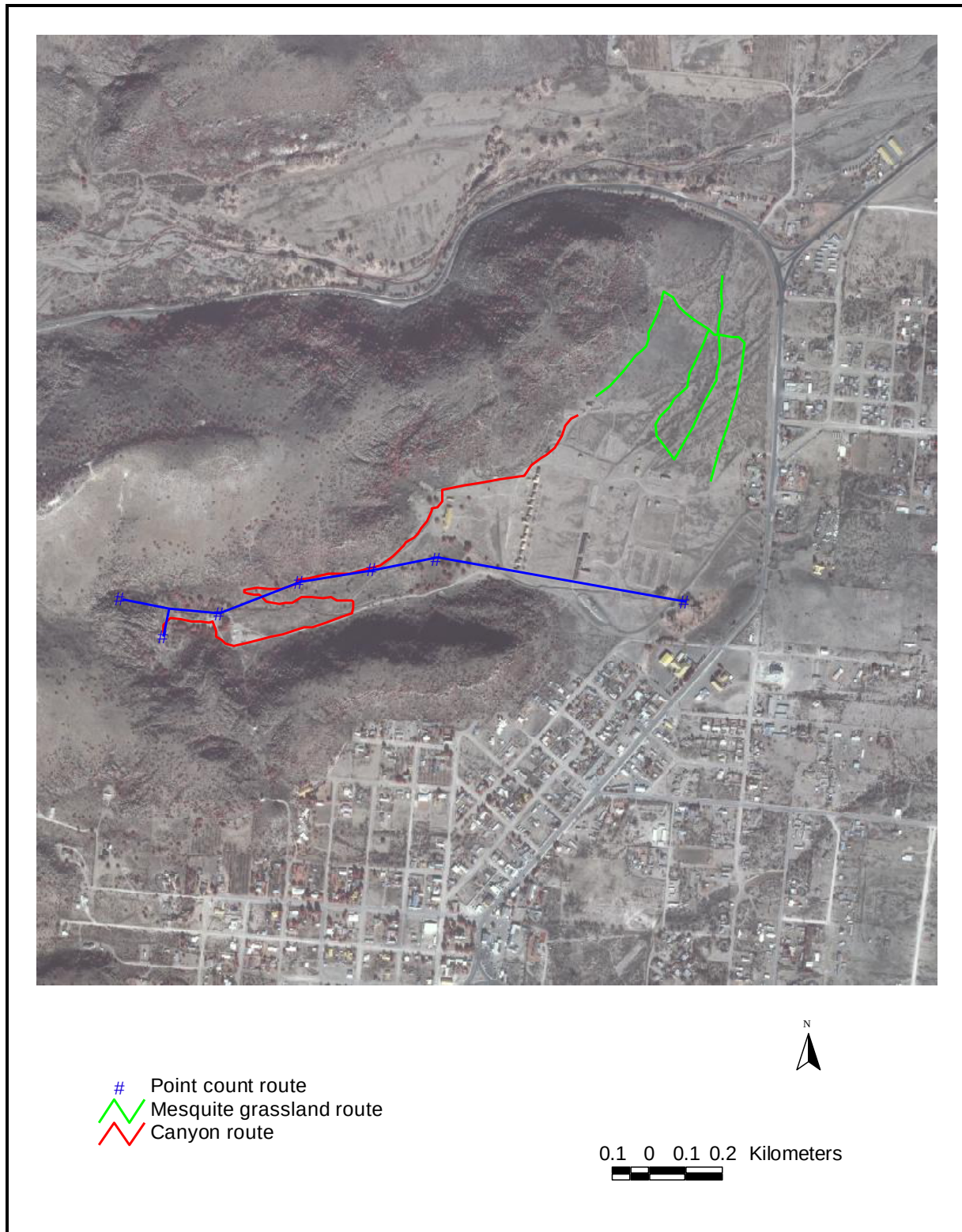


Figure 3. Hospital Canyon sampling sites in Fort Davis National Historic Site. Point count transect consists of seven stations running from east to west.

2. Mesquite Grassland (MEGR)

The MEGR site (Figure 3) was located 380 m north of the Fort Davis National Historical Site Visitor Center at an elevation of about 1,485 meters. The site consists of gently sloped native grama grassland with scattered individual trees and shrubs with mesquite dominant and few canyon hackberry and juniper trees. MEGR was surveyed using a timed area search of a 1.7km route that effectively provided coverage of an area of 8.5ha.

Guadalupe Mountains National Park

1. Choza Spring (CHSP)

The CHSP site (Figure 4) is about 4.25 km east-northeast of park headquarters at an elevation of 1,616 meters. The site consists of a perennial spring and its associated flowing stream. The site was surveyed in two portions (North and South), which were divided by Highway 62/180. The stream and watercourse support riparian vegetation such as willow, Texas madrone, oaks, southern white and ponderosa pine, junipers, walnut, mesquite, and many shrubs; and there are openings within the overstory vegetation that support patches of sedges, grasses and other marsh plants. Much of the site is in decomposed rock and organic soils, but the last 50-75 m of stream channel flows through bedrock and a series of rock plunge pools. Much of the site is a closed canopy of trees. The surrounding vegetation is desert scrub and uplands with considerable amounts of acacia, juniper, sumac and perennial grasses. CHSP was surveyed using a timed area search that covered approximately 4.2 ha along the drainage bottom and portions of the slopes associated with the riparian vegetation. Aside from the bisection of the site by Highway 62/180, there is little human activity in the area. Andersen and Mueller (2003) cautioned that fire is a potential threat to this site due to its dense understory and high fuel level.



 Survey area



0.2 0 0.2 0.4 Kilometers

Figure 4. Choza Spring sampling site in Guadalupe Mountains National Park.

2. Guadalupe Canyon/Guadalupe Spring (GUCS)

The GUCS site (Figure 5) is located about 3 km southwest of the park headquarters at an elevation ranging from 1,653 to 1,770 meters. The survey site consists of 3 separate areas: 1) Upper Guadalupe Spring site, as shown on USGS topographic maps, which consists of an ephemeral spring in the bottom of a canyon with scattered upland and desert scrub vegetation on slopes and 3 to 7 mature gray oak trees in the bottom. The site has other deciduous trees and shrubs such as southwestern chokecherry and brickle bush (*Brickellia* sp.), but is not a true “riparian” area; 2) a small seep area located in a canyon east of the Upper Guadalupe Spring, which has a small amount of emergent wetland vegetation concentrated near the ephemeral seeps and a few oaks and alligator juniper (some of the largest in the park), and; 3) a Middle or Lower Guadalupe Canyon located upstream from the old highway right-of-way. This Middle/Lower Guadalupe Canyon site has flowing surface water and true riparian vegetation consisting of willow, western chokecherry, oak, desert willow and emergent herbaceous wetland species such as sedges and rushes. The Middle/Lower Guadalupe Canyon site trends into a dry riparian/desert arroyo scrub vegetation as the canyon approaches the old highway and mesic species are replaced by more xeric species such as mesquite and acacia. GUSP was surveyed using a timed area search that covered approximately 3.68 ha along the canyon bottom and portions of the slopes associated with the vegetation at the 3 locations.

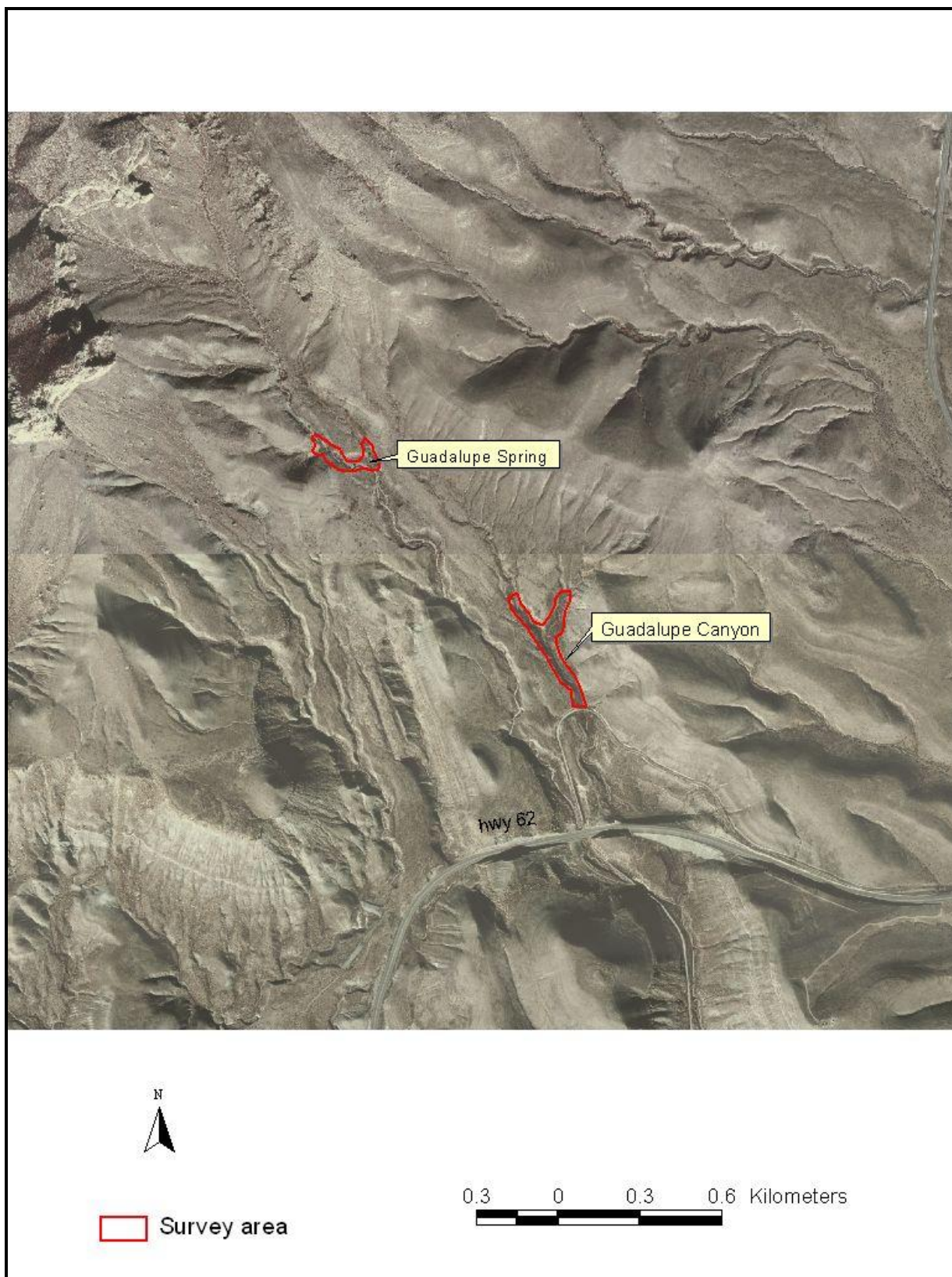


Figure 5. Guadalupe Canyon Spring sampling site in Guadalupe Mountains National Park.

3. East McKittrick Canyon (EMCK)

The EMCK site (Figure 6) is located about 11.2 km north-northeast of the park headquarters at an elevation ranging from 1,575 to 1,608 meters. The site consists of a permanent stream (above and below surface flow) in a large canyon bottom dominated by riparian species such as little walnut, velvet ash, Texas madrone, big-tooth maple, juniper, oaks, western choke cherry, numerous shrubs, and patches of emergent wetland vegetation (e.g., sawgrass). The canyon is the major drainage of the middle portion of the park and flows from west to east. The vegetation in this portion of EMCK is quite diverse and represents an ecotone between the lower desert scrub vegetation near the mouth of the canyon, and the pine-oak vegetation of middle and upper elevations. There is an apparent increase in both plant species diversity and vegetation structure as elevation is gained along the canyon bottom and water becomes more abundant. The regionally rare Knowlton's hop-hornbeam is found as scattered individuals along the upper half of this site. The surrounding hillsides are very steep and covered with varying densities and compositions of desert scrub or upland/montane scrub (depending on exposure). EMCK consisted of 11 50-meter radius point count stations spaced evenly along a 2km transect. Each survey point covered approximately 7,854 m² along the canyon bottom and portions of the shrublands associated with each point. About half of the point count stations were located in areas with above ground water. We often observed sunfish, Rio Grande leopard frogs and rainbow trout in longer stretches of water and deeper pools at this site.

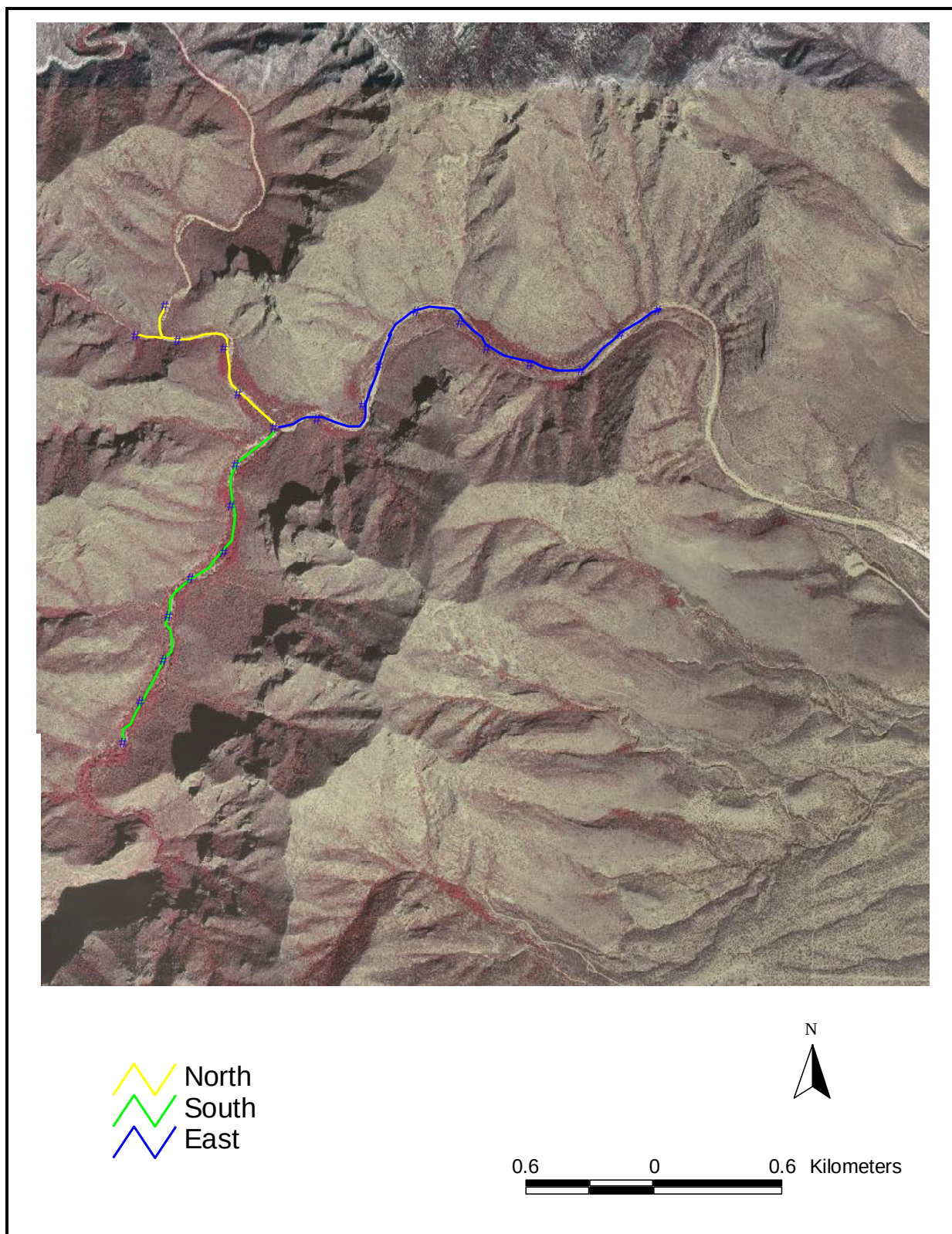


Figure 6. McKittrick Canyon sampling sites in Guadalupe Mountains National Park. North transect-five stations running north; South transect-eight stations running southwest; East transect-11 stations running east.

4. North McKittrick Canyon (NMCK)

The NMCK site (Figure 6) is located about 10.8 km north-northeast of the park headquarters at an elevation ranging from 1,618 to 1,646 meters. The site consists of a relatively steep-graded, cobbly, ephemeral watercourse with no above ground water present except during precipitation. Riparian and stream channel vegetation consists of big-tooth maple, little walnut, junipers, ponderosa pine, Douglas fir (one specimen near Point count station #3), chinkapin and gray oak, southwestern chokecherry and Texas madrone. This site has greater amounts of ponderosa pine than the EMCK site, probably due to the slight gain in elevation and orientation. Large individuals of the regionally rare Knowlton's hop-hornbeam are found at this site. Because there were no areas with above ground water, we found no emergent wetland species. The surrounding hillsides are very steep and covered with varying densities and compositions of desert scrub or upland/ montane scrub (depending on exposure). NMCK consisted of five 50-meter radius point counts spaced evenly along a 1.0km transect. Each survey point covered approximately 7,854 m² along the canyon bottom and adjacent shrubland slopes associated with each point.

5. South McKittrick Canyon (SMCK)

The SMCK site (Figure 6) is located about 9.7 km north-northeast of the park headquarters at an elevation ranging from 1,608 to 1,646 meters. The site consists of a relatively steep graded, cobbly, stream channel, much of which has above ground surface flow. Riparian and streamside vegetation consists of big-tooth maple, chinkapin and gray oak, Texas madrone, junipers, ponderosa and southwestern white pine, little walnut, western soapberry and some very large specimens of velvet ash. The regionally rare Knowlton's hop-hornbeam is found here in greater abundance than the EMCK or NMCK sites, and New Mexico locust was found only at this site. This site had the largest trees and more densely closed canopy than the other two sites and much of the canyon bottom remains shaded throughout the day from the steep canyon walls. There are many areas of the stream channel with patches of emergent wetland vegetation that consists mostly of sawgrass. SMCK was comprised of eight 50-meter radius point counts spaced evenly along a 1.8km transect. Each survey point covered approximately 7,854 m² along the canyon bottom and portions of the shrub slopes associated with each point. We often observed Rio Grande leopard frogs and rainbow trout in deeper pools of this site.

White Sands National Monument

1. Andrecito Creek (ANCR)

The ANCR site (Figure 7) is located about 27.5 km west of park headquarters at an elevation ranging from 1,234 to 1,250 meters. The site consists of a small ephemeral drainage that passes through desert scrub and small patches of sacaton grassland. Much of the upper portion of the drainage lacks a well-defined channel and true riparian vegetation, but at lower elevations near the dry lakebed are found denser concentrations and larger individuals of salt cedar, desert willow, mesquite and four-wing saltbush, forming a riparian corridor along an obvious stream channel. The lower half of the channel passes through more silty soils that are found at the higher elevations, and some down cutting and headward erosion has occurred in the area of Point count station #5. ANCR consisted of 12 50-meter radius point counts spaced evenly along a 2.5km transect. Each survey point covered approximately 7,854 m² along the drainage and portions of the shrublands associated with each point.



Survey route

0.3 0 0.3 0.6 Kilometers

Figure 7. Andrecito Creek sampling site, White Sands National Monument, consisting of 12 point count stations in consecutive order from east to west.

2. Headquarters and Visitor Center (HEQU)

The HEQU site (Figure 8) was located at an elevation of 1,217 meters in a hardpan depression along the edge of the White Sands gypsum dune field. Naturally occurring riparian vegetation was lacking, but the open park-like area had been planted with trees such as cottonwood and Siberian/Asian elm. Native shrubs such as three-leaf and little-leaf sumac and four-wing saltbush occurred around the perimeter of the site. Much of the area was paved and developed, and human impacts were much greater here than at any other site. HEQU was surveyed using a timed area search of a 4ha survey area with a specific route that was followed during each survey. During surveys many of the structures (e.g., homes, trailers, and visitor center and concessionaire facility) were occupied and one was under construction.

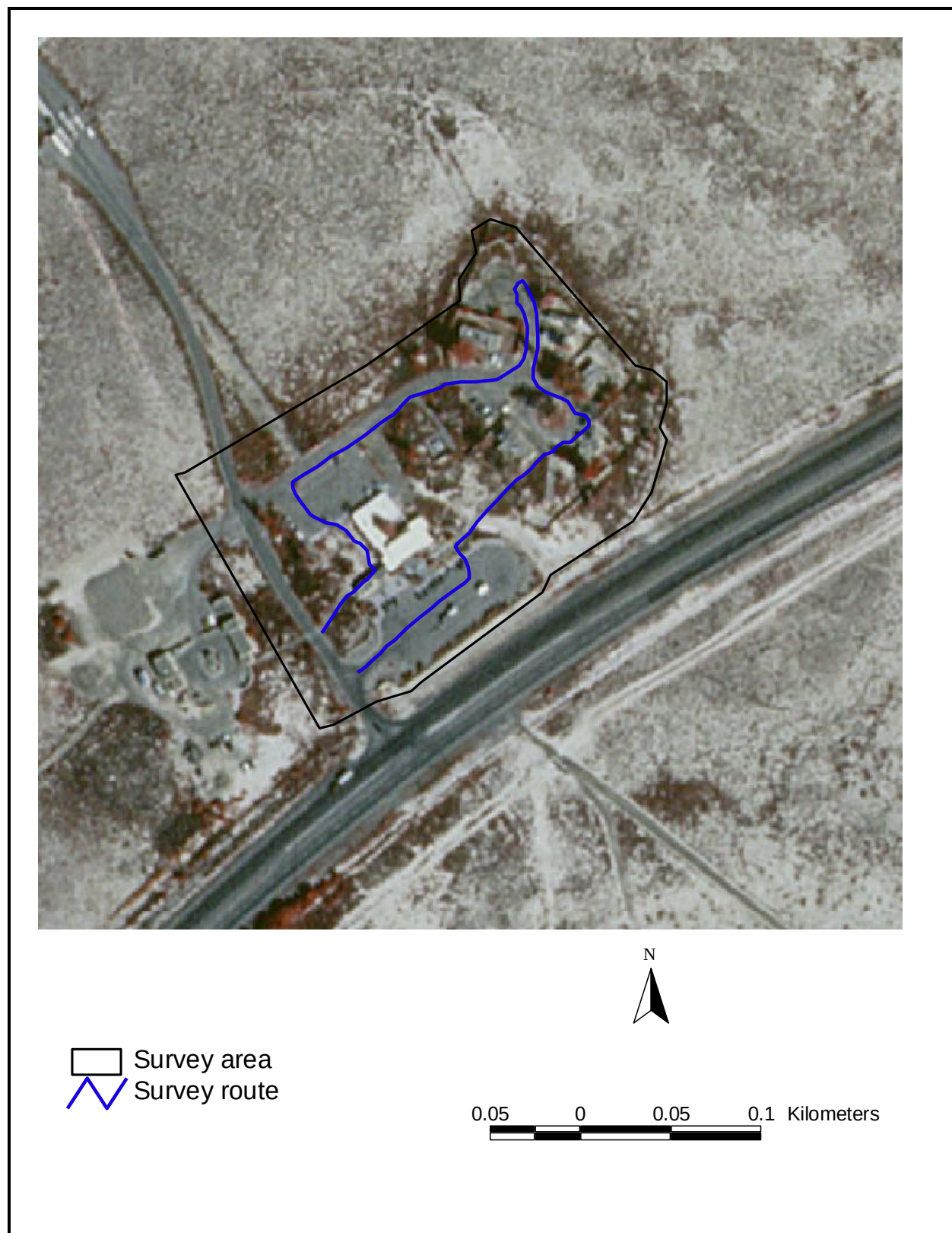


Figure 8. Park headquarters sampling site in White Sands National Monument.

Appendix B. Representative Photographs of Bird Sampling Sites at Four NPS Chihuahuan Desert Network Park Sites, National Park Service 2004-2006.

Carlsbad Caverns National Park, New Mexico

Grammer Seep



Looking west (upstream) from bedrock below seep. No true “riparian” in this area and upland vegetation dominated by sotol, ocotillo, agave, and oaks, a few Texas madrone, and juniper trees.



Looking north to main seep at the area with dense grasses (note dark staining on rock from past water seepage). Trees at this site include oaks, Texas madrone, juniper, and canyon hackberry.

Oak Spring



Looking at survey area from south to north, canyon drains northeast. Chinkapin oak is the dominate tree in the cove, with lesser amounts of juniper and gray oak; upland dominated by typical desert scrub and succulent species.



Close-up of Oak Spring September 2004 (note small pool of water, ferns, sedges, and grasses).

Walnut Canyon



Point count station #2, looking downstream (south) – note little walnut and desert willow trees, acacias, sotol, prickly pear and steep cliff in background at Point count station #1.



Point count station #7 looking downstream (southeast) – site had little walnut, canyon hackberry and desert willow trees, with acacias, mimosa, sotol, Apache plume, and upland scrub on slopes.



Point count station #8 looking downstream (east) into dense stand of little walnut, desert willow, canyon hackberry, acacia and stool; western chokecherry is also found at this site.

Rattlesnake Springs



Point count station #2 looking east – note cottonwood overstory with canyon hackberry, willow, Russian olive and mesquite understory with dense ground cover of grass.



Point count station #4 looking southeast – note dense growth of native willow, canyon hackberry and cottonwood trees and non-native Russian olive, with dense ground cover of grass.



Point count station #7 looking east to dense understory of mesquite, willow and Russian olive with cottonwood overstory (note: site adjacent to pond).



Point count station #8 looking west toward escarpment – note open vegetation cover with mesquite shrubs, canyon hackberry, acacia, and little-leaf sumac. Ground cover is mostly dense grass and some flowering perennials and annual forbs.



Flood-irrigated picnic area (near Point count station #4) with open, mature cottonwood canopy and turf grass cover (note: trees were planted and are maintained by NPS; turf is also maintained by staff).



Rattlesnake Springs and constructed pond, pump house, and NPS employee residence, with open canopy of cottonwood and non-native deciduous trees (e.g., Russian olive, Asian/Siberian elm, weeping willow, pecan, fruit, etc.) and mowed grass. Pond supports aquatic species such as turtles and warm-water game fish, and pond overflow supports a large marsh habitat with sedges, rushes, cattails, etc.

Fort Davis National Historic Site, Texas

Hospital Canyon (HOSP)



Point count station #2, looking east. Vegetation consists of scattered mature Emory oak trees with an understory of grasses, mesquite, yucca, and prickly pear cactus.



Point count station #7, looking east. Tree species include juniper, gray oak, and uplands with acacia and perennial native grasses.

Mesquite Grassland (MEGR)



Survey area dominated by native perennial grasses with scattered mesquite shrubs and sparse juniper trees.

Guadalupe Mountains National Park, Texas

Guadalupe Spring/Canyon



Middle portion of Guadalupe Canyon looking south toward Highway 62/180 – note riparian species such as willow, desert willow, canyon hackberry and western chokecherry with typical desert scrub-grama grassland upland vegetation.



Middle portion of Guadalupe Canyon bottom looking south toward old Highway/road scar – note flowing surface water and riparian vegetation including willow, canyon hackberry, sedges and rushes.



Middle portion of Guadalupe Canyon looking north-northwest toward El Capitan, site with flowing water, willows and typical desert scrub-grama grassland upland vegetation.



Upper portion of Guadalupe Canyon ("Guadalupe Spring" on USGS topologic maps), looking north toward El Capitan, with small "coves" of woodland trees such as oaks, junipers, and Texas madrones.

Choza Spring



South portion of Choza Spring portion (south of highway) looking west toward El Capitan – note abrupt edge between desert/upland scrub (*Leucophyllum* sp., *Agave* sp., *Nolina* sp.) and riparian (willow, Texas madrone, flame-leaf sumac, oak) vegetation.



South portion of Choza Spring (south of highway) looking east-southeast – note abrupt edge between desert/upland scrub (*Leucophyllum* sp., *Agave* sp., *Nolina* sp.) and riparian (willow, Texas madrone, flame-leaf sumac, oak, western white pine) vegetation.



South portion of Choza Spring (south of highway) looking east to bedrock pool with herbaceous riparian plants – note the general absence of riparian overstory in this stretch; approximately 50 meters downstream is a patch of willow trees. At these pools we observed Rio Grande leopard frogs.



South portion of Choza Spring (south of highway) looking west from bedrock pool area toward dense growth of riparian trees – note riparian overstory of Ponderosa pine, alligator juniper, Texas madrone, oaks, canyon hackberry and other trees with dense herbaceous riparian cover.



South portion of Choza Spring (south of highway) looking west toward Guadalupe Escarpment – note dense riparian overstory trees and herbaceous cover (e.g., Texas madrone, alligator juniper, flame-leaf sumac, sawgrass and grasses).



North portion of Choza Spring (north of highway) looking upstream – note dense overstory trees and herbaceous riparian cover (e.g., Texas madrone, willow, grasses, sedges, rushes, etc.).



North portion of Choza Spring (north of highway) looking upstream near source point of Choza Spring—note dense overstory trees and herbaceous riparian cover (e.g., Texas madrone, oaks, willow, western chokecherry, sawgrass, grasses, sedges, rushes, etc.).



North portion of Choza Spring (north of highway) looking downstream – note dense overstory of riparian trees, flowing water, and herbaceous ground cover. We observed Rio Grande leopard frogs in this portion of the site.

East McKittrick Canyon



East McKittrick Canyon looking upstream (west) from area near Point count Station #8 – riparian overstory vegetation consists of velvet ash, Texas madrone, big-tooth maple, junipers, and oaks; riparian herbaceous cover of sawgrass, sedges, etc.



East McKittrick Canyon looking upstream (west) from area near Point count Station #10 – riparian overstory vegetation consists of velvet ash, Texas madrone, big-tooth maple, junipers, oaks; minor amounts of riparian herbaceous cover of sedges, etc. (note travertine “steps” in streambed).



Point count station #2 looking downstream (east) – note “transition” or ecotonal area of upper elevation pine/pine-oak with lower elevation riparian/desert scrub. Overstory dominated by big-tooth maple, little walnut, oaks (chinkapin and gray), Texas madrone, velvet ash, ponderosa pine, junipers. No surface flow of water at this point.



Point count station #5 looking downstream (southeast) into dense grove of velvet ash and sawgrass – note this is the approximate location where water returns to the surface of the streambed.



Point count station #6 looking downstream (southeast) into overstory corridor of riparian species such as velvet ash, chinkapin and gray oak, big-tooth maple, and Texas madrone with herbaceous riparian plants such as sawgrass, columbine, and cardinal flower. Note: surface water is perennial at this location and we often found Rio Grande leopard frogs and cutthroat trout here.

North McKittrick Canyon



Looking downstream (south) from area between Point count station #'s 1 & 2 – overstory riparian vegetation consists of little walnut, junipers, Texas madrone, chinkapin and gray oak, and big-tooth maple.



Point count station #3 looking downstream (east) – low overstory riparian vegetation of big-tooth maple, chinkapin oak, Texas madrone, little walnut, and juniper with limited amounts of ponderosa pine and one Douglas fir.

South McKittrick Canyon



Looking downstream (northeast) from area near Point count station #6 – note very dense growth of riparian herbaceous cover (i.e., sawgrass); riparian trees include Texas madrone, big-tooth maple, chinkapin oak, gray oak, with ponderosa and western white pine and junipers.



Point count station #2 looking downstream (northeast) – perennial surface water flows in channel approximately 10 meters north of point; tall riparian overstory of velvet ash, big-tooth maple and chinkapin oak, with some areas of dense herbaceous cover (e.g., sawgrass, grasses).



Point count station #5 looking downstream (northeast) – dry streambed with large cobbles; riparian vegetation consists of big-tooth maple and chinkapin and gray oak with ponderosa pine and juniper.



Point count station #7 looking downstream (east) into dense riparian cover of velvet ash, big-tooth maple, chinkapin oak, juniper and ponderosa pine, with dense patches of herbaceous cover (e.g., sawgrass) and the endemic *Penstemon cardinalis* ssp. *regalis* on limestone boulder. Note: perennial surface water is present here and we often observed Rio Grande leopard frogs and cutthroat trout at this location.



Point count station #8 looking downstream (east) into dense riparian cover and steep slope/cliff with vegetation consisting of Texas madrone, velvet ash, big-tooth maple, junipers, chinkapin and gray oak, flame-leaf sumac, ponderosa pine and scattered individuals of New Mexico locust, with dense patches of riparian herbaceous cover (e.g., sawgrass), grasses and perennials. Note: surface water is perennial at this location and we often found Rio Grande leopard frogs and cutthroat trout here.

White Sands National Monument, New Mexico

Headquarters and Visitor Center



Survey route start point at west end of the headquarters complex. Shrubs included creosote, littleleaf sumac, saltbush.



Central portion of the headquarters survey area with cottonwood and Siberian elm trees, and halophytic shrubs.

Andrecito Creek



Point count station #1, looking west (upstream). Riparian vegetation consists of salt cedar and mesquite trees bordered by four-wing saltbush, alkali sacaton grass and annuals.



Point count station #3, looking west (upstream). Riparian vegetation consists mostly of mesquite and a few scattered salt cedar trees, bordered by four-wing saltbush, alkali sacaton grass and annuals.



Point count station #5, looking west (upstream) – note down-cutting and headward erosion. Riparian vegetation consists of small mesquite and a few desert willow trees with scattered four-wing saltbush, creosotebush, and prickly pear cactus.



Point count station #9, looking west (upstream) – note lack of stream channel and true “riparian” vegetation; site dominated by creosotebush and mesquite shrubs.

Appendix C. Bird Species Observed at Four NPS Chihuahuan Desert Network Park Sites.

Species are presented in phylogenetic order.

	COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
					CAVE	FODA	GUMO	WHSA
	Great Blue Heron	GBHE	<i>Ardea</i>	<i>herodias</i>	x			
	Unknown Heron (Tri-colored/Little-blue)	UNHE	<i>Egretta</i>	<i>sp.</i>	x			
	Ring-necked Duck	RNDU	<i>Aythya</i>	<i>collaris</i>	x			
	Lesser Scaup	LESC	<i>Athyra</i>	<i>affinis</i>	x			
	Turkey Vulture	TUVU	<i>Cathartes</i>	<i>aura</i>	x	x	x	x
	Golden Eagle	GOEA	<i>Aquila</i>	<i>chrysaetos</i>	x		x	
	Mississippi Kite	MIKI	<i>Ictinia</i>	<i>mississippiensis</i>	x			
	Northern Harrier	NOHA	<i>Circus</i>	<i>cyaneus</i>	x			x
	Sharp-shinned Hawk	SSHA	<i>Accipiter</i>	<i>striatus</i>	x		x	x
	Cooper's Hawk	COHA	<i>Accipiter</i>	<i>cooperii</i>	x	x	x	
	Common Black-hawk	CBHA	<i>Buteogallus</i>	<i>anthracinus</i>		x		
	Gray Hawk	GRHA	<i>Buteo</i>	<i>nitidus</i>	x	x		
	Zone-tailed Hawk	ZTHA	<i>Buteo</i>	<i>albonotatus</i>		x		
	Red-tailed Hawk	RTHA	<i>Buteo</i>	<i>jamaicensis</i>	x	x	x	
	Swainson's Hawk	SWHA	<i>Buteo</i>	<i>swainsoni</i>	x			x
	Unknown Hawk	UNHA	<i>Unknown</i>	<i>sp.</i>			x	
	American Kestrel	AMKE	<i>Falco</i>	<i>sparverius</i>	x	x	x	x
	Peregrine Falcon	PEFA	<i>Falco</i>	<i>peregrinus</i>	x			
	Wild Turkey	WITU	<i>Meleagris</i>	<i>gallopavo</i>	x			
	Northern Bobwhite	NOBO	<i>Colinus</i>	<i>virginianus</i>	x			
	Montezuma Quail	MOQU	<i>Cyrtonyx</i>	<i>montezumae</i>		x		
	Scaled Quail	SCQA	<i>Callipepla</i>	<i>squamata</i>	x		x	

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WSA
Gambel's Quail	GAQU	<i>Callipepla</i>	<i>gambelii</i>				X
Killdeer	KILL	<i>Charadrius</i>	<i>vociferus</i>	X	X		X
American Avocet	AMAV	<i>Recurvirostra</i>	<i>americana</i>				X
Upland Sandpiper	UPSA	<i>Bartramia</i>	<i>longicauda</i>	X			
Wilson's Snipe	WISN	<i>Gallinago</i>	<i>delicata</i>	X			
Band-tailed Pigeon	BTPI	<i>Patagioenas</i>	<i>fasciata</i>			X	
Rock pigeon	ROPI	<i>Columba</i>	<i>livia</i>				X
Eurasian Collared-dove	EUCD	<i>Streptopelia</i>	<i>decaocto</i>	X	X		X
White-winged Dove	WWD0	<i>Zenaida</i>	<i>asiatica</i>	X	X	X	X
Mourning Dove	MODO	<i>Zenaida</i>	<i>macroura</i>	X	X	X	X
Yellow-billed Cuckoo	YBCU	<i>Coccyzus</i>	<i>americanus</i>	X	X		
Greater Roadrunner	GRRO	<i>Geococcyx</i>	<i>californianus</i>	X	X	X	X
Great Horned Owl	GHOW	<i>Bubo</i>	<i>virginianus</i>	X			
Burrowing Owl	BUOW	<i>Athene</i>	<i>cunicularia</i>				X
Elf Owl	ELOW	<i>Micrathene</i>	<i>whitneyi</i>			X	
Common Nighthawk	CONI	<i>Chordeiles</i>	<i>minor</i>	X		X	
Lesser Nighthawk	LENI	<i>Chordeiles</i>	<i>acutipennis</i>	X			X
Common Poorwill	COPW	<i>Phalaenoptilus</i>	<i>nuttallii</i>	X		X	
White-throated Swift	WTSW	<i>Aeronautes</i>	<i>saxatalis</i>	X		X	
Blue-throated Hummingbird	BTHU	<i>Lampornis</i>	<i>clemenciae</i>			X	
Magnificent Hummingbird	MAHU	<i>Eugenes</i>	<i>fulgenes</i>			X	
Black-chinned Hummingbird	BCHU	<i>Archilohcus</i>	<i>alexandri</i>	X	X	X	
Ruby-throated Hummingbird	RTHU	<i>Archilochus</i>	<i>colubris</i>			X	
Calliope Hummingbird	CAHU	<i>Stellula</i>	<i>calliope</i>			X	
Broad-tailed Hummingbird	BTLH	<i>Selasphorus</i>	<i>platycercus</i>	X	X	X	X
Rufous Hummingbird	RUHU	<i>Selasphorus</i>	<i>rufus</i>		X	X	
Unknown Hummingbird	UNHU	<i>Unknown</i>				X	
Belted Kingfisher	BEKI	<i>Ceryle</i>	<i>alcyon</i>	X		X	

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Acorn Woodpecker	ACWO	<i>Melanerpes</i>	<i>formicivorus</i>		X		
Yellow-bellied Sapsucker	YNSA	<i>Sphyrapicus</i>	<i>varius</i>	X			
Red-naped Sapsucker	RNSA	<i>Sphyrapicus</i>	<i>nuchalis</i>	X		X	X
Ladder-backed Woodpecker	LBWO	<i>Picoides</i>	<i>scalaris</i>	X	X	X	X
Hairy Woodpecker	HAWO	<i>Picoides</i>	<i>villosus</i>			X	
Northern Flicker (red-shafted)	NOFL	<i>Colaptes</i>	<i>auratus</i>	X	X	X	X
Greater Pewee	GRPE	<i>Contopus</i>	<i>pertinax</i>	X			
Olive-sided Flycatcher	OSFL	<i>Contopus</i>	<i>cooperi</i>	X	X	X	
Western Wood-pewee	WEWP	<i>Contopus</i>	<i>sordidulus</i>	X	X	X	X
Willow Flycatcher	WIFL	<i>Empidonax</i>	<i>traillii</i>	X			
Hammond's Flycatcher	HAFL	<i>Empidonax</i>	<i>hammondii</i>	X		X	
Gray Flycatcher	GRFL	<i>Empidonax</i>	<i>wrightii</i>		X	X	X
Dusky Flycatcher	DUFL	<i>Empidonax</i>	<i>oberholseri</i>	X	X	X	X
Cordilleran Flycatcher	COFL	<i>Empidonax</i>	<i>occidentalis</i>	X		X	X
Unknown Empidonax	UNEM	<i>Empidonax</i>	<i>sp.</i>	X		X	
Black Phoebe	BLPH	<i>Sayornis</i>	<i>nigricans</i>	X		X	
Eastern Phoebe	EAPH	<i>Sayornis</i>	<i>phoebe</i>	X			
Say's Phoebe	SAPH	<i>Sayornis</i>	<i>saya</i>	X	X	X	X
Vermilion Flycatcher	VEFL	<i>Pyrocephalus</i>	<i>rubinus</i>	X	X		
Ash-throated Flycatcher	ATFL	<i>Myiarchus</i>	<i>cinerascens</i>	X	X	X	X
Cassin's Kingbird	CAKI	<i>Tyrannus</i>	<i>vociferans</i>	X	X	X	X
Western Kingbird	WEKI	<i>Tyrannus</i>	<i>verticalis</i>	X	X	X	X
Loggerhead Shrike	LOSH	<i>Lanius</i>	<i>ludovicianus</i>	X	X		X
Gray Vireo	GRVI	<i>Vireo</i>	<i>vicinior</i>	X		X	
Warbling Vireo	WAVI	<i>Vireo</i>	<i>gilvus</i>	X		X	X
Bell's Vireo	BEVI	<i>Vireo</i>	<i>bellii</i>	X			
Hutton's Vireo	HUVI	<i>Vireo</i>	<i>huttoni</i>			X	
Plumbeous Vireo	PLVI	<i>Vireo</i>	<i>plumbeus</i>	X		X	

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Cassin's Vireo	CAVI	<i>Vireo</i>	<i>cassinii</i>	x		x	
Blue-headed Vireo	BHVI	<i>Vireo</i>	<i>solitarius</i>			x	
Plumbeous Vireo	PLVI	<i>Vireo</i>	<i>plumbeus</i>	x		x	
Cassin's Vireo	CAVI	<i>Vireo</i>	<i>cassinii</i>	x		x	
Unknown Vireo	UNVI	<i>Vireo</i>	<i>sp.</i>			x	
Common Raven	CORA	<i>Corvus</i>	<i>corax</i>	x	x	x	x
Unknown Raven	UNRA	<i>Corvus</i>	<i>sp.</i>				x
Violet-green Swallow	VGSW	<i>Tachycineta</i>	<i>thalassina</i>	x	x	x	
Tree Swallow	TRSW	<i>Tachycineta</i>	<i>bicolor</i>	x			
Northern Rough-winged Swallow	NRSW	<i>Stelgidopteryx</i>	<i>serripennis</i>	x			x
Cliff Swallow	CLSW	<i>Petrochelidon</i>	<i>pyrrhonota</i>	x	x	x	
Cave Swallow	CASW	<i>Petrochelidon</i>	<i>fulva</i>	x			
Barn Swallow	BARS	<i>Hirundo</i>	<i>rustica</i>	x	x	x	x
Unknown Swallow	UNSW	<i>Petrochelidon</i>	<i>sp.</i>	x		x	
Mountain Chickadee	MOCH	<i>Poecile</i>	<i>gambeli</i>	x		x	
Black-crested Titmouse	BCTI	<i>Baeolophus</i>	<i>atricristatus</i>		x		
Juniper Titmouse	JUTI	<i>Baeolophus</i>	<i>rigdwayi</i>			x	
Verdin	VERD	<i>Auriparus</i>	<i>flaviceps</i>	x	x	x	x
Bushtit	BUSH	<i>Psaltiriparus</i>	<i>minimus</i>	x	x	x	
White-breasted Nuthatch	WBNU	<i>Sitta</i>	<i>carolinensis</i>	x		x	
Red-breasted Nuthatch	RBNU	<i>Sitta</i>	<i>canadensis</i>		x	x	
Cactus Wren	CACW	<i>Campylorhynchus</i>	<i>brunneicapillus</i>	x	x	x	x
Rock Wren	ROWR	<i>Salpinctes</i>	<i>obsoletus</i>	x	x	x	x
Canyon Wren	CANW	<i>Catherpes</i>	<i>mexicanus</i>	x	x	x	
Carolina Wren	CARW	<i>Thryothorus</i>	<i>ludovicianus</i>			x	
Bewick's Wren	BEWR	<i>Thryomanes</i>	<i>bewickii</i>	x	x	x	x
House Wren	HOWR	<i>Troglodytes</i>	<i>aedon</i>	x	x	x	x
Marsh Wren	MAWR	<i>Cistothorus</i>	<i>palustris</i>	x			

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Ruby-crowned Kinglet	RCKI	<i>Regulus</i>	<i>calendula</i>	x	x	x	x
Blue-gray Gnatcatcher	BGGN	<i>Poliophtila</i>	<i>caerulea</i>	x		x	x
Black-tailed Gnatcatcher	BTGN	<i>Poliophtila</i>	<i>melanura</i>	x		x	x
Townsend's Solitaire	TOSO	<i>Myadestes</i>	<i>townsendi</i>			x	
Swainson's Thrush	SWTH	<i>Catharus</i>	<i>ustulatus</i>			x	
Hermit Thrush	HETH	<i>Catharus</i>	<i>guttatus</i>	x	x	x	x
American Robin	AMRO	<i>Turdus</i>	<i>migratorius</i>				x
Gray Catbird	GRCA	<i>Dumetella</i>	<i>carolinensis</i>	x			
Northern Mockingbird	NOMO	<i>Mimus</i>	<i>polyglottos</i>	x	x	x	x
Sage Thrasher	SATH	<i>Oreoscoptes</i>	<i>montanus</i>	x			x
Brown Thrasher	BRTH	<i>Toxostoma</i>	<i>rufum</i>	x			
Curve-billed Thrasher	CBTH	<i>Toxostoma</i>	<i>curvirostre</i>		x	x	x
Crissal Thrasher	CRTH	<i>Toxostoma</i>	<i>crissale</i>	x		x	x
European Starling	EUST	<i>Sturnus</i>	<i>vulgaris</i>		x		x
Cedar Waxwing	CEDW	<i>Bombycilla</i>	<i>cedrorum</i>	x		x	x
Phainopepla	PHAI	<i>Phainopepla</i>	<i>nitens</i>	x	x	x	x
Orange-crowned Warbler	OCWA	<i>Vermivora</i>	<i>celata</i>	x	x	x	x
Nashville Warbler	NAWA	<i>Vermivora</i>	<i>ruficapilla</i>	x			
Virginia's Warbler	VIWA	<i>Vermivora</i>	<i>virginiae</i>	x		x	
Lucy's Warbler	LUWA	<i>Vermivora</i>	<i>luciae</i>	x			
Northern Parula	NOPA	<i>Parula</i>	<i>americana</i>	x			
Magnolia Warbler	MAWA	<i>Dendroica</i>	<i>magnolia</i>	x			
Yellow-rumped Warbler (Audubon's)	YRWA	<i>Dendroica</i>	<i>coronata</i>	x	x	x	x
Black-throated Gray Warbler	BTYW	<i>Dendroica</i>	<i>nigrescens</i>			x	
Townsend's Warbler	TOWA	<i>Dendroica</i>	<i>townsendi</i>	x	x	x	
Hermit Warbler	HEWA	<i>Dendroica</i>	<i>occidentalis</i>			x	
Grace's Warbler	GRWA	<i>Dendroica</i>	<i>graciae</i>			x	

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
American Redstart	AMRE	<i>Setophaga</i>	<i>ruticilla</i>	x			
Yellow Warbler	YEWA	<i>Dendroica</i>	<i>petechia</i>	x		x	x
MacGillivray's Warbler	MGWA	<i>Oporornis</i>	<i>tolmiei</i>	x		x	x
Wilson's Warbler	WIWA	<i>Wilsonia</i>	<i>pusilla</i>	x	x	x	x
Hooded Warbler	HOWA	<i>Wilsonia</i>	<i>citrina</i>			x	
Northern Waterthrush	NOWA	<i>Seiurus</i>	<i>noveboracensis</i>	x			
Common Yellowthroat	COYE	<i>Geothlypis</i>	<i>trichas</i>	x			
Yellow-breasted Chat	YBCH	<i>Icteria</i>	<i>virens</i>	x		x	
Unknown Warbler	UNWA	<i>Unknown</i>	<i>sp.</i>	x		x	
Western Tanager	WETA	<i>Piranga</i>	<i>ludoviciana</i>	x	x	x	
Summer Tanager	SUTA	<i>Piranga</i>	<i>rubra</i>	x	x	x	
Hepatic Tanager	HETA	<i>Piranga</i>	<i>flava</i>	x		x	
Green-tailed Towhee	GTTO	<i>Pipilo</i>	<i>chlorurus</i>	x	x	x	x
Spotted Towhee	SPTO	<i>Pipilo</i>	<i>maculatus</i>	x		x	
Canyon Towhee	CANT	<i>Pipilo</i>	<i>fuscus</i>	x	x	x	
Savannah Sparrow	SAVS	<i>Passerculus</i>	<i>sandwichensis</i>				x
Song Sparrow	SOSP	<i>Melospiza</i>	<i>melodia</i>	x		x	
Cassin's Sparrow	CASP	<i>Aimophila</i>	<i>cassinii</i>	x	x	x	x
Rufous-crowned Sparrow	RCSP	<i>Aimophila</i>	<i>ruficeps</i>	x	x	x	
Chipping Sparrow	CHSP	<i>Spizella</i>	<i>passerina</i>	x	x	x	x
Clay-colored Sparrow	CCSP	<i>Spizella</i>	<i>pallida</i>	x	x		x
Brewer's Sparrow	BRSP	<i>Spizella</i>	<i>breweri</i>	x	x	x	x
Black-chinned Sparrow	BCSP	<i>Spizella</i>	<i>atrogularis</i>	x	x	x	
Vesper Sparrow	VESP	<i>Pooecetes</i>	<i>gramineus</i>		x		x
Lark Sparrow	LASP	<i>Chondestes</i>	<i>grammacus</i>	x	x	x	x
Black-throated Sparrow	BTSP	<i>Amphispiza</i>	<i>bilineata</i>	x	x	x	x
Lark Bunting	LARB	<i>Calamospiza</i>	<i>melanocorys</i>	x			
Lincoln's Sparrow	LISP	<i>Melospiza</i>	<i>lincolnii</i>	x	x	x	x

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
White-crowned Sparrow	WCSP	<i>Zonotrichia</i>	<i>leucophrys</i>	x	x	x	x
Dark-eyed Junco	DEJU	<i>Junco</i>	<i>hyemalis</i>	x		x	
Chestnut-collared Longspur	CCLO	<i>Calcarius</i>	<i>ornatus</i>				x
Rose-breasted Grosbeak	RBGR	<i>Pheucticus</i>	<i>ludovicianus</i>	x			
Black-headed Grosbeak	BHGR	<i>Pheucticus</i>	<i>melanocephalus</i>	x	x	x	x
Northern Cardinal	NOCA	<i>Cardinalis</i>	<i>cardinalis</i>	x	x	x	
Pyrrhuloxia	PYRR	<i>Cardinalis</i>	<i>sinuatus</i>	x	x	x	x
Blue Grosbeak	BLGR	<i>Passerina</i>	<i>caerulea</i>	x	x	x	x
Indigo Bunting	INBU	<i>Passerina</i>	<i>cyanea</i>	x	x	x	
Lazuli Bunting	LAZB	<i>Passerina</i>	<i>amoena</i>			x	
Painted Bunting	PABU	<i>Passerina</i>	<i>ciris</i>	x			
Varied Bunting	VABU	<i>Passerina</i>	<i>versicolor</i>	x			
Dickcissel	DICK	<i>Spiza</i>	<i>americana</i>	x			
Red-winged Blackbird	RWBL	<i>Agelaius</i>	<i>phoeniceus</i>	x		x	x
Eastern Meadowlark	EAME	<i>Sturnella</i>	<i>magna</i>		x	x	
Western Meadowlark	WEME	<i>Sturnella</i>	<i>neglecta</i>	x			
Unknown Meadowlark	UNME	<i>Sturnella</i>	<i>sp.</i>				x
Yellow-headed Blackbird	YHBL	<i>Xanthocephalus</i>	<i>xanthocephalus</i>	x			x
Brewer's Blackbird	BRBL	<i>Euphagus</i>	<i>cyranocephalus</i>	x	x		x
Brown-headed Cowbird	BHCO	<i>Molothrus</i>	<i>ater</i>	x	x	x	x
Bronzed Cowbird	BROC	<i>Molothrus</i>	<i>aeneus</i>	x			x
Common Grackle	COGR	<i>Quiscalus</i>	<i>quiscula</i>				x
Great-tailed Grackle	GTGR	<i>Quiscalus</i>	<i>mexicanus</i>	x			x
Scott's Oriole	SCOR	<i>Icterus</i>	<i>parisorum</i>	x	x	x	x
Orchard Oriole	OROR	<i>Icterus</i>	<i>spurius</i>	x	x		x
Bullock's Oriole	BUOR	<i>Icterus</i>	<i>bullockii</i>	x			x
Baltimore Oriole	BAOR	<i>Icterus</i>	<i>galbula</i>	x			
Hooded Oriole	HOOR	<i>Icterus</i>	<i>cucullatus</i>	x			

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Unknown Oriole	UNOR	<i>Icterus</i>	<i>sp.</i>	x			
House Finch	HOFI	<i>Carpodacus</i>	<i>mexicanus</i>	x	x	x	x
Red Crossbill	RECR	<i>Loxia</i>	<i>curvirostra</i>			x	
Pine Siskin	PISI	<i>Carduelis</i>	<i>pinus</i>	x	x	x	x
Lesser Goldfinch	LEGO	<i>Carduelis</i>	<i>psaltria</i>	x	x	x	x
American Goldfinch	AMGO	<i>Carduelis</i>	<i>tristis</i>	x		x	
House Sparrow	HOSP	<i>Passer</i>	<i>domesticus</i>	x			x

Appendix D. Bird Species Observed at Four NPS Chihuahuan Desert Network Park Sites.

Species are presented in alphabetic order by their four letter code.

	COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
					CAVE	FODA	GUMO	WHSA
	Acorn woodpecker	ACWO	<i>Melanerpes</i>	<i>formicivorus</i>		x		
	American Avocet	AMAV	<i>Recurvirostra</i>	<i>americana</i>				x
	American Goldfinch	AMGO	<i>Carduelis</i>	<i>tristis</i>	x		x	
	American Kestrel	AMKE	<i>Falco</i>	<i>sparverius</i>	x	x	x	x
	American Redstart	AMRE	<i>Setophaga</i>	<i>ruticilla</i>	x			
	American Robin	AMRO	<i>Turdus</i>	<i>migratorius</i>				x
	Ash-throated Flycatcher	ATFL	<i>Myiarchus</i>	<i>cinerascens</i>	x	x	x	x
	Baltimore Oriole	BAOR	<i>Icterus</i>	<i>galbula</i>	x			
	Barn Swallow	BARS	<i>Hirundo</i>	<i>rustica</i>	x	x	x	x
	Black-chinned Hummingbird	BCHU	<i>Archilohcus</i>	<i>alexandri</i>	x	x	x	
	Black-chinned Sparrow	BCSP	<i>Spizella</i>	<i>atrogularis</i>	x	x	x	
	Black-crested Titmouse	BCTI	<i>Baeolophus</i>	<i>atricristatus</i>		x		
	Belted Kingfisher	BEKI	<i>Ceryle</i>	<i>alcyon</i>	x		x	
	Bell's Vireo	BEVI	<i>Vireo</i>	<i>bellii</i>	x			
	Bewick's Wren	BEWR	<i>Thryomanes</i>	<i>bewickii</i>	x	x	x	x
	Blue-gray Gnatcatcher	BGGN	<i>Polioptila</i>	<i>caerulea</i>	x		x	x
	Brown-headed Cowbird	BHCO	<i>Molothrus</i>	<i>ater</i>	x	x	x	x
	Black-headed Grosbeak	BHGR	<i>Pheucticus</i>	<i>melanocephalus</i>	x	x	x	x
	Blue-headed Vireo	BHVI	<i>Vireo</i>	<i>solitarius</i>			x	
	Blue Grosbeak	BLGR	<i>Passerina</i>	<i>caerulea</i>	x	x	x	x
	Black Phoebe	BLPH	<i>Sayornis</i>	<i>nigricans</i>	x		x	
	Brewer's Blackbird	BRBL	<i>Euphagus</i>	<i>cyancephalus</i>	x	x		x
	Bronzed Cowbird	BROC	<i>Molothrus</i>	<i>aeneus</i>	x			x
	Brewer's Sparrow	BRSP	<i>Spizella</i>	<i>breweri</i>	x	x	x	x
	Brown Thrasher	BRTN	<i>Toxostoma</i>	<i>rufum</i>	x			

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Black-tailed Gnatcatcher	BTGN	<i>Polioptila</i>	<i>melanura</i>	x		x	x
Broad-tailed Hummingbird	BTLH	<i>Selasphorus</i>	<i>platycercus</i>	x	x	x	x
Band-tailed Pigeon	BTPI	<i>Patagioenas</i>	<i>fasciata</i>			x	
Black-throated Sparrow	BTSP	<i>Amphispiza</i>	<i>bilineata</i>	x	x	x	x
Black-throated Gray Warbler	BTYW	<i>Dendroica</i>	<i>nigrescens</i>			x	
Bullock's Oriole	BUOR	<i>Icterus</i>	<i>bullockii</i>	x			x
Burrowing Owl	BUOW	<i>Athene</i>	<i>cunicularia</i>				x
Bushtit	BUSH	<i>Psaltiriparus</i>	<i>minimus</i>	x	x	x	
Cactus Wren	CACW	<i>Campylorhynchus</i>	<i>brunneicapillus</i>	x	x	x	x
Calliope Hummingbird	CAHU	<i>Stellula</i>	<i>calliope</i>			x	
Cassin's Kingbird	CAKI	<i>Tyrannus</i>	<i>vociferans</i>	x	x	x	x
Canyon Towhee	CANT	<i>Pipilo</i>	<i>fuscus</i>	x	x	x	
Canyon Wren	CANW	<i>Catherpes</i>	<i>mexicanus</i>	x	x	x	
Carolina Wren	CARW	<i>Thryothorus</i>	<i>ludovicianus</i>			x	
Cassin's Sparrow	CASP	<i>Aimophila</i>	<i>cassinii</i>	x	x	x	x
Cave Swallow	CASW	<i>Petrochelidon</i>	<i>fulva</i>	x			x
Cassin's Vireo	CAVI	<i>Vireo</i>	<i>cassinii</i>	x		x	
Common Black-hawk	CBHA	<i>Buteogallus</i>	<i>anthracinus</i>		x		
Curve-billed Thrasher	CBTH	<i>Toxostoma</i>	<i>curvirostre</i>		x	x	x
Chestnut-collared Longspur	CCLO	<i>Calcarius</i>	<i>ornatus</i>				x
Clay-colored Sparrow	CCSP	<i>Spizella</i>	<i>pallida</i>	x	x		x
Cedar Waxwing	CEDW	<i>Bombycilla</i>	<i>cedrorum</i>	x		x	x
Chihuahuan Raven	CHRA	<i>Corvus</i>	<i>cryptoleucus</i>				x
Chipping Sparrow	CHSP	<i>Spizella</i>	<i>passerina</i>	x	x	x	x
Cliff Swallow	CLSW	<i>Petrochelidon</i>	<i>pyrrhonota</i>	x	x	x	
Cordilleran Flycatcher	COFL	<i>Empidonax</i>	<i>occidentalis</i>	x		x	x
Common Grackle	COGR	<i>Quiscalus</i>	<i>quiscula</i>				x
Cooper's Hawk	COHA	<i>Accipiter</i>	<i>cooperii</i>	x	x	x	
Common Nighthawk	CONI	<i>Chordeiles</i>	<i>minor</i>	x		x	
Common Poorwill	COPW	<i>Phalaenoptilus</i>	<i>nuttallii</i>	x		x	

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Common Raven	CORA	<i>Corvus</i>	<i>corax</i>	x	x	x	x
Common Yellowthroat	COYE	<i>Geothlypis</i>	<i>trichas</i>	x			
Crissal Thrasher	CRTH	<i>Toxostoma</i>	<i>crissale</i>	x		x	x
Dark-eyed Junco	DEJU	<i>Junco</i>	<i>hyemalis</i>	x		x	
Dickcissel	DICK	<i>Spiza</i>	<i>americana</i>	x			
Dusky Flycatcher	DUFL	<i>Empidonax</i>	<i>oberholseri</i>	x	x	x	x
Eastern Meadowlark	EAME	<i>Sturnella</i>	<i>magna</i>		x	x	
Eastern phoebe	EAPH	<i>Sayornis</i>	<i>phoebe</i>	x			
Elf Owl	ELOW	<i>Micrathene</i>	<i>whitneyi</i>			x	
Eurasian Collared-dove	EUCD	<i>Streptopelia</i>	<i>decaocto</i>	x	x		x
European Starling	EUST	<i>Sturnus</i>	<i>vulgaris</i>		x		x
Gambel's Quail	GAQU	<i>Callipepla</i>	<i>gambelii</i>				x
Great Blue Heron	GBHE	<i>Ardea</i>	<i>herodias</i>	x			
Great Horned Owl	GHOW	<i>Bubo</i>	<i>virginianus</i>	x			
Golden Eagle	GOEA	<i>Aquila</i>	<i>chrysaetos</i>	x		x	
Gray Catbird	GRCA	<i>Dumetella</i>	<i>carolinensis</i>	x			
Gray Flycatcher	GRFL	<i>Empidonax</i>	<i>wrightii</i>		x	x	x
Gray Hawk	GRHA	<i>Buteo</i>	<i>nitidus</i>	x	x		
Greater Pewee	GRPE	<i>Contopus</i>	<i>pertinax</i>	X			
Greater Roadrunner	GRRO	<i>Geococcyx</i>	<i>californianus</i>	x	x	x	x
Gray Vireo	GRVI	<i>Vireo</i>	<i>vicinior</i>	x		x	
Grace's Warbler	GRWA	<i>Dendroica</i>	<i>graciae</i>			x	
Great-tailed Grackle	GTGR	<i>Quiscalus</i>	<i>mexicanus</i>	x			x
Green-tailed Towhee	GTTO	<i>Pipilo</i>	<i>chlorurus</i>	x	x	x	x
Hammond's Flycatcher	HAFL	<i>Empidonax</i>	<i>hammondii</i>	x		x	
Hairy Woodpecker	HAWO	<i>Picoides</i>	<i>villosus</i>			x	
Hepatic Tanager	HETA	<i>Piranga</i>	<i>flava</i>	x		x	
Hermit Thrush	HETH	<i>Catharus</i>	<i>guttatus</i>	x	x	x	x
Hermit Warbler	HEWA	<i>Dendroica</i>	<i>occidentalis</i>			x	
House Finch	HOFI	<i>Carpodacus</i>	<i>mexicanus</i>	x	x	x	x

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Hooded Oriole	HOOR	<i>Icterus</i>	<i>cucullatus</i>	x			
House Sparrow	HOSP	<i>Passer</i>	<i>domesticus</i>	x			x
Hooded Warbler	HOWA	<i>Wilsonia</i>	<i>citrina</i>			x	
House Wren	HOWR	<i>Troglodytes</i>	<i>aedon</i>	x	x	x	x
Hutton's Vireo	HUVI	<i>Vireo</i>	<i>huttoni</i>			x	
Indigo Bunting	INBU	<i>Passerina</i>	<i>cyanea</i>	x	x	x	
Juniper Titmouse	JUTI	<i>Baeolophus</i>	<i>ridgwayi</i>			x	
Killdeer	KILL	<i>Charadrius</i>	<i>vociferus</i>	x	x		x
Lark Bunting	LARB	<i>Calamospiza</i>	<i>melanocorys</i>	x			
Lark Sparrow	LASP	<i>Chondestes</i>	<i>grammacus</i>	x	X	x	x
Lazuli Bunting	LAZB	<i>Passerina</i>	<i>amoena</i>			x	
Ladder-backed Woodpecker	LBWO	<i>Picoides</i>	<i>scalaris</i>	x	X	x	x
Lesser Goldfinch	LEGO	<i>Carduelis</i>	<i>psaltria</i>	x	X	x	x
Lesser Nighthawk	LENI	<i>Chordeiles</i>	<i>acutipennis</i>	x			x
Lesser Scaup	LESC	<i>Athyra</i>	<i>affinis</i>	x			
Lincoln's Sparrow	LISP	<i>Melospiza</i>	<i>lincolnii</i>	x	x	x	x
Loggerhead Shrike	LOSH	<i>Lanius</i>	<i>ludovicianus</i>	x	x		x
Lucy's Warbler	LUWA	<i>Vermivora</i>	<i>luciae</i>	x			
Magnificent Hummingbird	MAHU	<i>Eugenes</i>	<i>fulgenes</i>			x	
Magnolia Warbler	MAWA	<i>Dendroica</i>	<i>magnolia</i>	x			
Marsh Wren	MAWR	<i>Cistothorus</i>	<i>palustris</i>	x			
MacGillivray's Warbler	MGWA	<i>Oporornis</i>	<i>tolmiei</i>	x		x	x
Mississippi Kite	MIKI	<i>Ictinia</i>	<i>mississippiensis</i>	x			
Mountain Chickadee	MOCH	<i>Poecile</i>	<i>gambeli</i>	x		x	
Mourning Dove	MODO	<i>Zenaida</i>	<i>macroura</i>	x	x	x	x
Montezuma Quail	MOQU	<i>Cyrtonyx</i>	<i>montezumae</i>		x		
Nashville Warbler	NAWA	<i>Vermivora</i>	<i>ruficapilla</i>	x			
Northern Bobwhite	NOBO	<i>Colinus</i>	<i>virginianus</i>	x			
Northern Cardinal	NOCA	<i>Cardinalis</i>	<i>cardinalis</i>	x	x	x	
Northern Flicker (red-shafted)	NOFL	<i>Colaptes</i>	<i>auratus</i>	x	x	x	x

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WSA
Northern Harrier	NOHA	<i>Circus</i>	<i>cyaneus</i>	x			x
Northern Mockingbird	NOMO	<i>Mimus</i>	<i>polyglottos</i>	x	x	x	x
Northern Parula	NOPA	<i>Parula</i>	<i>americana</i>	x			
Northern Waterthrush	NOWA	<i>Seiurus</i>	<i>noveboracensis</i>	x			
Northern Rough-winged Swallow	NRSW	<i>Stelgidopteryx</i>	<i>serripennis</i>	x			x
Orange-crowned Warbler	OCWA	<i>Vermivora</i>	<i>celata</i>	x	x	x	x
Orchard Oriole	OROR	<i>Icterus</i>	<i>spurius</i>	x	x		x
Olive-sided Flycatcher	OSFL	<i>Contopus</i>	<i>cooperi</i>	x	x	x	
Painted Bunting	PABU	<i>Passerina</i>	<i>ciris</i>	x			
Peregrine Falcon	PEFA	<i>Falco</i>	<i>peregrinus</i>	x			
Phainopepla	PHAI	<i>Phainopepla</i>	<i>nitens</i>	x	x	x	x
Pine Siskin	PISI	<i>Carduelis</i>	<i>pinus</i>	x	x	x	x
Plumbeous Vireo	PLVI	<i>Vireo</i>	<i>plumbeus</i>	x		x	
Pyrrhuloxia	PYRR	<i>Cardinalis</i>	<i>sinuatus</i>	x	x	x	x
Rose-breasted Grosbeak	RBGR	<i>Pheucticus</i>	<i>ludovicianus</i>	x			
Red-breasted Nuthatch	RBNU	<i>Sitta</i>	<i>canadensis</i>		x	x	
Ruby-crowned Kinglet	RCKI	<i>Regulus</i>	<i>calendula</i>	x	x	x	x
Rufous-crowned Sparrow	RCSP	<i>Aimophila</i>	<i>ruficeps</i>	x	x	x	
Red Crossbill	RECR	<i>Loxia</i>	<i>curvirostra</i>			x	
Ring-necked Duck	RNDU	<i>Aythya</i>	<i>collaris</i>	x			
Red-naped Sapsucker	RNSA	<i>Sphyrapicus</i>	<i>nuchalis</i>	x		x	x
Rock pigeon	ROPI	<i>Columba</i>	<i>livia</i>				x
Rock Wren	ROWR	<i>Salpinctes</i>	<i>obsoletus</i>	x	x	x	x
Red-tailed Hawk	RTHA	<i>Buteo</i>	<i>jamaicensis</i>	x	x	x	
Ruby-throated Hummingbird	RTHU	<i>Archilochus</i>	<i>colubris</i>			x	
Rufous Hummingbird	RUHU	<i>Selasphorus</i>	<i>rufus</i>		x	x	
Red-winged Blackbird	RWBL	<i>Agelaius</i>	<i>phoeniceus</i>	x		x	x
Say's Phoebe	SAPH	<i>Sayornis</i>	<i>saya</i>	x	x	x	x
Sage Thrasher	SATH	<i>Oreoscoptes</i>	<i>montanus</i>	x			x
Savannah Sparrow	SAVS	<i>Passerculus</i>	<i>sandwichensis</i>				x

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
Scott's Oriole	SCOR	<i>Icterus</i>	<i>parisorum</i>	x	x	x	x
Scaled Quail	SCQA	<i>Callipepla</i>	<i>squamata</i>	x		x	
Song Sparrow	SOSP	<i>Melospiza</i>	<i>melodia</i>	x		x	
Spotted Towhee	SPTO	<i>Pipilo</i>	<i>maculatus</i>	x		x	
Sharp-shinned Hawk	SSHA	<i>Accipiter</i>	<i>striatus</i>	x		x	x
Summer Tanager	SUTA	<i>Piranga</i>	<i>rubra</i>	x	x	x	
Swainson's Hawk	SWHA	<i>Buteo</i>	<i>swainsoni</i>	x			x
Swainson's Thrush	SWTH	<i>Catharus</i>	<i>ustulatus</i>			x	
Townsend's Solitaire	TOSO	<i>Myadestes</i>	<i>townsendi</i>			x	
Townsend's Warbler	TOWA	<i>Dendroica</i>	<i>townsendi</i>	x	x	x	
Tree Swallow	TRSW	<i>Tachycineta</i>	<i>bicolor</i>	x			
Turkey Vulture	TUVU	<i>Cathartes</i>	<i>aura</i>	x	x	x	x
Unknown Empidonax	UNEM	<i>Empidonax</i>	<i>Sp.</i>	x		x	
Unknown Heron (Tri-colored/Little-blue)	UNHE	<i>Egretta</i>	<i>sp.</i>	x			
Unknown Hummingbird	UNHU	<i>Unknown</i>				x	
Unknown Meadowlark	UNME	<i>Sturnella</i>	<i>sp.</i>				x
Unknown Oriole	UNOR	<i>Icterus</i>	<i>sp.</i>	x			
Unknown Raven	UNRA	<i>Corvus</i>	<i>sp.</i>				x
Unknown Swallow	UNSW	<i>Hirundo</i>	<i>sp.</i>	x		x	
Unknown Vireo	UNVI	<i>Vireo</i>	<i>sp.</i>			x	
Unknown Warbler	UNWA	<i>Unknown</i>	<i>sp.</i>	x		x	
Upland Sandpiper	UPSA	<i>Bartramia</i>	<i>longicauda</i>	x			
Varied Bunting	VABU	<i>Passerina</i>	<i>versicolor</i>	x			
Vermilion Flycatcher	VEFL	<i>Pyrocephalus</i>	<i>rubinus</i>	x	x		
Verdin	VERD	<i>Auriparus</i>	<i>flaviceps</i>	x	x	x	x
Vesper Sparrow	VESP	<i>Pooecetes</i>	<i>gramineus</i>		x		x
Violet-green Swallow	VGSW	<i>Tachycineta</i>	<i>thalassina</i>	x	x	x	
Virginia's Warbler	VIWA	<i>Vermivora</i>	<i>virginiae</i>	x		x	
Warbling Vireo	WAVI	<i>Vireo</i>	<i>gilvus</i>	x		x	x

COMMON NAME	4-LETTER CODE	GENUS	SPECIES	PARK			
				CAVE	FODA	GUMO	WHSA
White-breasted Nuthatch	WBNU	<i>Sitta</i>	<i>carolinensis</i>	x		x	
White-crowned Sparrow	WCSP	<i>Zonotrichia</i>	<i>leucophrys</i>	x	x	x	x
Western Kingbird	WEKI	<i>Tyrannus</i>	<i>verticalis</i>	x	x	x	x
Western Meadowlark	WEME	<i>Sturnella</i>	<i>neglecta</i>	x			
Western Scrub-jay	WESJ	<i>Aphelocoma</i>	<i>californica</i>		x	x	
Western Tanager	WETA	<i>Piranga</i>	<i>ludoviciana</i>	x	x	x	
Western Wood-pewee	WEWP	<i>Contopus</i>	<i>sordidulus</i>	x	x	x	x
Willow Flycatcher	WIFL	<i>Empidonax</i>	<i>traillii</i>	x			
Wilson's Snipe	WISN	<i>Gallinago</i>	<i>delicata</i>	x			
Wild Turkey	WITU	<i>Meleagris</i>	<i>gallopavo</i>	x			
Wilson's Warbler	WIWA	<i>Wilsonia</i>	<i>pusilla</i>	x	x	x	x
White-throated Swift	WTSW	<i>Aeronautes</i>	<i>saxatalis</i>	x		x	
White-winged Dove	WWDO	<i>Zenaida</i>	<i>asiatica</i>	x	x	x	x
Yellow-breasted Chat	YBCH	<i>Icteria</i>	<i>virens</i>	x		x	
Yellow-billed Cuckoo	YBCU	<i>Coccyzus</i>	<i>americanus</i>	x	x		
Yellow Warbler	YEWA	<i>Dendroica</i>	<i>petechia</i>	x		x	x
Yellow-headed Blackbird	YHBL	<i>Xanthocephalus</i>	<i>xanthocephalus</i>	x			x
Yellow-bellied Sapsucker	YNSA	<i>Sphyrapicus</i>	<i>varius</i>	x			
Yellow-rumped Warbler (Audubon's)	YRWA	<i>Dendroica</i>	<i>coranata</i>	x	x	x	X
Zone-tailed Hawk	ZTHA	<i>Buteo</i>	<i>albonotatus</i>		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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Natural Resource Stewardship and Science

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