Inventory of Amphibians and Reptiles in Southern Colorado Plateau National Parks

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Inventory of Amphibians and Reptiles in Southern Colorado National Parks

By Trevor B. Persons and Erika M. Nowak

In cooperation with the National Park Service

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U.S. Geological Survey

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Inventory of Amphibians and Reptiles in Southern Colorado Plateau National Parks

Trevor B. Persons and Erika M. Nowak

Abstract

In fiscal year 2000, the National Park Service (NPS) initiated a nationwide program to inventory vertebrates and vascular plants within the National Parks, and an inventory plan was developed for the 19 park units in the Southern Colorado Plateau Inventory & Monitoring Network. We surveyed 12 parks in this network for reptiles and amphibians between 2001 and 2003. The overall goals of our herpetofaunal inventories were to document 90% of the species present, identify park-specific species of special concern, and, based on the inventory results, make recommendations for the development of an effective monitoring program. We used the following standardized herpetological methods to complete the inventories: time-area constrained searches, visual encounter ("general") surveys, and nighttime road cruising. We also recorded incidental species sightings and surveyed existing literature and museum specimen databases. We found 50 amphibian and reptile species during fieldwork. These included 1 salamander, 11 anurans, 21 lizards, and 17 snakes. Literature reviews, museum specimen data records, and personal communications with NPS staff added an additional eight species, including one salamander, one turtle, one lizard, and five snakes. It was necessary to use a variety of methods to detect all species in each park. Randomly-generated 1-ha time-area constrained searches and night drives produced the fewest species and individuals of all the methods, while general surveys and randomly-generated 10-ha time-areas constrained searches produced the most. Inventory completeness was likely compromised by a severe drought across the region during our surveys. In most parks we did not come close to the goal of detecting 90% of the expected species present; however, we did document several species range extensions. Effective monitoring programs for herpetofauna on the Colorado Plateau should use a variety of methods to detect species, and focus on taxa-specific methods. Randomly-generated plots must take into account microhabitat and aquatic features to be effective at sampling for herpetofauna.

Key Words

Amphibians, herpetofauna, inventory, monitoring, night driving, reptiles, road cruising, time-area constrained search, Colorado Plateau, Arizona, Colorado, New Mexico, Utah, Aztec Ruins National Monument, Bandelier National Monument, Canyon de Chelly National Monument, Chaco Culture National Historic Park, El Malpais National Monument, El Morro National Monument, Glen Canyon National Recreation Area, Grand Canyon National Park, Hubbell Trading Post National Historic Site, Mesa Verde National Park, Navajo National Monument, Petrified Forest National Park, Petroglyph National Monument, Rainbow Bridge National Monument, Salinas Pueblo Missions National Monument, Sunset Crater Volcano National Monument, Walnut Canyon National Monument, Wupatki National Monument, Yucca House National Monument.

Introduction

In fiscal year 2000, the National Park Service (NPS) initiated a nationwide program to inventory vertebrates and vascular plants within the National Parks. As part of this new inventory effort led by the Inventory and Monitoring Program, a total of 265 National Park units (parks, monuments, recreation areas, historic sites, etc.) were identified as having significant natural resources, and these were divided into 32 groups or "networks" based on geographical proximity and similar habitat types. The many NPS areas on the Colorado Plateau of Utah, northern Arizona, northwestern New Mexico, and western Colorado were divided into northern and southern Colorado Plateau networks. An inventory plan was developed for the 19 park units in the Southern Colorado Plateau Inventory & Monitoring Network (SCPN) (Stuart 2000).

Long-term biological inventory goals for each park are to provide: 1) complete bibliographies of studies pertinent

to biological inventory of network parks; 2) detailed summaries of biological survey and natural history specimen data for the network parks; 3) species lists for each taxonomic group in relational database and hard copy format; 4) relative abundance estimates for selected species of concern in each vertebrate and vascular plant taxonomic group; 5) spatially located data for species of interest or concern; 6) spatial data on sampling site locations for GIS and a GIS data browser; 7) pertinent herbarium and museum vouchers databases; and 8) recommendations for long-term monitoring within the network.

The overall goals of our herpetofauna inventories were to: 1) provide each park with a baseline inventory of reptiles and amphibians in major habitats within the parks with the goal of documenting 90% of the species present; 2) identify park-specific species of special concern (which could become part of future "vital signs" monitoring); and 3) based on the inventory, make recommendations for the development of an effective monitoring program so that Resource Management staff at each park can assess the condition of amphibian and reptile populations over time, and detect significant changes in those populations.

In the first year (2001) of reptile and amphibian inventories in the SCPN, we surveyed the following park units: Aztec Ruins National Monument (AZRU), El Morro National Monument (ELMO), Petroglyph National Monument (PETR), Salinas Pueblo Missions National Monument (SAPU), Sunset Crater Volcano National Monument (SUCR), Walnut Canyon National Monument (WACA), Wupatki National Monument (WUPA), and Yucca House National Monument (YUHO) (Nowak et al. 2002). In 2002 we began inventory work at Bandelier National Monument (BAND), Chaco Culture National Historic Park (CHCU), and El Malpais National Monument (ELMA) (Nowak et al. 2003), and we continued fieldwork at all parks in 2002 and 2003, although efforts in 2003 were primarily concentrated at BAND, CHCU, and ELMA. In addition, we conducted surveys at Glen Canyon National Recreation Area (GLCA) in 2003, and reviewed existing data for other parks in the SCPN that did not receive funding, i.e., Grand Canyon National Park (GRCA), Petrified Forest National Park (PEFO), Mesa Verde National Park (MEVE), and Rainbow Bridge National Monument (RABR). Finally, responsibility for conducting inventories at Canyon de Chelly National Monument (CACH), Hubbell Trading Post National Historic Site (HUTR), and Navajo National Monument (NAVA) was transferred to the Navajo Nation Natural Heritage Program. For completeness we have included a summary of results from these three parks, based on the work of Mikesic (2005a, b, c).

Study Area

Our study area covered much of the southern Colorado Plateau, as well as the adjacent Rio Grande Valley area of north-central New Mexico. Figure 1 shows the location of each park in the SCPN. Stuart (2000) and Thomas et al. (2004) present descriptions of the habitats and other features of each park unit. Brief overviews of the major habitats found at each park are included in the park accounts (Appendices A-S).

Methods

Because of the dispersed locations of the parks surveyed, and the limited time and funding available for fieldwork at any given park, we only used visual survey methods during these inventories. While trapping methods (such as pitfall traps; Campbell and Christman 1982) often capture rare or secretive species that are difficult to detect using visual surveys, these results are often obtained only after substantial trapping effort. The different visual survey methods employed during these inventories are outlined below.

Time-Area Constrained Searches

Time-area constrained searches (TACS) are a version of visual encounter surveys defined by Crump and Scott (1994) in which not only the amount of time spent searching, but also the area covered, are standardized. TACS consist of walking systematically through each habitat within the sampling area for a specified amount of time, searching all reasonable areas within that habitat, and recording reptiles and amphibians encountered (e.g., Drost and Nowak 1997, Scott 1994). This method yields a number of individuals and species collected or observed per person-hour.

Using one or two people, we conducted 1-hour TACS within 1-ha (2.5 acres) plots. We conducted randomly located plot surveys only in larger parks (i.e., BAND, CHCU, ELMA, ELMO, PETR, SUCR, WACA, and WUPA). These sites were a subset of those generated using GIS to stratify parks by habitat (see Stuart 2000). In 2001, we also conducted non-random 1-ha TACS plots, primarily in the smaller parks that fell below the size threshold for a stratified random sampling design (Stuart 2000). However, in 2002 and 2003 we did not conduct any non-random TACS plot surveys in any parks. In smaller parks (i.e., AZRU, SAPU, and YUHO) we primarily used general survey and nighttime road driving methods. For our surveys at GLCA in 2003 we only used general survey and road driving methods.

In 2001, all TACS plots were 1-ha (2.5 acres) in size, generally 100 m (328 feet) square. In some areas, we were forced to move the plot center or change its shape to stay within a given habitat type. For each plot, we recorded the location of the center point in UTM coordinates using a global positioning system (GPS) unit, as well as plot dimensions and orientation if different from cardinal bearings (N, S, E, W). We also photographed and described the topography, elevation, slope, aspect, vegetation, and non-vegetative cover of each plot using data sheets developed in conjunction with the

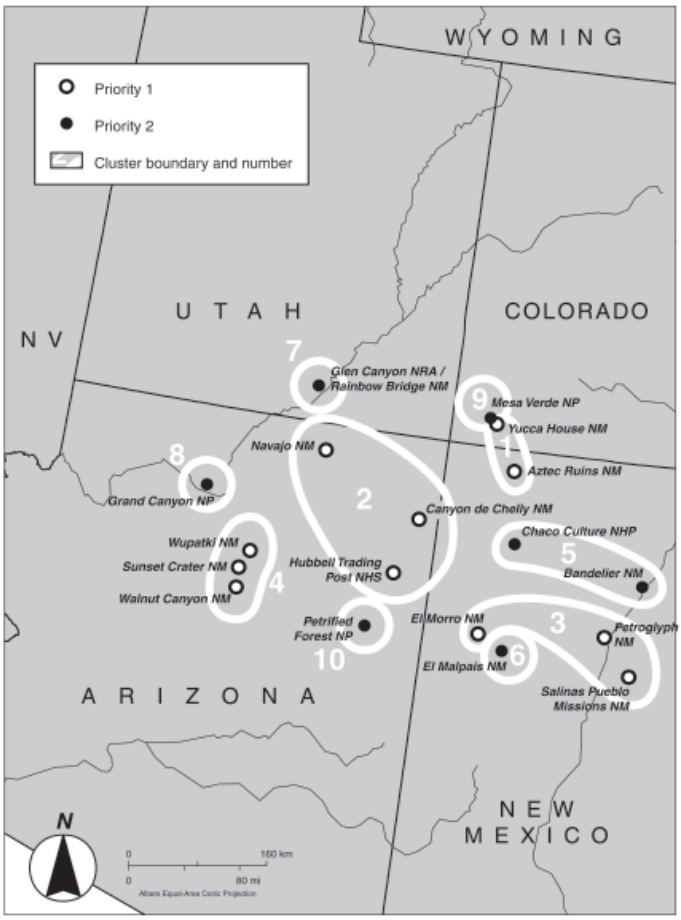

Figure 1. Location of National Park Service units in the Southern Colorado Plateau Inventory & Monitoring Network. See Stuart (2000) for a description of park clusters.

network coordinator at the time (Anne Cully, now Lisa Thomas) and data manager (Nicole Tancreto) for the SCPN (Figure 2).

In 2002 and 2003, some of the random TACS plot surveys were altered to be time constrained but functionally area-unconstrained. These surveys were conducted like the regular 1-ha plots, but we surveyed over a wider area (between 1 and 10 ha [2.5 and 25 acres]; henceforth referred to as "10-ha TACS") centered on the random point. We allowed ourselves to cover an area up to 10 ha, but given that we were limited to an hour, we often did not cover such a large area. Instead, we targeted favorable microhabitats in order to increase the probability of finding more species on each survey. These surveys represented a compromise between the flexibility of the general surveying technique (below) and the statistically based criterion of random survey points.

General Surveys

We also conducted visual encounter surveys that were not time or area-limited. In these "general surveys," we sampled habitats that appeared to be of high quality for reptiles or amphibians, were otherwise unique, and/or were not represented by TACS plots. The focus of this method was to search selected microhabitats opportunistically without necessarily covering a given area thoroughly. Most of these general surveys were conducted during the day, but we also conducted some at night. Nocturnal general surveys were used primarily to search amphibian breeding areas and document calling and/or larvae.

Road or Night Driving Surveys

Driving slowly on roads at night and carefully scanning the road in the headlights of the vehicle is recognized as an excellent method for surveying some groups of reptiles, particularly snakes (e.g., Klauber 1939, Mendelson and Jennings 1992, Rosen and Lowe 1994). This method is also effective for surveying amphibians (Shaffer and Juterbock 1994), particularly in the arid southwest where many anuran species are seldom active during daytime, but can often be found crossing roads on warm, rainy nights. Although suitable paved or hard-packed dirt roads within or adjacent to many of the parks we surveyed were minimal, we conducted limited road driving at all parks.

We standardized night driving surveys by driving a vehicle at slow speeds (30-40 km per hour), identifying all amphibians and reptiles encountered to species and recorded if they were either alive on the road (AOR) or dead on the road (DOR), sexing and aging all individuals, as possible, and recording locations to the nearest 0.16 km (0.1 mi) using calibrated vehicle odometers.

Random Encounters

Amphibians and reptiles seen incidental to other fieldwork by us or seen by park staff were referred to as "random encounters." As with the amphibians and reptiles seen or captured by the different sampling methods described above, we recorded standard data on random encounters, including date, time, location, species, age class or size measurements, and if possible, sex.

Voucher Specimens

We attempted to document the presence of each species at each park by collecting at least one individual of each species at each park for those species not already represented by specimens in institutional collections. Some individuals were taken alive and humanely euthanized, but we also salvaged many animals that were found dead on roads in or near the parks. Specimens were injected with and immersed in 10% formalin for fixing, and then transferred to 55% isopropyl alcohol for preservation, using standard techniques (e.g. Pisani 1973). Most of these specimens have been deposited in the U.S. Geological Survey's Biological Survey Collection at the

Figure 2. Field data form used for herpetofauna 1-ha TACS plots and 10-ha TACS surveys in the Southern Colorado Plateau Inventory & Monitoring Network in 2001-2003. The two pages were photocopied back to back.

Park Code _____ **Pg.** _____ **of** _____

Southern Colorado Plateau Herpetofauna Surveys

Date _____ **Observers** _____ **Location** _____

GPS Unit _____ **Datum / Zone** _____ **Survey Type (circle): 1 Ha TACS Plot ~10 Ha TCS survey**

UTMs: Easting _____ **Northing** _____ **EPE** _____

Elevation _____ **USGS Quad** _____ **Slope** _____ **Aspect** _____

Description of Plot _____

_____

Photo #s _____ **Description of Photo Shots** _____

Landform Class _____ **Soil Type** _____ **Surface Water Type** _____

Cover Stratum	Species	% Cover	Height
Tree Total %			
Shrub Total %			
Herbaceous Total %			
Unvegetated Total %	Bedrock		
	Large Rocks (>10 cm)		
	Small Rocks (0.2 - 10 cm)		
	Sand / Bare Soil		
	Litter / Duff		
	Woody Debris (> 1 cm)		
	Biotic Crust		

Figure 2. Field data form used for herpetofauna 1-ha TACS plots and 10-ha TACS surveys in the Southern Colorado Plateau Inventory & Monitoring Network in 2001-2003. The two pages were photocopied back to back.—Continued

Park Code _____ **Pg.** _____ **of** _____

Southern Colorado Plateau Herpetofauna Surveys

Date _____ **Observers** _____ **Location** _____

	Time	% Cloud Cover	Sun Condition	Ta °C	Ts °C	Wind Max. (mph)	Wind Avg. (mph)	rH %
Begin								
End								

HERPETOFAUNA OBSERVATIONS

Species	Time	Sex	Age Class	Notes

Notes _____

Museum of Southwestern Biology, University of New Mexico, but specimens from SUCR, WACA, and WUPA have been deposited in the Flagstaff Area National Monuments vertebrate collection, which is currently housed at WACA. In addition to a field series tag and detailed data tag, each specimen has a National Park Service issue specimen tag containing information on species, collector, date of collection, collection site, and NPS (ANCS+) accession and catalog numbers.

Literature and Museum Specimen Data Searches

We conducted literature searches, and also searched specimen record data from a number of institutional museum collections, especially for parks in Arizona and Utah-states that do not have recent, comprehensive amphibian and reptile accounts as do New Mexico and Colorado (Degenhardt et al. 1996, Hammerson 1999). The most extensive searches were made of records from the vicinity of the three Flagstaff area parks (SUCR, WACA, WUPA) in Coconino County, Arizona. These included records from the American Museum of Natural History (AMNH), Arizona State University (ASU), Brigham Young University (BYU), California Academy of Sciences (CAS), The Carnegie Museum (CM), University of Colorado Museum (CU), University of Kansas Museum of Natural History (KU), Los Angeles County Museum (LACM), Museum of Comparative Zoology (MCZ), Museum of Northern Arizona (MNA), Museum of Southwestern Biology, University of New Mexico (MSB), Museum of Vertebrate Zoology (MVZ), Northern Arizona University (NAU), United States National Museum (USNM), University of Arizona (UAZ), University of Michigan Museum of Zoology (UMMZ), University of Texas at El Paso (UTEP), and the Flagstaff Area National Monuments vertebrate collection (SUCR, WACA, WUPA). Other datasets searched included MSB for all New Mexico counties where SCPN parks were located, BYU, KU, LACM, MVZ, UAZ, UMMZ, UTEP, and the University of Utah (UU) for counties in southern Utah encompassing GLCA and RABR, the MEVE collection for specimens from YUHO, and the USGS Biological Survey collection (USGS BS/FC, housed at MSB) for all SCPN parks. In addition, we were able to search the Colorado Division of Wildlife's amphibian and reptile specimen database for records from YUHO. This database includes all records represented on species account dot maps in Hammerson (1999).

We did not attempt to conduct thorough museum specimen review for parks not surveyed by us during this inventory (i.e., CACH, GRCA, HUTR, MEVE, NAVA, PEFO, RABR). For these parks, we primarily relied on literature sources (for GRCA, MEVE, PEFO, and RABR) and the reports on concurrent inventories in the Navajo Nation SCPN parks (CACH, HUTR, NAVA) by Mikesic (2005a, b, c). Finally, we did not include specimens from CHCU that we located in datasets from MSB and MVZ, as these were too numerous (hundreds of records), and consisted entirely of well-documented species (Jones 1970). Most of these specimens are, in fact, those cited by Jones (1970).

It should be noted that in many instances we did not actually examine museum specimens to verify species identifications. However, we did evaluate the probable legitimacy of these records by considering locality information, as well as who collected the specimens. Problematical records are discussed in the park species accounts. Often, however, the original collectors were well known herpetologists that had worked extensively in the region, and their identifications had been previously confirmed.

Field Data Collection, Data Analysis, and Data Products

Survey site locations and selected capture locations of individual animals were recorded using Garmin® (GPSIII Plus or Garmin 12) or Trimble GeoExplorer® hand-held GPS units. We recorded Universal Transverse Mercator (UTM) coordinates in the NAD27 datum in order to match the USGS topographic maps of SCPN parks.

The effectiveness of the different sampling methods was evaluated by determining overall species richness and capture rate per unit effort for each of the sampling methods. The number of species or individuals captured per unit effort was calculated by dividing the number captured or sighted by the total effort for that method. We measured sampling effort in person-hours, i.e., the number of hours spent surveying multiplied by the number of observers for any given survey. Random encounters are not quantifiable in terms of effort, but they added important information on the distribution and abundance of species within the parks.

Data were analyzed with the statistical program SPSS version 11.5.0 for Windows (SPSS 2002). To compare rates of animals detected between the different time-recorded survey methods (effectiveness), we first corrected (weighted) the total number of individuals seen by the total effort for each survey type. We then compared expected versus observed individuals for each method using the non-parametric Kruskal-Wallis-H test, a variant of the X^2 test that weights and ranks multiple independent variables (Sokal and Rohlf 1981). We repeated these tests to compare the effectiveness of survey methods for each taxonomic group (amphibians, lizards, and snakes). In these analyses, we excluded eggs and tadpoles, which are difficult to count accurately when they occur in large numbers, but included larval salamanders, which tend to occur in smaller groups in the areas we surveyed.

To estimate inventory completeness, we developed a master list of species potentially occurring at each park. Development of these master lists were based on consultation of selected literature sources (e.g., Cox and Tanner 1995, Degenhardt et al. 1996, Hammerson 1999, Stebbins 1985, 2003), extensive personal knowledge of the distribution and habitats of southwestern amphibians and reptiles, specimen data from

selected museum collections, and results of fieldwork from the 2001-2003 seasons. Probability of species occurrence was ranked as low (0-33%), medium (34-67%), or high (68-100%). In Tables A-1 through S-1 these three rankings are coded as 1, 2, and 3, respectively. For quantitative analysis, these rankings were converted to the midpoint of their percentage range, i.e. 0.17, 0.50, and 0.83. These values were used as weighting factors for species not yet documented. For example, two species with rankings of medium probability of occurrence would combine to equal one full expected species (0.50 x 2=1.00 species), whereas six species of low probability of occurrence would be required to equal one full expected species (0.17 x 6=1.02 species). Species found by us during the inventory, or known from previously collected specimens or reliable observations, are weighted 1.00. Such weighting of categorical probability data is generally not recommended for statistical applications; however, we feel it justifiable because we are not using the resulting inventory completeness estimates for statistical probability or hypothesis testing. Instead, we are generating locally-specific estimates of percent inventory completeness as mandated by the NPS I&M program, in a manner that integrates a range of information including inventory results, pre-existing information, and professional knowledge. These considerations should be kept in mind when interpreting the inventory completeness estimates, and underscore the need to focus on the more detailed discussions in the species accounts - especially for undocumented species.

In addition to master lists, we generated species accumulation curves (e.g., Scott 1994) to evaluate inventory completeness. The original SCPN inventory plan (Stuart 2000) also recommended use of mark-recapture based models (e.g., Burnham and Overton 1979) to estimate inventory completeness. However, the necessary statistical condition of equal detectability among species is strongly violated in surveys of amphibians and reptiles. In addition, because mark-recapture models require the use of random (e.g., plot survey) data, results could only reasonably have been applied to lizards, the group best suited to these types of daytime, visual encounter survey techniques.

Data products delivered separately to the SCPN include a Microsoft Access® database containing all field data on individual surveys, species observations, and habitat site characterization of the random plots. Additional datasets include Microsoft Excel® spreadsheets of voucher specimens collected during the present inventory, as well as of museum specimen data compiled from institutional collections. Other products delivered to the SCPN include copies of field data sheets and field notebooks, as well as photographs (35 mm color slides) of most random plot survey sites. Metadata for this inventory is being developed with the assistance of the SCPN data manager. The SCPN data manager, based on species lists and NPSpecies checklist field assignments in Tables A-1 through S-1, has updated the online NPSpecies database for all parks.

Table 1. Common and scientific names of amphibians and reptiles referred to in the text, following Stebbins (2003). Recent studies have proposed changes in the taxonomy of some species found in SCPN parks, and interested readers should consult Crother (2000) and Crother et al. (2003) for a summary of these proposals.

Common Name	Scientific Name
Amphibians	
Tiger Salamander	(*Ambystoma tigrinum*).
Jemez Mountains Salamander	(*Plethodon neomexicanus*).
Couch's Spadefoot	(*Scaphiopus couchii*).
Plains Spadefoot	(*Spea bombifrons*).
Great Basin Spadefoot	(*Spea intermontana*).
Mexican (New Mexico) Spadefoot	(*Spea multiplicata*).
Sonoran Desert Toad	(*Bufo alvarius*).
Great Plains Toad	(*Bufo cognatus*).
Red-spotted Toad	(*Bufo punctatus*).
Woodhouse's Toad	(*Bufo woodhousii*).
Canyon Treefrog	(*Hyla arenicolor*).
Mountain Treefrog	(*Hyla eximia*).
Western Chorus Frog	(*Pseudacris triseriata*).
Bullfrog	(*Rana catesbeiana*).
Relict Leopard Frog	(*Rana onca*).
Northern Leopard Frog	(*Rana pipiens*).
Lowland Leopard Frog	(*Rana yavapaiensis*).
Turtles and Tortoises	
Painted Turtle	(*Chrysemys picta*).
Western Box Turtle	(*Terrapene ornata*).
Spiny Softshell	(*Trionyx spiniferus*).
Desert Tortoise	(*Gopherus agassizii*).
Lizards	
Zebra-tailed Lizard	(*Callisaurus draconoides*).
Great Basin Collared Lizard	(*Crotaphytus bicinctores*).
Eastern (Common) Collared Lizard	(*Crotaphytus collaris*).
Desert Iguana	(*Dipsosaurus dorsalis*).
Long-nosed Leopard Lizard	(*Gambelia wislizenii*).
Lesser Earless Lizard	(*Holbrookia maculata*).
Greater Short-horned Lizard	(*Phrynosoma hernandesi*).
Roundtail Horned Lizard	(*Phrynosoma modestum*).
Desert Horned Lizard	(*Phrynosoma platyrhinos*).
Common Chuckwalla	(*Sauromalus obesus*).
Sagebrush Lizard	(*Sceloporus graciosus*).
Desert Spiny Lizard	(*Sceloporus magister*).
Eastern Fence Lizard	(*Sceloporus undulatus*).
Long-tailed Brush Lizard	(*Urosaurus graciosus*).
Ornate Tree Lizard	(*Urosaurus ornatus*).
Side-blotched Lizard	(*Uta stansburiana*).
Many-lined Skink	(*Eumeces multivirgatus*).
Great Plains Skink	(*Eumeces obsoletus*).
Western Skink	(*Eumeces skiltonianus*).
Chihuahuan Spotted Whiptail	(*Cnemidophorus exsanguis*).
Little Striped Whiptail	(*Cnemidophorus inornatus*).
New Mexico Whiptail	(*Cnemidophorus neomexicanus*).
Checkered Whiptail	(*Cnemidophorus tesselatus*).
Western Whiptail	(*Cnemidophorus tigris*).
Plateau Striped Whiptail	(*Cnemidophorus velox*).

Table 1. Common and scientific names of amphibians and reptiles referred to in the text, following Stebbins (2003). Recent studies have proposed changes in the taxonomy of some species found in SCPN parks, and interested readers should consult Crother (2000) and Crother et al. (2003) for a summary of these proposals.—Continued.

Common Name	Scientific Name
Lizards (Continued)	
Madrean Alligator Lizard	(*Elgaria kingii*).
Desert Night Lizard	(*Xantusia vigilis*).
Western Banded Gecko	(*Coleonyx variegatus*).
Gila Monster	(*Heloderma suspectum*).
Snakes	
Texas Blind Snake	(*Leptotyphlops dulcis*).
Western Blind Snake	(*Leptotyphlops humilis*).
Glossy Snake	(*Arizona elegans*).
Racer	(*Coluber constrictor*).
Ring-necked Snake	(*Diadophis punctatus*).
Corn Snake	(*Elaphe guttata*).
Chihuahuan Hook-nosed Snake	(*Gyalopion canum*).
Western Hog-nosed Snake	(*Heterodon nasicus*).
Night Snake	(*Hypsiglena torquata*).
Common Kingsnake	(*Lampropeltis getula*).
Sonoran Mountain Kingsnake	(*Lampropeltis pyromelana*).
Milk Snake	(*Lampropeltis triangulum*).
Coachwhip	(*Masticophis flagellum*).
Striped Whipsnake	(*Masticophis taeniatus*).
Smooth Green Snake	(*Opheodrys vernalis*).
Gopher Snake	(*Pituophis catenifer*).
Long-nosed Snake	(*Rhinocheilus lecontei*).
Mountain Patch-nosed Snake	(*Salvadora grahamii*).
Western Patch-nosed Snake	(*Salvadora hexalepis*).
Western Ground Snake	(*Sonora semiannulata*).
Southwestern Black-headed Snake	(*Tantilla hobartsmithi*).
Plains Black-headed Snake	(*Tantilla nigriceps*).
Black-necked Garter Snake	(*Thamnophis cyrtopsis*).
Western Terrestrial Garter Snake	(*Thamnophis elegans*).
Checkered Garter Snake	(*Thamnophis marcianus*).
Common Garter Snake	(*Thamnophis sirtalis*).
Western Lyre Snake	(*Trimorphodon biscutatus*).
Lined Snake	(*Tropidoclonion lineatum*).
Western Diamond-backed Rattlesnake	(*Crotalus atrox).*
Speckled Rattlesnake	(*Crotalus mitchellii*).
Black-tailed Rattlesnake	(*Crotalus molossus*).
Mojave Rattlesnake	(*Crotalus scutulatus*).
Western Rattlesnake	(*Crotalus viridis*).
Grand Canyon Rattlesnake	(*Crotalus viridis abyssus*).
Arizona Black Rattlesnake	(*Crotalus viridis cerberus*).
Midget-faded Rattlesnake	(*Crotalus viridis concolor*).
Great Basin Rattlesnake	(*Crotalus viridis lutosus*).
Hopi Rattlesnake	(*Crotalus viridis nuntius*).
Prairie Rattlesnake	(*Crotalus viridis viridis*).
Massasauga	(*Sistrurus catenatus*).

Results and Discussion

Overview of Inventory Results

We found 50 amphibian and reptile species during fieldwork for herpetological inventories at 12 National Park Service units in the SCPN in 2001-2003. These included 1 salamander, 11 anurans, 21 lizards, and 17 snakes. Literature reviews, museum specimen data records, and personal communications with NPS staff added an additional eight species, including one salamander, one turtle, one lizard, and five snakes. Details of relative abundance and habitat associations of each species at each park are found in the individual park accounts (Appendices A-S). Scientific names for these and other species mentioned in this report are presented in Table 1. Scientific and common names follow Stebbins (2003).

Although our ability to document many species was probably compromised by the persistent drought that severely impacted the southern Colorado Plateau during the inventory period, we nonetheless obtained baseline data on amphibian and reptile species occurrence at all 12 SCPN parks we surveyed. For those parks with little or no previous herpetofaunal inventory work (i.e., AZRU, SAPU, SUCR, WACA, YUHO), we now have data on occurrence of common species. We also documented new species at most of the other parks, all of which have had at least some prior herpetofaunal inventory work. Perhaps the highlight of these inventories was the discovery of Mountain Treefrogs at ELMA, which constituted a substantial range extension in New Mexico, and substantiated an unverified record from the Zuni Mountains region from the 1870's (Monatesti et al. 2005). Another exciting discovery was the occurrence of Western Banded Geckos at WUPA, which constitute the first records for the Little Colorado River basin, and only the second record from the Colorado Plateau away from the Colorado River (Persons and Nowak 2004a). We also documented new county records for Red-spotted Toad and Roundtail Horned Lizard from SAPU, and Night Snake from ELMO (Persons and Nowak 2005a, b, c). Finally, at WACA we discovered an isolated population of Little Striped Whiptail, a species with a very limited distribution on the southern Colorado Plateau (Persons 2005).

Sampling Effort and Efficacy of Methods

We spent approximately 1,684 person-hours surveying for amphibians and reptiles between April 2001 and September 2003 at 12 different SCPN parks. We used seven methods, including general surveys, nocturnal general surveys, 1-ha TACS, 10-ha TACS, non-random TACS, and night driving. Total amount of time spent on each sampling method at each park is summarized in Table 2. Not all methods were used in all parks. Four parks (AZRU, GLCA, SAPU, and YUHO) did not have random points generated for them, so we decided

Table 2. Total person-hours of survey effort for each time-recorded method at each of 12 parks in the Southern Colorado Plateau Inventory & Monitoring Network surveyed during amphibian and reptile inventories in 2001-2003. 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS plot, N-R TACS = non-random 1-ha TACS plot, GS = general survey, NGS = nocturnal general survey, and ND = night drive.

Park	1-ha TACS	10-ha TACS	N-R TACS	GS	NGS	ND	Total
AZRU	-	-	12.5	63.2	20.8	6.1	102.6
BAND	7.2	6.3	-	198.6	12.4	7.4	231.9
CHCU	10.6	8.3	-	122.5	6.8	57.7	205.9
ELMA	22.8	9.3	-	52.1	1.8	33.4	119.4
ELMO	8.3	6.2	3.3	58.2	7.4	15.3	98.7
GLCA	-	-	-	87.5	2.7	8.9	99.1
PETR	26.9	9.1	11.1	92.3	9.6	0.5	149.5
SAPU	-	-	19.5	114.4	25.9	22.2	182.0
SUCR	11.7	7.0	-	5.3	-	6.8	30.8
WACA	15.7	10.9	-	78.9	0.8	7.4	113.7
WUPA	20.0	11.3	-	145.6	-	30.8	207.7
YUHO	-	-	11.0	109.3	19.5	3.1	142.9
Total	**123.2**	**68.4**	**57.4**	**1,127.9**	**107.7**	**199.6**	**1,684.2**

to conduct supplemental non-random TACS in three of these and several other parks. We did not conduct nocturnal general surveys at SUCR due to its paucity of suitable amphibian breeding locations, nor at WUPA because previous research there documented all species potentially detectable using this method (Persons 2001a).

The greatest sampling effort occurred at the largest parks with the greatest potential herpetofaunal species richness: BAND had the highest sampling effort (14% of the total sampling effort), followed by WUPA (12% of total sampling effort). The smallest, least species-rich parks (due to being at higher elevations and having less habitat diversity) received the least sampling effort: SUCR and WACA received 1.8% and 6.7% of the total effort, respectively. GLCA and ELMO received substantially less effort than we originally planned (each had approximately 6% of total effort) because surveys in each park were limited to one field season.

When assessing effort spent on each type of method across parks, we kept in mind the stated goal of detecting 90% of the herpetofauna at each park. Based on our previous experience (e.g. Drost et al. 2001, Drost and Nowak 1997), we focused the majority of our sampling effort on the methods most likely to quickly detect new species in the widest variety of habitats: general surveying (67% of all person-hours spent) and night driving (12% of effort). We spent the least amount of time on non-random TACS (3% of effort, conducted only during the first year of surveys) and 10-ha TACS (4% of effort, conducted only during the second year of sampling). Nocturnal general surveys (6% of effort) and 1-ha TACS (7% of effort) were intermediate.

The amount of time spent on each method was not necessarily correlated with either the total number of individuals or species detected by that method, nor the rate at which individuals were detected. Tables A-2 through S-2 list the numbers of individuals and species detected by each method for each park. For initial comparison, these numbers were tallied across all parks and the number of individuals detected per unit effort was calculated for each taxonomic group (Table 3).

The raw number of animals detected would appear to indicate differences in the effectiveness of our time-recorded survey methods, and in fact when these numbers were corrected by effort (Table 3), we found a significant difference in the number of individuals detected between the survey methods (X^2= 15.04; d.f.= 5; p= 0.010). Significantly fewer animals were detected during night drives compared to the other methods.

When the total number of individuals detected per effort were compared between the TACS plots, there was no statistically significant difference in effectiveness (X^2= 2.81; d.f.= 2; p= 0.24). There was a non-significant trend of random 1-ha TACS plots detecting the fewest individuals per effort, and 10-ha random TACS plots detecting the most individuals. This is what we expected, primarily due to the random placement of these small plots in habitats that were not stratified according to herpetological considerations, especially slope, substrate, and water features. Interestingly, simply moving these small 1-ha plots to hand-picked habitats that we thought would be better habitats for detecting herpetofauna was not sufficient either; to make these plots more effective we needed to increase their size 10-fold, and thus include more macro- and microhabitats.

The effectiveness of the different time-recorded methods (excluding random encounters) in detecting individuals was also compared within each taxonomic group. There was no statistically significant difference between the methods in detecting individual amphibians, presumably due to the large variance in number of individuals detected (X^2 = 7.0; d.f. = 3; p = 0.07). From a practical standpoint, however, TACS plots detected few or no individual amphibians, while general and nocturnal general surveys detected large numbers. Similarly

Table 3. Number of individuals, individual detection rate per unit effort, and minimum total number of species detected by different methods during a herpetological inventory of 12 southern Colorado Plateau National Parks, 2001-2003. Amount of effort was measured in person-hours. The total number of individual amphibians does not include tadpoles and egg masses, because estimations of total numbers are not reliable for those life stages. "+"'s are added to the total number of species detected when unidentified animals are included (a few more species may have been detected than could be identified).

	1-ha Random Plots	10-ha Random Plots	Non-Random Plots	General Surveys	Nocturnal General Surveys	Night Driving	Random Encounters
			Amphibians				
Individuals	-	3	-	591	277	194	370
Individuals / Effort	-	0.04	-	0.52	2.57	0.97	-
Species	-	2+	-	8+	9+	7+	8+
			Lizards				
Individuals	355	278	188	3,800	2	9	344
Individuals / Effort	2.88	4.06	3.27	3.37	0.02	0.04	-
Species	13+	13+	11+	21+	2	3	18+
			Snakes				
Individuals	5	6	23	219	10	74	63
Individuals / Effort	0.04	0.09	0.40	0.19	0.09	0.37	-
Species	4	5+	6+	12+	4	10+	11+
			Total				
Individuals	360	287	211	4,610	289	277	777
Individuals / Effort	2.90	4.19	3.67	4.08	2.68	1.39	-
Species	17+	20+	17+	41+	15+	20+	37+

with snakes, there was no statistically significant difference in individual detections between the methods ($X^2 = 5.0$; d.f. = 5; p = 0.416). Again, there is a non-significant trend toward both random and non-random 1-ha TACS detecting fewer individual snakes and general surveys and night drives detecting more snakes. Conversely, there was a statistically significant difference between the methods in detecting individual lizards ($X^2 = 14.0$; d.f. = 5; p = 0.016). TACS and general surveys detected similar numbers of individuals when corrected for effort, while nocturnal general surveys and night drives detected almost none.

General surveys detected the greatest species richness of all the methods (41 or more species), while nocturnal general surveys detected the fewest species (at least 15 species). Within taxonomic groups, general surveys detected the highest species richness for both lizards (at least 21 species) and snakes (at least 12 species), while nocturnal general surveys detected the largest number of amphibian species (at least 9).

Some unanticipated patterns emerge from further examination of Table 3. Contrary to our expectations, 10-ha random TACS plots produced more individual lizards detected per unit effort than general surveys, probably because most of these surveys were conducted during peak morning activity times for lizards, whereas general surveys were conducted at all times of day. However, general surveys produced far more species. Daytime general surveys produced more individual amphibians per effort but fewer amphibian species than nighttime general surveys, perhaps because groups of larval salamanders and small metamorphic toads in or near breeding areas were easier to detect and count during daylight. Non-random 10-ha TACS plots had the greatest detection rate for snakes (individuals per person-hour), and the most snake species were detected during general surveys, instead of night driving or nocturnal general surveys as we originally expected. This may be a function of cool night-time temperatures in most Colorado Plateau National Parks depressing snake activity, although functionally the number of individual snakes detected during night drives is only slightly lower than that of general surveys.

Importantly, the method "random encounters" detected every taxonomic group, in high numbers of both individuals and species. As noted earlier, this is a catch-all method comprised of incidental sightings of animals by us, other researchers, or park staff, as we were involved in activities other than the six time-recorded survey methods. For example, a "random encounter" occurred if an animal was sighted on the road while driving or walking between survey points or methods. Random encounters by other researchers and park staff produced species that we did not detect during any of our survey methods, e.g., Long-nosed Snake and Texas Blind Snake at PETR.

Estimates of Inventory Completeness

Using the weighted master list approach, we calculated a mean estimated inventory completeness of 75% (range = 46-

Table 4. Estimated inventory completeness of different taxonomic groups of amphibians and reptiles at each park in the Southern Colorado Plateau Inventory & Monitoring Network.

Park	Amphibians	Turtles	Lizards	Snakes	Overall
AZRU	40%	100%	68%	52%	57%
BAND	82%	0%	83%	47%	65%
CACH	92%	-	97%	61%	85%
CHCU	67%	-	87%	84%	81%
ELMA	86%	-	92%	56%	76%
ELMO	71%	-	84%	86%	81%
GLCA	75%	0%	73%	81%	76%
GRCA	63%	100%	90%	86%	84%
HUTR	82%	-	79%	50%	69%
MEVE	64%	-	100%	93%	90%
NAVA	86%	-	75%	49%	71%
PEFO	100%	-	92%	91%	94%
PETR	20%	100%	97%	83%	79%
RABR	67%	-	60%	15%	46%
SAPU	86%	0%	83%	62%	73%
SUCR	0%	-	83%	24%	54%
WACA	69%	-	78%	55%	66%
WUPA	100%	-	96%	90%	95%
YUHO	72%	-	88%	67%	77%
Mean	**70%**	**50%**	**84%**	**65%**	**75%**

95%) for all 19 SCPN parks, including the parks not funded under this project (GRCA, RABR, PEFO, MEVE) or inventoried separately by the Navajo Nation (CACH, HUTR, NAVA) (Tables A-1 through S-1). Complete details of species occurrence and probability ranking of hypothetical species for each park are found in Tables A-1 through S-1, and a summary of inventory completeness for all parks is presented in Table 4.

Inventory Completeness of Different Taxonomic Groups

Using the same weighting methods and data from Tables A-1 through S-1, we calculated that the mean estimated inventory completeness at all SCPN parks is 70% for amphibians (range = 0-100%), 84% for lizards (range = 60-100%), and 65% for snakes (range = 15-93%). Turtles are only known from four SCPN parks (AZRU, GLCA, GRCA, PETR), and may occur at two others (BAND and SAPU). For these six parks, estimated inventory completeness for turtles is 50% (range = 0-100%). Estimated inventory completeness for each taxonomic group at each park are presented in Table 4. The relatively high success rate for lizards is likely because most lizard species are diurnal and conspicuous, and our efforts (as well as others in previous surveys or collections) were biased towards daytime searches (both plots and general surveys) that easily detect such species. Most amphibians on the southern Colorado Plateau (especially spadefoot toads) breed during the summer monsoon season, and are often active on only a few nights a year, making them difficult to locate. In addition, these inventories took place during a severe (and ongoing) regional drought (Webb et al. 2004), which may have reduced amphibian populations and/or activity during the project period. As with amphibians, many snake species are primarily nocturnal, and many are extremely secretive in their habits, so a low completeness for snakes is not surprising.

For both amphibians and snakes, however, the single most important factor limiting inventory completeness was the lack of extensive networks of roads in most of the SCPN parks surveyed. Based on data from our own studies in the region (Drost et al. 1999, 2001, Persons 2001a), nighttime road surveys are by far the most effective method for detecting both amphibians and snakes. For example, at Petrified Forest National Park (Drost et al. 1999, 2001), the combination of general daytime foot surveys for lizards and extensive nighttime road surveys for amphibians and snakes resulted in an overall estimated inventory completeness of >90% (Table L-1).

Evaluating Inventory Completeness through Species Accumulation

Species accumulation curves (plotted per survey day) for the 12 SCPN parks surveyed are shown in Figures A-1 through S-1. In these graphs, vertical lines through the data separate yearly survey days. Total number of species detected may not agree with those given in Tables A-1 through S-1 because only the species we actually observed during our own surveys are included in these analyses.

Species accumulation rates at most parks slowed down by the end of the first season. While accumulation rates increased slightly for most parks in subsequent years (generally after the onset of the summer monsoon season), for two parks (AZRU and SUCR), no further species accumulation occurred after the first year.

The asymptotic nature of the species accumulation curve for many parks (e.g., AZRU, YUHO, and SUCR) is misleading, as we did not in fact come very close to detecting 90% of the expected species at many of these parks. This false asymptote tells us only that we came close to detecting most of the common and/or easily observed species using our current methods. Our methods were heavily weighted toward daytime surveys, particularly randomly located plot searches. While random 1-ha and 10-ha TACS may provide a basis for statistical comparison among parks or habitats, they primarily detect only diurnal lizards, a group of species easily found by general survey methods.

Perhaps even more important in limiting inventory completeness overall was the short duration (1-3 years) and limited amount of total time available to us to spend on fieldwork in any given park. When a variety of field methods are used over a long span of time, species accumulation curves can give a reliable estimate of degree of inventory completeness, i.e., a strongly asymptotic curve suggests that surveys are at or near 100% completeness (Scott 1994). In a two-year amphibian and reptile inventory at Petrified Forest National Park, where researchers were based at the park during much of the field season, Drost et al. (1999) plotted a strongly asymptotic species accumulation curve, and comparison with master lists of expected species produced an estimated inventory completeness of >90% (Table L-1). This high success rate was due to the combination of field methods that adequately sampled across taxa. In particular, nighttime road driving was extremely effective at sampling amphibians and snakes, including many species not detected by any other method.

Literature and Museum Specimen Data Searches

We have drawn on a number of sources in compiling our lists of species documented or expected to occur in each park, including literature (e.g., Bateman 1976, 1980, Davenport et al. 1998, Degenhardt 1975, Degenhardt et al. 1996, Douglas 1966, Drost et al. 1999, 2001, Fowlie 1965, Gehlbach 1965, Hammerson 1999, Harris 1963, Jones 1970, Lightfoot et al. 1994, Miller et al. 1982, Oliver 2003, Parmenter et al. 1996, Persons 1999, 2001a, Persons and Bradley 2000, Scott 1979, Stebbins 1985, 2003, Tanner 1958a) and museum specimen data sources. Museum specimen records from SCPN parks are presented in Appendix T. In addition to museum acronyms defined in the methods section (above), other collections found during literature searches (Appendix T) include those of Clayton J. May (CJM), Colorado State University (CSU), Cottonwood Gulch Foundation (CWGF), Texas Natural History Collection (TNHC), and Stephen F. Hale (SFH).

In addition, we reviewed species lists and natural history observation cards for many parks. Although these seldom had associated documentation (e.g., photographs) that would allow us to accept a record as proof of occurrence, they sometimes alerted us to the possibility of a species occurring in a particular park. In a few cases, however, observations and species descriptions were recorded well enough for us to accept these records.

Based on review of the literature and museum specimen records, we added additional species (i.e., those not found by us during field surveys in 2001-2003) at 11 of the 12 SCPN parks surveyed. We did not locate any previous records for new species at SAPU. Details of species documentation are presented in Tables A-1 through S-1. For parks that received no funding for field surveys during this inventory (GRCA, MEVE, PEFO, RABR), literature review was our primary source of information on species occurrence (e.g., Douglas 1966; Drost et al. 1999, 2001; Eaton 1935, Miller et al. 1982). However, museum specimen records and more recent literature sources (e.g., geographic distribution notes in Herpetological Review) were also used to update species lists, particularly for GRCA. Species lists for the three parks on the Navajo Nation (CACH, HUTR, NAVA) were taken from Mikesic (2005a, b, c), although we have used our own judgment in evaluating the potential occurrence of undocumented species at those parks.

Voucher Specimens

We collected 158 amphibian and reptile specimens at the 12 SCPN parks surveyed in 2001-2003. A complete list of these specimens and associated cataloging information is presented in Table 5.

Considerations for Future Inventory Work and Long-term Monitoring

Effectiveness of Different Methods for Inventory

Snakes and lizards were detected by every method we used (random and non-random 1-ha TACS plots, 10-ha TACS plots, general and nocturnal general surveys, night driving, and random encounters). Amphibians were not detected in either random or non-random 1-ha TACS plots, likely due to the plots' small size and random placement in areas or habitats that did not contain nearby water sources. Thus, we cannot recommend using these plots for future inventory efforts, although they may retain statistical value in future monitoring efforts. The effectiveness of these plots as part of a multi-spe-

Table 5. Amphibians and reptiles collected at 12 Southern Colorado Plateau National Park areas during herpetofaunal inventories in 2001-2003. Most specimens have been deposited in the USGS Biological Survey Collection (BS/FC), housed at the Museum of Southwestern Biology, Albuquerque, New Mexico, but specimens from SUCR, WACA, and WUPA are housed at the Flagstaff Area National Monuments collection in Flagstaff, Arizona. NPS Accession numbers for each park are AZRU- 243, BAND-631, CHCU-735, ELMA-60, ELMO-58, PETR-21, SAPU-229, SUCR-49, WACA-234, WUPA-412, and YUHO-28.

Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Bufo woodhousii	AZRU 14050	7794	6/17/01	Trevor B Persons, Shawn C Knox	TBP 098	In irrigation ditch in apple orchard	767495	4080512
Cnemidophorus tigris	AZRU 14052	7796	6/18/01	Trevor B Persons, Shawn C Knox	TBP 100	Large wash in northern section of monument; UTM is center of 1 ha TACS plot	767344	4080971
Cnemidophorus velox	AZRU 14045	7789	5/22/01	Shawn C Knox, Erika M Nowak	TBP 089	Upland area north of Farmer's Ditch at north boundary; UTM is center of 1 ha TACS plot	232568	4081166
Cnemidophorus velox	AZRU 14046	7790	5/22/01	Shawn C Knox, Erika M Nowak	TBP 090	Upland area north of Farmer's Ditch at north boundary; UTM is center of 1 ha TACS plot	232568	4081166
Cnemidophorus velox	AZRU 14051	7795	6/18/01	Trevor B Persons, Shawn C Knox	TBP 099	Large wash in northern section of monument; UTM is center of 1 ha TACS plot	767344	4080971
Cnemidophorus velox	AZRU 14054	7798	6/18/01	Trevor B Persons, Shawn C Knox	TBP 102	Large wash in norther section of monument; UTM is center of 1 ha TACS plot	767344	4080971
Cnemidophorus velox	AZRU 14055	7799	6/18/01	Shawn C Knox, Trevor B Persons	TBP 103	Along main irrigation ditch running east/west through Mon., ca. 100 m E of western boundary		
Cnemidophorus velox	AZRU 14057	7801	7/21/02	Eric Zepnewski	TBP 214	Along Animas River		
Cnemidophorus velox	AZRU 14058	7802	8/6/02	Trevor B Persons	TBP 226	By wash above Farmer's Ditch	767223	4081187
Cnemidophorus velox	AZRU 14059	7803	8/6/02	Trevor B Persons	TBP 227	Near wash above Farmer's Ditch	767202	4081070
Crotaphytus collaris	AZRU 14053	7797	6/18/01	Trevor B Persons, Shawn C Knox	TBP 101	Large wash in northern section of monument; UTM is center of 1 ha TACS plot	767344	4080971
Pseudacris triseriata	AZRU 14049	7793	6/17/01	Trevor B Persons, Shawn C Knox	TBP 097	In irrigation ditch in apple orchard	767523	4080521
Sceloporus graciosus	AZRU 14056	7800	8/4/01	Shawn C Knox	TBP 146	On mesa NW of ruins	767158	4081074
Sceloporus undulatus	AZRU 14047	7791	6/17/01	Trevor B Persons, Shawn C Knox	TBP 095	Visitor Center		
Thamnophis elegans	AZRU 14048	7792	6/17/01	Shawn C Knox, Trevor B Persons	TBP 096	Grassy field w. of Animas River	232981	4080533

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Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Ambystoma tigrinum	BAND 24921	7806	5/29/02	Trevor B Persons	TBP 179	Stock tank just southwest of jct. of Dome Road with SR 4	371166	3967927
Ambystoma tigrinum	BAND 24922	7807	5/29/02	Trevor B Persons	TBP 180	Stock tank just southwest of jct. of Dome Road with SR 4	371166	3967927
Cnemidophorus exsanguis	BAND 24923	7808	7/7/02	AJ Monatesti	TBP 204	Mouth of Alamo Canyon (confluence with Rio Grande)	383096	3952860
Cnemidophorus velox	BAND 24919	7804	5/28/02	Trevor B Persons	TBP 177	Along Falls Trail, Frijoles Canyon.	386081	3958395
Eumeces multivirgatus	BAND 24920	7805	5/29/02	Trevor B Persons	TBP 178	Along Frijoles Creek in monument headquarters area	384985	3960171
Pseudacris triseriata	BAND 24924	7809	4/24/03	AJ Monatesti	TBP 277	Pond in NW corner of monument	371718	3967618
Salvadora grahamiae	BAND 24925	7810	5/6/03	AJ Monatesti	TBP 282	Lower end of Frijoles Canyon, ca. 1/4 mile from Rio Grande	386385	3957319
Thamnophis elegans	BAND 24926	7811	7/20/03	Erika M Nowak	TBP 297	Frijoles Creek, ca. 3 mi. WNW (upsteam) of monument headquarters	380060	3962857
Cnemidophorus velox	CHCU 98229	7813	8/7/02	Robert Emerson, Erika M Nowak	TBP 251	Trail to Wetherill Cemetary, Pueblo Bonito Ruins	233260	3994615
Hypsiglena torquata	CHCU 98228	7812	7/18/02	AJ Monatesti	TBP 220	Main visitor's road, 2.0 rd. mi. from park entrance on CR 7900	238748	3991020
Thamnophis elegans	CHCU 98230	7814	8/7/02	Robert Emerson, Erika M Nowak	TBP 252	Loop road just past north gate	237695	3991072
Ambystoma tigrinum	ELMA 4186	7826	4/29/03	AJ Monatesti	TBP 278	Spring fed tank on road 301"Big Tubes area"	764469	3867790
Ambystoma tigrinum	ELMA 4187	7827	4/29/03	AJ Monatesti	TBP 279	Spring fed tank on road 301"Big Tubes area"	764469	3867790
Ambystoma tigrinum	ELMA 4188	7828	4/29/03	AJ Monatesti	TBP 280	Spring fed tank on road 301"Big Tubes area"	764469	3867790
Cnemidophorus velox	ELMA 4175	7815	5/31/02	Trevor B Persons	TBP 181	Behind Northwest New Mexico Visitor's Center, just s. of exit 85 of I-40, Grants	242201	3889640

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Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Cnemidophorus velox	ELMA 4176	7816	6/1/02	Trevor B Persons	TBP 182	Ca. half mile west of El Calderón parking area off SR 53	772552	3873443
Cnemidophorus velox	ELMA 4181	7821	7/23/02	AJ Monatesti	TBP 225	Just west of SR 117 about 4 miles north of CR 44	228889	3849950
Cnemidophorus velox	ELMA 4184	7824	8/8/02	AJ Monatesti	TBP 249	Ca. 0.05 mi. SE of parking lot at NW New Mexico VC, just s. exit 85 of I-40, Grants	242388	3889604
Cnemidophorus velox	ELMA 4185	7825	8/8/02	AJ Monatesti	TBP 250	Ca. 0.34 mi. SE of parking area at NW New Mexico VC, just s. exit 85 of I-40, Grants	242508	3889145
Crotalus viridis	ELMA 4191	7831	7/12/03	AJ Monatesti	TBP 296	SR 117, 0.4 miles s. of Sandstone Bluffs overlook road	242554	3871170
Crotaphytus collaris	ELMA 4189	7829	3/30/03	AJ Monatesti	TBP 281	Ca. 100 m south of El Calderón parking area	231358	3871780
Holbrookia maculata	ELMA 4194	7834	8/9/03	AJ Monatesti	TBP 304	Northwest New Mexico Visitor's Center, Grants	242483	3889550
Hyla eximia	ELMA 4195	7835	8/10/03	AJ Monatesti	TBP 305	Roadside pool along CR 42, ca. 2.7 rd. mi. s. of SR 53, just e. of Continental Divide	763413	3875108
Hyla eximia	ELMA 4196	7836	8/10/03	AJ Monatesti	TBP 306	Roadside pool along CR 42, ca. 2.7 rd. mi. s. of SR 53, just e. of Continental Divide	763413	3875108
Hyla eximia	ELMA 4197	7837	8/10/03	AJ Monatesti	TBP 307	Roadside pool along CR 42, ca. 2.7 rd. mi. s. of SR 53, just e. of Continental Divide	763413	3875108
Phrynosoma hernandesi	ELMA 4199	7839	9/7/03	AJ Monatesti	TBP 313	Just w. of Zuni-Acoma trailhead, ca. 1/3 mile south of SR 53	231508	3871504
Pituophis catenifer	ELMA 4193	7833	7/23/03	Erika M Nowak	TBP 299	SR 117, North Pasture area	233696	3855592
Sceloporus undulatus	ELMA 4198	7838	9/6/03	AJ Monatesti	TBP 312	Just w. of SR 117, south of The Narrows	233526	3858447
Spea bombifrons	ELMA 4182	7822	8/8/02	AJ Monatesti	TBP 247	SR 117, 1.7 rd. miles north of jct. with CR 42	774767	3844709
Spea bombifrons	ELMA 4183	7823	8/8/02	AJ Monatesti	TBP 248	SR 117, 0.3 rd. miles north of jct. with CR 42	772663	3844045

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Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Spea multipicata	ELMA 4177	7817	7/22/02	AJ Monatesti	TBP 221	SR 117, 10.3 rd. miles s. of South Narrows campground		
Spea multipicata	ELMA 4178	7818	7/22/02	AJ Monatesti	TBP 222	SR 117, 9.0 rd. miles s. of South Narrows campground.		
Spea multipicata	ELMA 4179	7819	7/22/02	AJ Monatesti	TBP 223	SR 117, 3.8 rd. miles s. South Narrows campground		
Spea multipicata	ELMA 4180	7820	7/22/02	AJ Monatesti	TBP 224	SR 117, 6.8 miles s. of South Narrows campground		
Thamnophis cyrtopsis	ELMA 4192	7832	7/22/03	Erika M Nowak	TBP 298	2.2 rd. miles s. of Sandstone Bluffs turnoff on SR 117	240748	3869213
Urosaurus ornatus	ELMA 4190	7830	5/8/03	AJ Monatesti	TBP 283	Base of SAndstone Bluffs near monument boundary	240701	3870187
Cnemidophorus velox	ELMO 2276	7841	8/8/03	AJ Monatesti	TBP 303	Near ruins on top of El Morro Rock	741490	3880246
Hypsiglena torquata	ELMO 2275	7840	8/9/02	Eric Zepnewski	TBP 255	Campground		
Arizona elegans	PETR 10154	7854	May 2003	Mike Medrano	TBP 311	Visitor Center entrance road, DOR		
Cnemidophorus inornatus	PETR 10150	7850	7/21/01	Erika M Nowak	TBP 147	On old road between Butte and Vulcan Volcanoes	388610	3892152
Cnemidophorus inornatus	PETR 10151	7851	7/21/01	Erika M Nowak	TBP 148	Under large double set pf power lines on easement road	339135	3892446
Diadophis punctatus	PETR 10148	7848	7/19/01	Erika M Nowak, Shawn C Knox	TBP 131	Volcanoes area	340143	3889430
Eumeces obsoletus	PETR 10143	7843	5/20/01	Shawn C Knox, Trevor B Persons	TBP 077	In flats along trail in Rinconada Canyon	342803	3888329
Leptotyphlops dulcis	PETR 10152	7852	6/20/02	Rich Anderson, Susan Caffery	TBP 195	Along south edge of Rinconada Canyon	342442	3887702
Masticophis flagellum	PETR 10153	7853	8/23/02	Mike Medrano	TBP 310	Entrance road directly south of weather station, Los Imagines Visitor Center		

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Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Masticophis taeniatus	PETR 10144	7844	5/20/01	Trevor B Persons, Shawn C Knox	TBP 078	In flats of Rinconada Canyon	342304	3888063
Phrynosoma modestum	PETR 10147	7847	5/21/01	Erika M Nowak, Shawn C Knox	TBP 088	Southern Geologic Window unit	341001	3891623
Sceloporus undulatus	PETR 10145	7845	5/21/01	Trevor B Persons, Shawn C Knox	TBP 079	West of road, in Boca Negra Canyon	343061	3891971
Sceloporus undulatus	PETR 10146	7846	5/21/01	Trevor B Persons, Shawn C Knox	TBP 080	west of road in Boca Negra Canyon	343113	3891907
Uta stansburiana	PETR 10142	7842	5/20/01	Trevor B Persons, Shawn C Knox	TBP 076	Near parking area s. of Vulcan Volcano	338580	3889584
Uta stansburiana	PETR 10149	7849	7/19/01	Erika M Nowak, Shawn C Knox	TBP 133	Ca. 1.2 mi E Vulcan Volcano	340694	3890347
Ambystoma tigrinum	SAPU 45005	7860	5/18/01	Trevor B Persons, Shawn C Knox	TBP 073	Abo unit, in upper of two largest pools in main canyon	373484	3812379
Ambystoma tigrinum	SAPU 45007	7862	5/18/01	Trevor B Persons, Shawn C Knox	TBP 075	Abó unit, pool above larger pools in main canyon	373498	3812408
Arizona elegans	SAPU 45008	7863	7/23/01	Erika M Nowak	TBP 143	Gran Quivira unit, by visitor center gate	399053	3791090
Bufo punctatus	SAPU 45006	7861	5/18/01	Trevor B Persons, Shawn C Knox	TBP 074	Abó unit, on path beside pool, along main canyon	373436	3812380
Cnemidophorus exsanguis	SAPU 45002	7857	5/18/01	Trevor B Persons, Shawn C Knox	TBP 070	Abó unit, in rocky draw	373604	3812712
Cnemidophorus exsanguis	SAPU 45014	7869	8/22/01	Trevor B Persons	TBP 155	Abó unit, along wash n. of ruins	373542	3813022
Cnemidophorus inornatus	SAPU 45013	7868	8/22/01	Trevor B Persons	TBP 154	Gran Quivira unit, south of ruins	399150	3790878
Cnemidophorus inornatus	SAPU 45022	7877	8/6/02	Eric Zepnewski	TBP 253	Gran Quivira unit, ca. 30 feet north of south boundary.	398160	3790873
Crotaphytus collaris	SAPU 45001	7856	5/18/01	Trevor B Persons, Shawn C Knox	TBP 069	Abó unit, in rocky draw	373595	3812701

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Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Eumeces obsoletus	SAPU 45018	7873	4/25/02	Shawn C Knox	TBP 170	Quarai unit.	381345	3828907
Hypsiglena torquata	SAPU 45019	7874	7/1/02	Trevor B Persons	TBP 191	SR 55, 1.2 rd. mi. e. of entrance to Gran Quivira ruins	400275	3791702
Hypsiglena torquata	SAPU 45021	7876	7/2/02	Trevor B Persons	TBP 194	Paved road just s. of Canyon Espinoso, Abo unit.	373553	3812331
Phrynosoma modestum	SAPU 45004	7859	5/18/01	Shawn C Knox, Trevor B Persons	TBP 072	Abó unit, in rocky draw	373489	3812739
Pituophis catenifer	SAPU 45009	7864	7/23/01	Erika M Nowak	TBP 144	Quarai unit (0.3 mi. east of Quarai unit, not actually within boundary)	382026	3828980
Sceloporus undulatus	SAPU 45000	7855	5/18/01	Trevor B Persons, Shawn C Knox	TBP 068	Abo unit, on wall of main ruins	373711	3812729
Sceloporus undulatus	SAPU 45012	7867	8/22/01	Trevor B Persons	TBP 153	Gran Quivira unit; west end of unit.	398275	3790928
Sceloporus undulatus	SAPU 45016	7871	8/23/01	Trevor B Persons	TBP 157	Quarai unit, rocks by foot bridge	381285	3828663
Spea bombifrons	SAPU 45010	7865	7/23/01	Erika M Nowak	TBP 150	Gran Quivira unit; SR 55, 1.0 mi. e. of turnoff into unit	400187	3791697
Spea bombifrons	SAPU 45017	7872	8/23/01	Trevor B Persons	TBP 158	Quarai unit, on Spanish Corral Trail	381402	3828437
Spea multipicata	SAPU 45011	7866	7/26/01	Erika M Nowak	TBP 151	Abó unit; On US 60 at jct. of SR 513, just south of Abo unit	373898	3811801
Thamnophis cyrtopsis	SAPU 45003	7858	5/18/01	Trevor B Persons, Shawn C Knox	TBP 071	Abó unit, in rocky draw	373489	3812739
Thamnophis elegans	SAPU 45015	7870	8/23/01	Trevor B Persons	TBP 156	Quarai unit, in stream at eastern boundary	381603	3828741
Tropidoclonion lineatum	SAPU 45023	7878	8/7/02	Eric Zepnewski	TBP 254	SR 55, 0.8 rd. miles SE of entrance rd. to Quarai unit or ca. 1 air mile due east of Quarai unit		
Urosaurus ornatus	SAPU 45020	7875	7/2/02	Trevor B Persons	TBP 193	Rocky side wash of Canyon Espinoso, SW corner of Abo unit	373260	3812612

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Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Phrynosoma hernandesi	SUCR 1113		7/4/01	Trevor B Persons	TBP 116	south of FR 545 near east boundary; UTM is center of plot.	455409	3913574
Sceloporus undulatus	SUCR 1114		7/4/01	Trevor B Persons	TBP 117	south of FR 545 near east boundary; UTM is center of plot.	455409	3913574
Urosaurus ornatus	SUCR 1115		7/14/01	Trevor B Persons	TBP 124	SW edge of Bonito Lava Flow east of Lenox Crater; UTM is center of plot.	452788	3912755
Urosaurus ornatus	SUCR 1116		7/14/01	Trevor B Persons	TBP 125	SW edge of Bonito Lava Flow east of Lenox Crater; UTM is center of plot.	452788	3912755
Cnemidophorus velox	SUCR 1117		5/17/02	Trevor B Persons	TBP 175	Near northeast corner of monument, ca. 6940 feet elev.	455383	3914949
Cnemidophorus velox	WACA 6366		5/10/01	Trevor B Persons	TBP 063	Bottom of Walnut Canyon (eastern part of expanded boundary)	458018	3892334
Cnemidophorus inornatus	WACA 6367		5/10/01	Trevor B Persons	TBP 064	Bottom of Walnut Canyon (eastern psart of expanded boundary)	457594	3891999
Cnemidophorus inornatus	WACA 6368		5/25/01	Trevor B Persons	TBP 082	Bottom of Walnut Canyon NE of Santa Fe dam	457272	3891871
Cnemidophorus velox	WACA 6369		5/25/01	Trevor B Persons	TBP 083	Bottom of Walnut Canyon, NE of Santa Fe dam	457481	3891941
Cnemidophorus inornatus	WACA 6370		5/25/01	Trevor B Persons	TBP 084	Bottom of Wanut Canyon (near TBP 064)	457595	3892005
Hyla arenicolor	WACA 6371		5/25/01	Trevor B Persons	TBP 085	Cherry Canyon	456227	3890159
Hyla arenicolor	WACA 6372		5/25/01	Trevor B Persons	TBP 086	Cherry Canyon	456227	3890159
Hyla arenicolor	WACA 6373		5/25/01	Trevor B Persons	TBP 087	Cherry Canyon	456227	3890159
Cnemidophorus velox	WACA 6374		6/7/01	Trevor B Persons	TBP 091	Bottom of Walnut Canyon	459412	3892855
Cnemidophorus velox	WACA 6375		7/5/01	Trevor B Persons	TBP 118	Bottom of Walnut Canyon; UTM is center of plot.	459383	3892704

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Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Cnemidophorus velox	WACA 6376		7/5/01	Trevor B Persons	TBP 119	Bottom of Walnut Canyon	459189	3892627
Cnemidophorus velox	WACA 6377		7/5/01	Trevor B Persons	TBP 120	Bottom of Walnut Canyon; UTM is center of plot.	459070	3892704
Cnemidophorus velox	WACA 6378		7/5/01	Trevor B Persons	TBP 121	Bottom of Walnut Canyon; UTM is center of plot.	459070	3892704
Cnemidophorus inornatus	WACA 6379		7/5/01	Trevor B Persons	TBP 122	Bottom of Walnut Canyon; UTM is center of plot.	459070	3892704
Cnemidophorus inornatus	WACA 6380		7/17/01	Trevor B Persons	TBP 127	On rocky slope of side canyon south of Walnut Canyon, ca. 6420 feet elevation; UTM is center of plot.	458914	3892391
Cnemidophorus velox	WACA 6381		7/17/01	Trevor B Persons	TBP 128	Bottom of Walnut Canyon; UTM is center of plot.	458758	3892704
Cnemidophorus velox	WACA 6382		7/17/01	Trevor B Persons	TBP 129	Side canyon west of trick tank, s. side of Walnut Canyon	459415	3892433
Spea multipicata	WACA 6383		7/12/02	Trevor B Persons	TBP 200	Just s. of FR 303 on entrance road	454171	3892497
Hyla arenicolor	WACA 6384		7/12/02	Trevor B Persons	TBP 201	Sewage Lagoons (northwestmost of 3 ponds), SE/4 of NE/4 of Sec. 26, T21N R8E		
Ambystoma tigrinum	WACA 6385		7/25/03	Erika M Nowak	TBP 300	Entrance road, 1.7 mi. s. of I-40 (or 1.3 mi. n. of VC entrance booth)	454294	3893932
Sceloporus magister	WUPA 24694		5/7/01	Trevor B Persons	TBP 051	Sandstone outcrop w. of FR 545 just n. of monument boundary	467621	3927954
Uta stansburiana	WUPA 24695		5/7/01	Trevor B Persons	TBP 052	Sanstone outcrop just w. of FR 545, just n. of monument boundary	467640	3928021
Sceloporus undulatus	WUPA 24696		5/7/01	Trevor B Persons	TBP 053	Sandstone outcrop just w. of FR 545, just n. of mon. bdy.	467643	3928012
Gambelia wislizenii	WUPA 24697		5/7/01	Trevor B Persons	TBP 054	On River Road, 0.73 rd. mi. NE of jct. with Wukoki ruins road	469344	3932279
Cnemidophorus tigris	WUPA 24698		5/7/01	Trevor B Persons	TBP 055	On River Road, 0.52 rd. mi. w. of cattleguard at Black Falls Crossing	474236	3936257
Cnemidophorus tigris	WUPA 24699		5/7/01	Trevor B Persons	TBP 056	Just below Heiser Spring	468005	3928919

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Cnemidophorus velox	WUPA 24700		5/9/01	Trevor B Persons	TBP 057	East of Antelope Wash	463557	3933387
Holbrookia maculata	WUPA 24701		5/9/01	Trevor B Persons	TBP 058	East of Antelope Wash	464353	3935199
Cnemidophorus inornatus	WUPA 24702		5/9/01	Trevor B Persons	TBP 059	Bottom of Antelope Wash	464266	3935834
Cnemidophorus velox	WUPA 24703		5/9/01	Trevor B Persons	TBP 060	Bottom of Antelope Wash, same area as TBP 059	464263	3935765
Cnemidophorus tigris	WUPA 24704		5/9/01	Trevor B Persons	TBP 061	Bottom of Antelope Wash	464067	3935225
Urosaurus ornatus	WUPA 24705		5/11/01	Trevor B Persons	TBP 065	NW end of Hull's Canyon graben	457483	3933190
Urosaurus ornatus	WUPA 24706		5/11/01	Trevor B Persons	TBP 066	NW end of Hull's Canyon graben	457468	3933189
Cnemidophorus inornatus	WUPA 24707		5/15/01	Trevor B Persons	TBP 067	Soutyh of blowhole, s. of FR 545 ca. 1 mile east of US 89, near whiptail study grassland point #1	453290	3936586
Sceloporus magister	WUPA 24708		6/12/01	Trevor B Persons	TBP 093	Road along Doney Mountain	464183	3933536
Holbrookia maculata	WUPA 24709		6/15/01	Trevor B Persons	TBP 094	West of South Mesa, and South of West Mesa	454918	3934235
Cnemidophorus velox	WUPA 24710		6/28/01	Trevor B Persons	TBP 114	Below Mesa Well, just s. of n. Wupatki bdy.	460544	3937515
Cnemidophorus velox	WUPA 24711		6/28/01	Trevor B Persons	TBP 115	Below Mesa Well, just s. of n. Wupatki boundary	460492	3937050
Urosaurus ornatus	WUPA 24712		7/8/01	Trevor B Persons	TBP 123	Basalt outcrop ca. 1 mile ENE of Lomaki Ruins area	459237	3937275
Cnemidophorus inornatus	WUPA 24713		7/19/01	Trevor B Persons	TBP 130	Ca. 1/4 mi. e. of US 89; UTM is center of plot.	452182	3934748
Cnemidophorus inornatus	WUPA 24714		8/5/01	Trevor B Persons	TBP 134	South of Mesa Well, Antelope Prairie	461454	3937001

Table 5. Amphibians and reptiles collected at 12 Southern Colorado Plateau National Park areas during herpetofaunal inventories in 2001-2003. Most specimens have been deposited in the USGS Biological Survey Collection (BS/FC), housed at the Museum of Southwestern Biology, Albuquerque, New Mexico, but specimens from SUCR, WACA, and WUPA are housed at the Flagstaff Area National Monuments collection in Flagstaff, Arizona. NPS Accession numbers for each park are AZRU- 243, BAND-631, CHCU-735, ELMA-60, ELMO-58, PETR-21, SAPU-229, SUCR-49, WACA-234, WUPA-412, and YUHO-28.—Continued

Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Coleonyx variegatus	WUPA 24715		4/23/02	Trevor B Persons	TBP 167	Deadman Wash, SE/4 of NE/4 of NE/4 of Sec. 20, T25N R10E, ca. 4560 feet elev.	468940	3932197
Cnemidophorus velox	WUPA 24716		4/23/02	Trevor B Persons	TBP 168	Deadman Wash, ca. half mile east of FR 545, ca. 4660 feet elev.	467761	3931562
Uta stansburiana	WUPA 24718		5/8/02	Trevor B Persons	TBP 172	West of Doney Mountain Wash	466806	3934463
Spea multipicata	WUPA 24718		7/10/02	Trevor B Persons	TBP 197	FR 545, ca. 200 m. w. of Lomaki rd.	457213	3936320
Spea bombifrons	WUPA 24719		7/10/02	Trevor B Persons	TBP 198	FR 545 at jct. of Wukoki Ruins road.	466851	3930254
Hypsiglena torquata	WUPA 24720		7/24/02	Trevor B Persons	TBP 213	FR 545, milepost 11.0, center of Sec. 13, T25N R9E, elev. ca. 4890 feet.		
Ambystoma tigrinum	WUPA 24721		9/7/02	Trevor B Persons	TBP 258	FR 545, 0.2 miles north of south turnoff to Heiser Spring area	468239	3929185
Coleonyx variegatus	WUPA 24722		9/10/02	Trevor B Persons	TBP 259	Kana-a Wash, ca. 1/4 mile SE of Wukoki Ruin, ca. 4600 feet elev.	470658	3931404
Lampropeltis getulus	WUPA 24723		7/12/03	Trevor B Persons	TBP 295	Milepost 1.9 on FR 545 (i.e. 1.9 rd. mi. east of US 89)		
Crotalus viridis	WUPA 24724		8/3/03	Trevor B Persons	TBP 302	FR 545 at milepost 12.8 (Deadman Wash)		
Bufo woodhousii	YUHO 1084	7884	5/30/02	Erika M Nowak	TBP 183	Pond on Ismay land ca. 3/4 mile NNE of monument (ruins), e-cen. Sec. 26, T35N R17W	705497	4126197
Cnemidophorus velox	YUHO 1081	7881	6/19/01	Trevor B Persons, Shawn C Knox	TBP 106	Near main ruin mounds; UTM is center of 1 Ha TACS plot	705222	4124990
Cnemidophorus velox	YUHO 1085	7885	8/8/02	Trevor B Persons	TBP 233	Ismay property, by Ute Mtn. ditch, w. of original monument (ruins).	704972	4125070
Cnemidophorus velox	YUHO 1086	7886	8/9/02	Trevor B Persons	TBP 234	Pond just west of original monument (ruins).	705129	4124983
Cnemidophorus velox	YUHO 1087	7887	8/9/02	Trevor B Persons	TBP 235	By pond just west of original monument (ruins).	705153	4124958

Table 5. Amphibians and reptiles collected at 12 Southern Colorado Plateau National Park areas during herpetofaunal inventories in 2001-2003. Most specimens have been deposited in the USGS Biological Survey Collection (BS/FC), housed at the Museum of Southwestern Biology, Albuquerque, New Mexico, but specimens from SUCR, WACA, and WUPA are housed at the Flagstaff Area National Monuments collection in Flagstaff, Arizona. NPS Accession numbers for each park are AZRU- 243, BAND-631, CHCU-735, ELMA-60, ELMO-58, PETR-21, SAPU-229, SUCR-49, WACA-234, WUPA-412, and YUHO-28.—Continued

Species	NPS Catalog Number	BS/FC Number	Date	Collector(s)	Field #	Locality	UTM East	UTM North
Cnemidophorus velox	YUHO 1088	7888	8/23/02	Renata J Platenberg	TBP 262	Gravel pit area of Ismay land just south of original monument (ruins).	705130	4124635
Crotaphytus collaris	YUHO 1090	7890	7/2/03	AJ Monatesti	TBP 294	Ismay land on east side of US 666	707414	4122308
Pituophis catenifer	YUHO 1089	7889	5/30/03	AJ Monatesti	TBP 284	Monument proper (ruins area)	705206	4124896
Sceloporus graciosus	YUHO 1080	7880	6/18/01	Trevor B Persons, Shawn C Knox	TBP 105	Along a dirt road on Ismay property	704418	4123921
Sceloporus undulatus	YUHO 1082	7882	8/5/01	Shawn C Knox	TBP 145	East end of Ismay Draw (southern drainage)	708796	4121372
Thamnophis elegans	YUHO 1079	7879	6/18/01	Shawn C Knox, Trevor B Persons	TBP 104	By Ute Mountain irrigation ditch on Ismay property	704997	4125094
Uta stansburiana	YUHO 1083	7883	8/6/01	Shawn C Knox	TBP 149	northern drainage of Ismay Draw	708868	4122137

cies inventory project could be improved by stratifying the habitat layers by abiotic features and water sources that are important to small, relatively non-mobile terrestrial invertebrates and plants (Mike Bogan and Glenn Rink, personal communication).

We feel the best focus for future inventory projects will be using a diversity of methods, and most importantly, over a long period of time. The only Southern Colorado Plateau Network parks that have succeeded in meeting the nationwide inventory goal of >90% of potential species detected are WUPA and PEFO (not surveyed during the current project), and both of these parks have conducted several intensive herpetofaunal inventories over multi-year periods (e.g. Drost et al. 1999, 2001; Persons 2001a, 2001b; Persons et al. 2003). The importance of random encounters in detecting individuals and species in our current research underscores the value of trained observers simply spending time in the field to document species for inventory projects. Future inventories may wish to focus on this aspect more than on sampling under tight statistical prescriptions.

One serious drawback of our inventories was that there was insufficient funding to get personnel to all parks during important summer rains, events which may only occur one or two nights a year. Due to this inherent logistical constraint, we missed critical amphibian breeding events, and our detections of this taxonomic group were likely lower than expected for many parks.

Future Inventory Work

We have not yet reached a satisfactory level of herpetofaunal inventory completeness at many parks within the SCPN. Therefore, the NPS may wish to consider allocating a portion of long-term monitoring funding for amphibians and reptiles towards the goal of establishing a more complete baseline of species occurrence at SCPN parks. Park-specific considerations on further inventory work can be found in the park accounts (Appendices A-S). It may be preferable to design a long-term monitoring program such that the percentage of effort allocated to inventory decreases over time, while the percentage of monitoring increases, until an adequate baseline of species occurrence exists at each SCPN park.

It should be noted that inventory and monitoring are not mutually exclusive endeavors (see also Swann 1999). In fact, many methods designed to monitor more inclusive subsets of the herpetofaunal community (e.g., road driving surveys for snakes) are the same ones used for inventory. Thus, a

well-rounded monitoring program that focuses on each major "subset" of the herpetofauna will monitor not only the population status of particular focal species within each group, but will simultaneously monitor the herpetofaunal community as a whole, and in the process will document new species and lead toward a more complete baseline of species occurrence.

New species will also be documented opportunistically. Observations or collections by NPS staff can be invaluable in these efforts, especially for uncommon or secretive species that are generally undetected during periodic, short duration visits to the park by researchers. Now that baseline data exist on species occurrence at most SCPN parks, help of interested staff and volunteers can more easily be directed towards documenting suspected species (or those known but not properly vouchered). If park staff becomes involved in documenting herpetofauna, they should be trained by herpetologists in the identification of these species and the proper collection and initial storage of suitable specimens.

Road killed animals can be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens. For rare or secretive species, or those that represent important regional distributional data, animals could be captured alive and given to professional herpetologists for processing and documentation. At a minimum, high-quality, sharp focus, close-up photographs or (preferably) digital images should be taken of the animal while it is in captivity and shown to expert herpetologists to confirm identification before release. While not suitable for use as photographic vouchers, an advantage of digital images is that they can be quickly and easily e-mailed to experts.

Currently, the Arizona chapter of Partners in Amphibian and Reptile Conservation (PARC) is initiating a statewide atlas project for herpetofauna, the Atlas of Arizona's Amphibians and Reptiles (AAAR). This project will incorporate specimen data from museum collections across the country, as well as observational data from the Arizona Game and Fish Department's Heritage Data Management System database and other sources. Ultimately, species occurrence data, including spatial data in a GIS, will be available to academic researchers and natural resource agency staff, and possibly to the general public via the Internet. Such a resource would be invaluable to inventory efforts such as the present one, as data on existing voucher specimens could be quickly gathered, and field efforts targeted to finding those species not recorded from the parks previously. We recommend that the SCPN consider participating in AAAR and other similar state or regional multi-agency inventory and monitoring efforts.

Long-term Monitoring

At the completion of the current herpetofauna inventories in the SCPN, our understanding of the distribution and abundance of the different amphibian and reptile groups varies. In general, we know the most about lizards and the least about snakes, and amphibians fall somewhere in between. Because we know the most about lizards, and because many of the same species are common in many parks in the SCPN, they are ideal candidates for an SCPN-wide long-term monitoring program. In addition, lizards, which are relatively sedentary, usually respond quickly and drastically to fluctuations in precipitation and concomitant variation in primary productivity at a site. For this reason, common diurnal desert lizards have been the centerpieces of herpetofaunal monitoring at Organ Pipe Cactus National Monument for over a decade (Rosen and Lowe 1996, Rosen 2000).

While endemic, focal, or at-risk species are often monitored for their own sakes, they may not always best reflect the integrity of the ecosystem as a whole, and therefore may not necessarily be the best candidates for "vital signs" monitoring. In addition, we are unaware of any amphibians or reptiles in the SCPN parks that fit the classical definition of a keystone species, which is one category of vital sign the SCPN has identified as potential monitoring targets. Instead, the NPS may wish to focus herpetofaunal monitoring on the most common species or species groups, because these species probably contribute the most to large-scale ecosystem functions (e.g., nutrient cycling as both predators and prey). These targeted species or species groups should be easily observed and counted, and respond predictably and measurably to fluctuations of climatic variables. In addition, targeted species or species pairs would ideally occur differentially (in terms of abundance and distribution) along elevation or habitat gradients within a park. For example, subtle changes in distribution or composition of a particular vegetation community may affect lizard distribution or abundance, and these changes in the lizard community would be easiest to measure in a habitat transition zone.

Rigorous transect-based monitoring of lizard communities has been underway at Organ Pipe Cactus National Monument (ORPI) for over a decade (Rosen and Lowe 1996), and such a method may be applicable to areas on the Colorado Plateau as well. As part of a separate study (Rosen et al. 2002), additional lizard line transects were established at ORPI. However, in an effort to detect greater numbers of lizards, and facilitate fieldwork in steep, rocky terrain, transects simply utilized existing backcountry hiking trails. Although not random, such transects would be easy to establish and convenient to run. Because of their convenient location, such transects could be run many times a year at little expense, and

this aspect would help assure such a monitoring program to be continued into the future. Examples of potential transects in SCPN parks include the Frijoles Canyon trail at BAND and the Rinconada Canyon loop trail at PETR. Based on our work at BAND, it appears that Tree Lizards have decreased dramatically throughout the monument since previous surveys in the 1970's (Degenhardt 1975), including along Frijoles Creek. If such a lizard survey transect had been established in the 1970's along Frijoles Creek, we would now have valuable data with which to study the apparent decline of Tree Lizards, and could analyze those data with respect to both external (e.g., climatic) and internal park conditions (e.g. fire history) over that time.

Some parks have specific habitats or management issues that affect the herpetofauna, and these should be considered in the design of monitoring programs at those parks. These issues include management of grasslands at some parks (WUPA, PEFO, CHCU, PETR, GLCA), including fire management, juniper expansion, and long-term grazing effects; habitat fragmentation and isolation and road mortality (at PETR and AZRU, possibly affecting amphibian and reptile populations, especially of long-lived species such as Western Box Turtle); wildland fire at BAND, affecting habitat of the endemic Jemez Mountains Salamander; artificial water management (ditches and ponds at AZRU and YUHO and Glen Canyon Dam at GLCA) affecting amphibians; and management of unexcavated ruin rubble mounds at YUHO and SAPU, used as overwintering sites for snakes and likely other species.

The SCPN has recently developed a list of "core vital signs" for long-term monitoring across the network, and amphibians were selected as indicators of a number of aquatic habitats. Preliminary protocol development for amphibian monitoring has identified a number of species or species groups as monitoring targets. These include Northern Leopard Frog and Canyon Treefrog in spring and tinaja habitats, development of non-destructive monitoring methods for Jemez Mountains Salamander at BAND, and monitoring of explosive breeders (toad-like anurans) through night driving surveys.

Taxonomic Groups Suitable for Long-term Monitoring

As stated above, we recommend that herpetofaunal monitoring in the SCPN should focus on the most common species or species groups. Below is a summary of the taxonomic groups best suited to monitoring in the SCPN, along with suggestions for monitoring methods suitable for each group.

Diurnal Lizards

Species composition of this group varies by park and habitat, but common members suitable for monitoring include Side-blotched Lizard, Tree Lizard, Eastern Fence Lizard, and whiptail lizards. In a few SCPN few parks, Sagebrush Lizard and Lesser Earless Lizard should be included. Usually two to three species will be dominant in a given community in a park, and these species would become the focus of monitoring. At some parks, Side-blotched Lizards and Tree Lizards form a species pair, where although they use similar rocky habitats, the Tree Lizard usually prefers slightly more mesic conditions. Changes in the abundance or micro-distribution of these two species may reflect subtle changes in environmental conditions, and they are thus ideal candidates for monitoring. Appropriate methods for diurnal lizards could include visual strip transects and/or time-constrained searches.

One or two species of whiptails will usually be common members of a lizard community in SCPN parks, and would be included in general diurnal lizard monitoring. However, whiptail lizards deserve particular attention precisely because often more than one species occur together, and changes in vegetation or other habitat features may be reflected in a differential response of the different whiptail species. In addition, it is common in SCPN parks for syntopic species pairs of whiptails to consist of a bisexual, sexually reproducing species and a unisexual, parthenogenetically reproducing one. Unisexual whiptails are generally considered to be "weedy" species (Wright and Lowe 1968), able to succeed in disturbed habitats, both natural and human-altered. In some areas in the Southwest, unisexual species have largely replaced bisexual species as habitats have become disturbed and degraded (e.g., Bogan et al. 1998, Wright and Lowe 1968). Species of whiptails that could be included in monitoring in SCPN parks include Little Striped Whiptail (bisexual), Western Whiptail (bisexual), New Mexico Whiptail (unisexual), Chihuahuan Spotted Whiptail (unisexual), and Plateau Striped Whiptail (unisexual). Like diurnal lizards generally (above), line transects or time-constrained searches are probably the best methods for long-term monitoring of whiptails.

Toad-like Anurans

Included in this group are both spadefoot toads and true toads. As many as six species in this group occur together in some SCPN parks, and all are easily found by night driving methods in lower-elevation parks where extensive paved roads exist (e.g., ELMO, PEFO, WUPA, CHCU). Night driving is probably the most efficient means to monitor this group in the SCPN, as the timing and location of breeding activity is unpredictable. Even when breeding is not monitored directly, it can sometimes be inferred from road driving surveys. For example, at WUPA, a two-year road driving study during a drought period (1999-2000) verified breeding by spadefoots by the presence of young individuals on the road, whereas one common true toad species (Great Plains Toad) probably did not breed over the course of the survey, or recently before, due the presence of only adult animals found during road surveys (Persons 2001a). In addition, changes in location of breeding sites (e.g., disappearance of sites) in the general area of a road transect could be inferred from night driving results. For example, clumped distribution of anuran records along the road at Wupatki (Persons 2001a) corresponded to the location

of known breeding sites, and long-term changes in species distribution may reflect changes in the occurrence or quality of such breeding sites.

Snakes

Like anurans, snakes should be monitored with road driving surveys. Unlike with diurnal lizards, where large enough sample sizes of a few common species can be obtained, monitoring of snakes should probably focus on trends in ecological subsets of the snake community, such as lizard-eating snakes, rodent-eating snakes, or egg-laying versus live-bearing species. Even so, it may be difficult to obtain large enough sample sizes for statistical analysis. Trends in these ecological groups may reflect changes in environmental conditions, which may in turn be affecting predator or prey availability or moisture regimes affecting snake reproduction (e.g., desiccation of egg clutches). It will be difficult to monitor snakes at SCPN parks without extensive paved roads. Snakes should be included in monitoring programs at all parks, but methods and amount of effort allocated to snakes at individual parks will vary, more so than with other components of an SCPN wide monitoring program. Also, inventory completeness is low for snakes at most SCPN parks, so at least in the early stages of the monitoring program it may be advantageous to focus additional effort on completing species inventories.

Species of Special Concern

These species occur at only one or a few SCPN parks, and are included because they are of concern as exotic species, they exist as small, isolated populations, or they may be considered "indicator species" within an important habitat type.

Jemez Mountains Salamander

This species occurs only in the Jemez Mountains of New Mexico, and a portion of its distribution lies within BAND. While the bulk of the population (outside BAND) is frequently the focus of monitoring by the State of New Mexico and/or the U.S.D.A. Forest Service, it would be desirable to implement a non-destructive, long-term monitoring program for this species within BAND, possibly using artificial cover (Fellers and Drost 1994) or nighttime searches during favorable weather conditions (Michelle Cummer, personal communication).

Tiger Salamander

Aside from the terrestrial Jemez Mountains Salamander at BAND, this is the only salamander species found within the SCPN. Although they probably occur at every park in the SCPN, in areas where perennial water is absent (e.g., CHCU, PEFO, WUPA) they breed in temporary pools and are difficult to locate most of the year, making monitoring difficult. However, at some parks (ELMO, SAPU) Tiger Salamanders occur in permanent spring-fed pools, and at these sites should be monitored as potential "canaries in the coal mine" for these springs, which may be affected by drought, regional water draw-downs, or unforeseen contamination.

Couch's Spadefoot

This species, which is common in the Sonoran and Chihuahuan Desert regions, occurs disjunctly in grassland habitats on the Colorado Plateau in northeastern Arizona, including at PEFO. Couch's Spadefoot should be a focus of amphibian monitoring at PEFO, given its restricted, relictual distribution in the region.

Mountain Treefrog

This species was unknown from any SCPN park prior to 2003, when we discovered an isolated population at ELMA, well north of its known range (Monatesti et al. 2005). A first step should be additional, targeted inventory work, with the goal of incorporating Mountain Treefrogs into ELMA's long-term monitoring program.

Northern Leopard Frog

Leopard frogs have declined throughout much of their range, and all populations of this species within SCPN parks should be included in monitoring. However, GLCA and NAVA may be the only two parks in the network that harbor this species, although isolated populations of this or another leopard frog species may still exist at GRCA as well (Charles Drost, personal communication).

Bullfrog

This species, native to the eastern United States, is widely regarded as a predatory scourge to native aquatic herpetofauna in the Southwest (e.g., Rosen and Schwalbe 2002). The only SCPN park in which we found this species was BAND, and only along the Rio Grande River, where eradication may be impossible. Bullfrogs should be included in the SCPN monitoring program as an invasive species to watch for, so that early eradication efforts could be successful in isolated areas.

Little Striped Whiptail

This species has a spotty, relictual distribution on the southern Colorado Plateau, where it usually occupies grassland habitats. Within the SCPN, it is known to occur at PEFO, PETR, SAPU, WACA, and WUPA, and at all parks occurs together with a related, unisexual species (Plateau Striped Whiptail at PEFO, WACA, and WUPA; New Mexico Whiptail at PETR; and Chihuahuan Spotted Whiptail at SAPU). Monitoring the relative abundance of this and co-occurring unisexual species could be an important tool for assessing

changes in the integrity of grassland ecosystems at PEFO, PETR, and WUPA.

New Mexico Whiptail

While this species occurs naturally in the Rio Grande Valley of New Mexico, including at PETR and BAND, it occurs as an introduced population at PEFO (Persons 2001b, Persons and Wright 1999b). This introduced population should be monitored to determine if its distribution is expanding within and adjacent to the park.

Box Turtle

This species only occurs naturally within the SCPN at PETR, although an introduced population (or perhaps a single individual) has existed at PEFO for the past few years. This long-lived species may be affected by habitat fragmentation and isolation at PETR, particularly the population occurring below the lava bluffs escarpment adjacent to Unser Boulevard. However, cost-effective monitoring would be difficult. An in-depth, autecological study of Box Turtles at PETR would be an excellent graduate student project, and such a study could help determine appropriate long-term monitoring methods, as well as identify possible current or predicted future stressors.

Milk Snake

On the southern Colorado Plateau (especially in northern Arizona), Milk Snakes appear to be distributed primarily in grassland habitats, and may be good indicators of grassland ecosystem health in the region (Drost et al. 2001). Within the SCPN, Milk Snakes are known from MEVE, PEFO, and WUPA, and may occur at other parks as well. Although difficulty in locating large numbers of Milk Snakes makes monitoring them challenging, they should be highlighted in any larger snake community monitoring program where they are known or suspected to occur.

Arizona Black Rattlesnake

Traditionally, the Arizona Black Rattlesnake has been regarded as a subspecies of the Western Rattlesnake (e.g., Stebbins 2003), but recent work suggests it should be regarded as a separate species, *Crotalus cerberus* (Pook et al. 2000, Douglas et al. 2002). It is native to the central Arizona highlands along and south of the Mogollon Rim, occurs at WACA, and may occur at SUCR. The species is at the northern edge of its range in the Flagstaff, Arizona area, and could potentially be impacted by the increasing human population in the area, particularly around WACA. Distribution, status, and genetic affinity of the species in the WACA area should be determined, including location and protection of overwintering sites in and near the monument.

Massasauga

This small rattlesnake is only known to occur in the SCPN at PETR, where it is found on the sandy grasslands in the western area of the monument. The Massasauga could be impacted at PETR by road mortality and collecting along Paseo de Vulcan. It may be possible to monitor this species with night driving adjacent to the monument (Paseo de Vulcan) or targeted foot searches during optimal weather conditions.

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Appendix A. Aztec Ruins National Monument (AZRU)

AZRU is located near the town of Aztec, San Juan County, New Mexico, along the Animas River, a tributary of the San Juan River. Elevation ranges between 1,705 and 1,764 m (5,594-5,788 ft). The monument encompasses 124 ha (306 acres), and was established to protect ancient Puebloan ruins, including the large ceremonial Great Kiva. Habitats at AZRU include sagebrush and saltbush scrub, shrub grassland, rocky juniper woodland (along washes), fallow fields, an active irrigation ditch and irrigated fruit orchard, scattered groves of large cottonwood trees, and riparian habitat along the Animas River. Additional information on natural resources at AZRU is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 103 person-hours surveying for herpetofauna at AZRU in 2001-2003. Methods used and number of person-hours spent on each method included general surveys (63.2), nocturnal general surveys (20.8), non-random 1-ha TACS plot surveys (12.5), and night driving (6.1). We recorded 207 individual amphibians and reptiles of 11 species during our surveys, and we documented one additional species based on review of literature and museum specimen records. A summary of the total number of each species observed by each method at AZRU is presented in Table A-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at AZRU

Based on our surveys at AZRU and inclusion of previously documented species we estimate an inventory completeness of 57% (Table A-1). A species accumulation curve based on our surveys in 2001-2003 is shown in Figure A-1. We found no new species after the first year, and this asymptotic species accumulation curve suggests we are close to reaching inventory completeness. However, we believe this is a false asymptote that indicates only that we are close to detecting most of the common species, using our current methods. Detecting the remaining species at AZRU will require much greater field effort and more targeted searches during favorable conditions. For example, drought conditions during our inventory may have been responsible for the lack of detections of some amphibian species such as Tiger Salamander (observed by AZRU staff prior to our surveys), Plains Spadefoot, and Mexican Spadefoot. Many of the undocumented species likely to occur at AZRU are snakes, including many uncommon or secretive species like Glossy Snake, Western Hog-nosed Snake, and Night Snake.

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology, Berkeley (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from AZRU. We used dot distribution maps in Degenhardt et al. (1996) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to AZRU.

We located museum specimen records for three species at or near AZRU (Appendix T). These included records for Northern Leopard Frog and Greater Short-horned Lizard from "Aztec," and Painted Turtle from AZRU. We examined the Painted Turtle specimen, located at the Museum of Southwestern Biology, and verified its identification. We found no literature on amphibians and reptiles at AZRU, although Harris (1963) and Harris et al. (1967) investigated the herpetofauna of the San Juan basin.

Sensitive Species and Threats to the Herpetofauna

AZRU is located in an agricultural and residential area, and habitats in and near the monument have been altered by this intensive land use, undoubtedly affecting amphibians and reptiles. Snakes are killed by vehicles adjacent to AZRU, and this mortality may negatively impact populations over time. If Northern Leopard Frogs or Painted Turtles still inhabit the Animas River in and near AZRU, they may represent isolated populations of those species. A proposed dam along the Animas River upstream of AZRU could impact aquatic herpetofauna in the monument if it were to change the hydrology of the river in ways important to amphibians (e.g., backwater pools used as breeding sites by toads).

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at AZRU is only 57%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort could focus

on documenting amphibians (especially Tiger Salamander and spadefoot toads) and snakes. The Animas River could be intensively surveyed to determine the status of Northern Leopard Frog and Painted Turtle at AZRU, as well as to search for Black-necked Garter Snake. Without the benefit of extensive roads available for night driving surveys, locating many snake species (e.g., Common Kingsnake, Glossy Snake, Western Hog-nosed Snake, Night Snake) may require substantial field effort and different methods, such as funnel or pitfall traps. More surveys could be conducted in the northern section of the monument, which is the most likely area to find Lesser Earless Lizard, Glossy Snake, and Western Hog-nosed Snake.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at AZRU to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At AZRU, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as the flooded fruit orchard and along the Animas River where Woodhouse's Toads and Western Chorus Frogs are common. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At AZRU, Plateau Striped Whiptail and Eastern Fence Lizard may be good candidates for monitoring, because these species are common throughout the monument and at most SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at AZRU

Because we do not have data on population sizes or density of species at AZRU, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at AZRU, and also with the same species elsewhere throughout its range in the region. An asterisk (*) below denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at AZRU, as well as NPSpecies checklist field assignments, are presented in Table A-1.

Species Documented From Aztec Ruins National Monument

*Woodhouse's Toad (*Bufo woodhousii*)

This species was common in both the flooded fruit orchard just west of the main ruins site and along the Animas River. We do not know if Woodhouse's Toads bred successfully in the flooded ditches in the orchard, but we did find tadpoles and newly metamorphosed toadlets along the Animas River. When in use, the Farmer's Ditch irrigation ditch running through AZRU appears too deep and swiftly flowing to support this or other amphibian species.

*Western Chorus Frog (*Pseudacris triseriata*)

Like the Woodhouse's Toad, we found chorus frogs in the lower flooded ditches of the irrigated fruit orchard in areas where dense vegetation bordered the water, and also along the Animas River. We also heard them calling from the fields just south of the monument.

*Painted Turtle (*Chrysemys picta*)

Although we did not find Painted Turtles during our surveys, a specimen at the Museum of Southwestern Biology (MSB 7514) was collected at AZRU in 1948, probably in or near the Animas River, which contains suitable habitat for this species. Targeted searches could determine the present status of Painted Turtles at and near AZRU.

*Eastern Collared Lizard (*Crotaphytus collaris*)

This species was common in the rocky washes of the upland mesa in the northern section of the monument, above Farmer's Ditch. We did not find any Collared Lizards below the ditch, however, probably because vegetation is generally too dense in the orchard, field, and riparian habitats dominant there.

*Sagebrush Lizard (*Sceloporus graciosus*)

We observed only a single individual Sagebrush Lizard during our surveys, collected on the upland mesa in the northwest part of the monument.

*Eastern Fence Lizard (*Sceloporus undulatus*)

This species was common at AZRU, and was found in all habitats throughout the monument. Eastern Fence Lizards were often observed on and around the visitor center and ruins.

*Western Whiptail (*Cnemidophorus tigris*)

Of the two whiptail lizard species at AZRU, the Western Whiptail is the more desert-adapted species. We found this species only in the more open habitats above Farmer's Ditch, and even there it was much less common than the Plateau Striped Whiptail.

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual (all-female) species was abundant at AZRU and was found throughout the monument. Unisexual whiptails usually prefer disturbed or ecotonal habitats (e.g., Wright and Lowe 1968), habitat types common at AZRU. Plateau Striped Whiptails were especially common in these areas of AZRU, such as in roadside weeds along the old road between the visitor center and irrigated orchard. While the Plateau Striped Whiptail actually represents a complex of species (Wright 1993), some undescribed, individuals we observed and collected at AZRU appear to be *Cnemidophorus velox* proper (i.e., the same as those used in the original description of the species).

Striped Whipsnake (*Masticophis taeniatus*)

We only observed three Striped Whipsnakes at AZRU during our surveys. Although apparently not abundant at AZRU, the species probably occurs throughout the monument.

Gopher Snake (*Pituophis catenifer*)

Although we found only six individual Gopher Snakes during our surveys, it was nonetheless the second most common snake species, and probably occurs throughout the monument. We found Gopher Snakes in various habitats, including in the shrub grassland in the northern section of the monument, and within a rotting log in the wooded riparian habitat near the Animas River.

*Western Terrestrial Garter Snake (*Thamnophis elegans*)

This was the most common snake species at AZRU, although we found it only in the southern section of the monument, below Farmer's Ditch. Garter snakes are probably common at AZRU because of active irrigation, which creates favorable wet habitats such as the seasonally flooded fruit orchard.

Western Rattlesnake (*Crotalus viridis*)

Although generally common in the region, we observed only one individual Western Rattlesnake at AZRU during our surveys. This species probably occurs throughout the monument.

Species That Possibly Occur at Aztec Ruins National Monument

Tiger Salamander (*Ambystoma tigrinum*)

Apparently, six salamanders (almost certainly this species) entered and died on the floor of the Great Kiva at AZRU a few years prior to our surveys (Terry Nichols, personal communication). Although we did not find any during this inventory, possibly due to drought conditions, Tiger Salamanders are probably common.

Plains Spadefoot (*Spea bombifrons*)

This species has been collected throughout the San Juan River basin (Degenhardt et al. 1996), and probably occurs at AZRU. Because this grassland species generally avoids river bottoms and wooded areas (Degenhardt et al. 1996), it is most likely to be found in the upland habitat north of Farmer's Ditch.

Mexican Spadefoot (*Spea multiplicata*)

Like the Plains Spadefoot, this species has been collected throughout the region, and almost certainly occurs at AZRU. Because the Mexican Spadefoot occupies a wide variety of habitats, including river valleys and agricultural lands as well as grasslands and shrublands (Degenhardt et al. 1996), it probably occurs throughout AZRU. Both spadefoot species are generally only active during the summer monsoon period.

Red-spotted Toad (*Bufo punctatus*)

Although widespread throughout the Colorado Plateau region, the Red-spotted Toad has not been collected from many localities in the San Juan basin (Degenhardt et al. 1996), and it usually prefers rockier habitats than are found at AZRU. If the species does occur at AZRU, it would probably be along the Animas River. Because this and other true toads (Bufo) are generally much more surface active than spadefoots, especially in permanent aquatic habitats such as the Animas River, our failure to find it suggests it may be absent.

Bullfrog (*Rana catesbeiana*)

Bullfrogs, which are native to the eastern United States, have become widely established throughout the west, including along the San Juan River in New Mexico (Degenhardt et al. 1996). Although the species appears to be absent from AZRU, it could become established in irrigation ditches, ponds, or other permanent water sources.

Northern Leopard Frog (*Rana pipiens*)

Two specimens (MVZ 16468-9) of this species were collected at "Aztec" in 1933. In addition, two specimens in the Museum of Southwestern Biology database (MSB 850-1) collected at "Aztec" in 1946, and labeled as *Rana blairi* (Plains Leopard Frog), are also likely Northern Leopard Frogs, which is the only species of Leopard Frog found in the region. Northern Leopard Frogs may persist along the Animas River, although our failure to locate them suggests they may now be absent. The irrigation ditch running through AZRU, when in operation, appears to be too deep and swiftly flowing to support leopard frogs or other amphibians.

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

There is only a single record of this species from northwestern New Mexico (Degenhardt et al. 1996), although it is unclear why it is so rare in the region. Habitat in the northern section of AZRU appears suitable for Long-nosed Leopard Lizards, and the species may possibly occur there.

Lesser Earless Lizard (*Holbrookia maculata*)

This grassland species is found throughout northwestern New Mexico, although there are few records in close proximity to the San Juan River (Degenhardt et al. 1996). The flat, grassland habitat in the northern section of AZRU appears suitable for this species.

Greater Short-horned Lizard (*Phrynosoma hernandesi*)

This species almost certainly occurs at AZRU, but our failure to document it suggests it is uncommon or rare. A specimen at the Museum of Southwestern Biology (MSB 1340) was collected in 1946 at "Aztec," confirming its presence in the AZRU area.

Ornate Tree Lizard (*Urosaurus ornatus*)

Ornate Tree Lizards have been collected along the San Juan River in New Mexico (Degenhardt et al. 1996), and we initially expected that they might occur at AZRU. However, our failure to find this conspicuous, diurnal species suggests it is probably absent from the monument, most likely because of a lack of suitable rocky or boulder habitat.

Side-blotched Lizard (*Uta stansburiana*)

Like the Ornate Tree Lizard, we had initially expected to find Side-blotched Lizards at AZRU, based on their widespread distribution within the San Juan basin (Degenhardt et al. 1996). Also like the Tree Lizard, our failure to find the species suggests it may be absent from AZRU. However, because Side-blotched Lizards occur in a wide variety of habitats, and on a wide array of substrates (Degenhardt et al. 1996), more thorough surveys may detect this species within the monument.

Little Striped Whiptail (*Cnemidophorus inornatus*)

This species has been collected in many parts of the San Juan basin in New Mexico, including in the Animas River valley (Degenhardt et al. 1996). In the San Juan basin, the species occupies grassland habitats (Harris 1963), and habitat in the northern portion of AZRU appears suitable. Our failure to locate the species, despite targeted searches for it, suggests it may be absent from the monument.

Glossy Snake (*Arizona elegans*)

In New Mexico, Glossy Snakes prefer sandy grasslands and shrublands (Degenhardt et al. 1996) and almost certainly occur at AZRU. They are probably most likely to be found in the upland portion of the monument, above Farmer's Ditch.

Racer (*Coluber constrictor*)

Although the Racer is rare in the region, it has been collected along the San Juan River in the vicinity of Farmington (Degenhardt et al. 1996), and it might occur along the Animas River valley as well. If present at AZRU, it would most likely be found along the Animas River and other more mesic habitats in the monument (e.g., Farmer's Ditch, agricultural fields).

Ring-necked Snake (*Diadophis punctatus*)

Although this species has not been documented from the San Juan Basin (Degenhardt et al. 1996), isolated (relictual) populations occur throughout much of the Southwest (Stebbins 2003). If such a population occurs at AZRU, it would be most likely to be found in the low-lying areas near the Animas River, where there is subsurface moisture, as required by the species (Degenhardt et al. 1996).

Western Hog-nosed Snake (*Heterodon nasicus*)

Isolated populations of this species occur in the San Juan basin, near Farmington (Degenhardt et al. 1996). Western Hog-nosed Snakes prefer areas with loose, sandy soil for burrowing (Stebbins 2003), and habitat in the upland area of AZRU, north of Farmer's Ditch, appears suitable.

Night Snake (*Hypsiglena torquata*)

This species is found in many habitats throughout the region, and almost certainly occurs at AZRU. Night Snakes are, as their name implies, strictly nocturnal and can usually only be found during the day by overturning rocks used as cover. Where paved roads are available for extensive night driving surveys, Night Snakes are often found to be quite common (e.g., Drost et al. 2001).

Common Kingsnake (*Lampropeltis getula*)

This species was recently discovered in extreme northwestern New Mexico (Davenport et al. 1998), and may occur

more widely in the San Juan basin. If present at AZRU, it may be found in any habitat type within the monument.

Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has a spotty distribution throughout the Southwest (Stebbins 2003), but has been collected in the San Juan basin from near Farmington (Degenhardt et al. 1996). Based on its apparent preference for grasslands on the southern Colorado Plateau in Arizona (Drost et al. 2001, and unpublished data), Milk Snakes would be most likely to occur in the upland portion of AZRU, above Farmer's Ditch.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

Although we only observed the Western Terrestrial Garter Snake at AZRU during this inventory, the Black-necked Garter Snake has been collected in the Animas River valley (Degenhardt et al. 1996), and may also occur within the monument. This species is more aquatic than the Western Terrestrial Garter Snake, and if present at AZRU would most likely occur along the Animas River.

Table A-1. Amphibian and reptile species known or expected to occur at Aztec Ruins National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	3	Probably Present	
Plains Spadefoot	3	Probably Present	
Mexican Spadefoot	3	Probably Present	
Red-spotted Toad	1	Unconfirmed	
Woodhouse's Toad	SX	Present in Park	Common
Western Chorus Frog	SX	Present in Park	Common
Bullfrog	1	Unconfirmed	
Northern Leopard Frog	1	Unconfirmed	
Painted Turtle	SP	Present in Park	Rare
Eastern Collared Lizard	SX	Present in Park	Common
Long-nosed Leopard Lizard	1	Unconfirmed	
Lesser Earless Lizard	2	Unconfirmed	
Greater Short-horned Lizard	3	Probably Present	
Sagebrush Lizard	SX	Present in Park	Rare
Eastern Fence Lizard	SX	Present in Park	Common
Ornate Tree Lizard	1	Unconfirmed	
Side-blotched Lizard	2	Unconfirmed	
Little Striped Whiptail	1	Unconfirmed	
Western Whiptail	SX	Present in Park	Common
Plateau Striped Whiptail	SX	Present in Park	Abundant
Glossy Snake	3	Probably Present	
Racer	1	Unconfirmed	
Ring-necked Snake	1	Unconfirmed	
Western Hog-nosed Snake	2	Unconfirmed	
Night Snake	3	Probably Present	
Common Kingsnake	1	Unconfirmed	
Milk Snake	2	Unconfirmed	
Striped Whipsnake	OX	Present in Park	Uncommon
Gopher Snake	OX	Present in Park	Common
Black-necked Garter Snake	2	Unconfirmed	
Western Terrestrial Garter Snake	SX	Present in Park	Common
Western Rattlesnake	OX	Present in Park	Uncommon

Table A-1. Amphibian and reptile species known or expected to occur at Aztec Ruins National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.—Continued

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
TOTAL RANK 1	9		
TOTAL RANK 2	5		
TOTAL RANK 3	6		
TOTAL FOUND (SX, OX, SP, OP)	12		
WEIGHTED TOTAL	21.0		
ESTIMATED INVENTORY COMPLETENESS	57%		

Table A-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Aztec Ruins National Monument, 2001-2003. GS = general survey, NGS = nocturnal general survey, N-R TACS = non-random 1-ha time-area constrained search (TACS) plot, ND = night driving, and RE = random encounter.

Species	GS	NGS	N-R TACS	ND	RE	Total
Woodhouse's Toad	3	8		1	2	14
Western Chorus Frog	6	13		1		20
Eastern Collared Lizard	12		11		3	26
Sagebrush Lizard			1			1
Eastern Fence Lizard	16				2	18
Western Whiptail	4		4			8
Plateau Striped Whiptail	73		21		6	100
Striped Whipsnake			1		2	3
Gopher Snake	4			1	1	6
Western Terrestrial Garter Snake	4	1		2	3	10
Western Rattlesnake			1			1
TOTAL	122	22	39	5	19	207

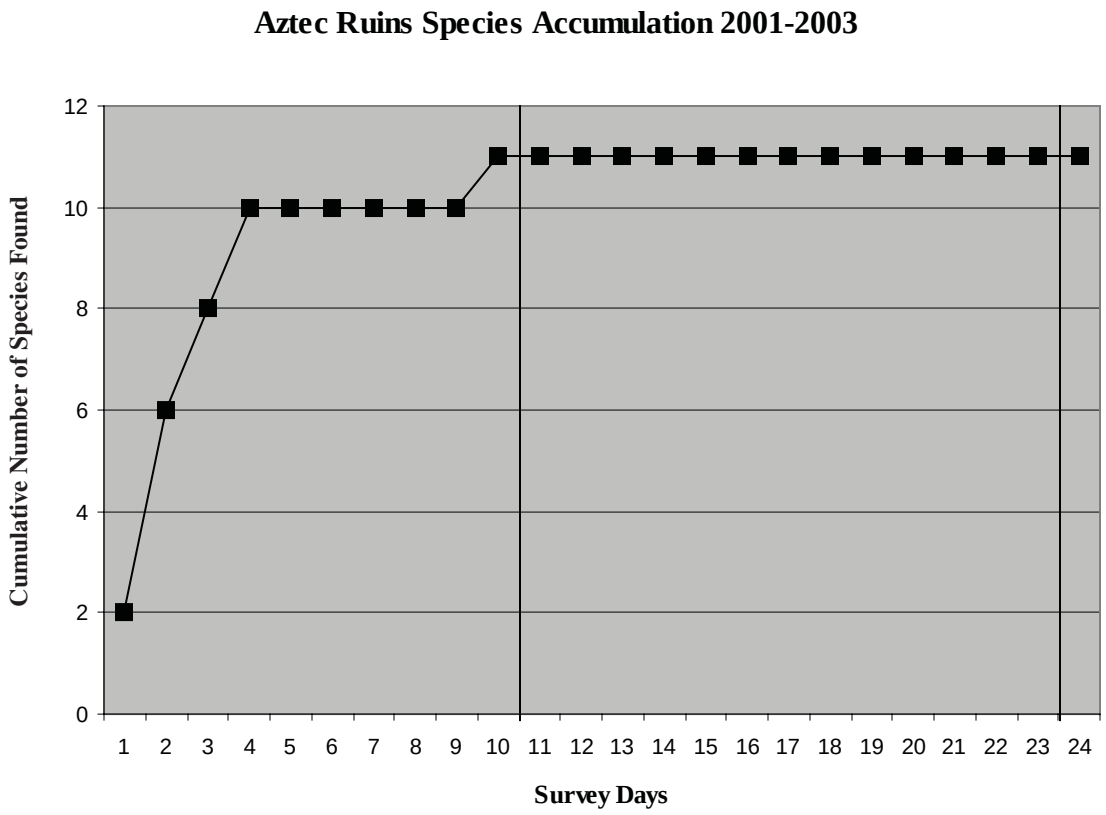

Figure A-1. Species accumulation curve for amphibians and reptiles at Aztec Ruins National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix B. Bandelier National Monument (BAND)

BAND is located along the eastern edge of the Jemez Mountains in north-central New Mexico, near the town of Los Alamos. Elevation ranges between 1,626-3,081 m (5,335-10,109 ft). The monument encompasses 13,303 ha (32,858 acres), and was established to protect ancient Anasazi pueblo ruins. Habitats at BAND range from high elevation spruce-fir forests in the northwest part of the monument to dry, shrub and grassland habitats along the eastern boundary near the Rio Grande. Pinyon-juniper woodlands are extensive throughout much of BAND, and deep canyons cut through the Pajarito Plateau, joining the Rio Grande, which is known in that area as White Rock Canyon. Areas along the Rio Grande and the lower reaches of many large canyons (e.g., Frijoles, Capulin, Alamo canyons) have periodically been inundated by Cochiti Reservoir, created when Cochiti Dam was built downstream of BAND. Additional information on natural resources at BAND is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 232 person-hours surveying for herpetofauna at BAND in 2002-2003. Methods used, and number of person-hours spent on each method, included general surveys (198.6), nocturnal general surveys (12.4), random 1-ha TACS plot surveys (7.2), random 10-ha TACS plot surveys (6.3), and night driving (7.4). We recorded 606 individual amphibians and reptiles of 17 species during our surveys, and we documented six additional species based on review of literature and museum specimen records. A summary of the total number of each species observed by each method is presented in Table B-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at BAND

Based on our surveys at BAND and inclusion of previously documented species we estimate an inventory completeness of 65% (Table B-1). A species accumulation curve based on our surveys in 2002-2003 is shown in Figure B-1. This asymptotic species accumulation curve suggests we are close to reaching inventory completeness with our surveys alone. However, we believe this is a false asymptote that indicates only that we are close to detecting most of the common species, using our current methods, as evidenced by the large number of previously documented and expected species. Detecting the remaining species at BAND will require much greater field effort and more targeted searches during favorable conditions. Many of the undocumented species likely to occur at BAND are snakes, including many uncommon or secretive species like Texas Blind Snake, Glossy Snake, Corn Snake, Smooth Green Snake, and Night Snake.

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from BAND. We used dot distribution maps in Degenhardt et al. (1996) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to BAND.

We located museum specimen records for 14 species at BAND (Appendix T), most of which were collected during a previous inventory by Degenhardt (1975). In addition, we located specimens (at MSB) from near BAND for a number of species that have yet to be vouchered within the monument. These included Couch's Spadefoot, Glossy Snake, Coachwhip, and Black-necked Garter Snake from the vicinity of Cochiti Lake, and New Mexico Whiptail from White Rock Canyon at the mouth of Sanchez Canyon (MSB 41041). This last locality is only about 2.4 km (1.5 mi) south (along the Rio Grande) of the BAND boundary. All of these records suggest these species may occur along the Rio Grande within BAND. In fact, there are reports of both New Mexico Whiptail and Black-necked Garter Snake from within BAND (Guthrie 1976), but specimens were not collected. Degenhardt (1975) stated he collected a Gopher Snake from BAND, but we were unable to locate this record in the MSB specimen database.

Previous amphibian and reptile surveys at BAND include a general, monument-wide survey by Degenhardt (1975) and a survey focusing on the lower canyons (prior to filling of Cochiti Reservoir) by Guthrie (1976). Guthrie (1978, 1979) evaluated the status of the Jemez Mountains Salamander within BAND, and Ramotnik (1988) summarized and mapped all collection localities for that species, including within BAND.

Sensitive Species and Threats to the Herpetofauna

The Jemez Mountains Salamander is listed as threatened by the state of New Mexico. This species is endemic to the Jemez Mountains, including areas within BAND, and has apparently undergone range-wide declines in recent decades (Michelle Cummer, Los Alamos National Laboratory, per-

sonal communication). Wildfire or prescribed burns in the high elevation forests at BAND could impact the habitat of the Jemez Mountains Salamander, and the monument may wish to consider this as an integral part of its fire management policies.

The non-native Bullfrog may be difficult, if not impossible, to eliminate from the Rio Grande at BAND. Monitoring efforts in the lower side canyons should watch for this species in order to prevent it from impacting those habitats as well. Because road mortality probably does not pose a threat to the herpetofauna within BAND, most potential threats are extrinsic to the monument, and include drought and radioactive contamination from the nearby Los Alamos National Laboratory, and multiple-use practices (including catastrophic fires) on adjacent National Forest lands (Thomas et al. 2004).

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at BAND is only 65%, we recommend that more effort be directed towards inventory of amphibians and reptiles. Future inventory effort should focus on documenting (with voucher specimens) highly probable species, including spadefoot toads, New Mexico Whiptail, and many snakes (e.g., Texas Blind Snake, Corn Snake, Coachwhip, Smooth Green Snake, Western Rattlesnake). Without the benefit of extensive roads available for night driving surveys, locating many snake species may require substantial field effort and different methods, such as funnel or pitfall traps. Most surveys for undocumented species should be conducted in the lower canyon areas, but Smooth Green Snake and Western Rattlesnake should be searched for in higher elevation parts of the monument.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at BAND to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core “vital signs” for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At BAND, amphibian monitoring may include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as along the Rio Grande for Woodhouse’s Toads and stock tanks in the northwest portion of the monument for Tiger Salamanders and Western Chorus Frogs. In addition, amphibian monitoring may include development of a protocol for non-destructive long-term monitoring of the Jemez Mountain Salamander at BAND using sampling with artificial cover (e.g., Fellers and Drost 1994). However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At BAND, Eastern Fence Lizard and Plateau Striped Whiptail may be good candidates for monitoring, because these species are common throughout the monument and at most SCPN parks, making network-wide comparisons possible.

In addition, Ornate Tree Lizard would be a good candidate for inclusion in lizard monitoring at BAND because our results suggest they may have declined within the monument. Degenhardt (1975) described the Tree Lizard, along with the Eastern Fence Lizard and the Chihuahuan Spotted Whiptail, as being one the most abundant and widely distributed lizards at BAND. However, during our surveys in 2002-2003 we observed 328 Eastern Fence Lizards, 51 Chihuahuan Spotted Whiptails, and only six Tree Lizards (Table B-1)). Many of the larger canyons, including Frijoles Canyon, appear to be ideal for Tree Lizards, but we generally only found Eastern Fence Lizards in these habitats. The Eastern Fence Lizard has a wider ecological distribution than the Tree Lizard, which often prefers more mesic habitats (Stebbins 2003), and it is possible that long-term climatic changes (i.e., drought) could be responsible for a shift in the relative abundance of these two species.

Species Accounts of Amphibians and Reptiles at BAND

Because we do not have data on population sizes or density of species at BAND, and because many species are secretive or are active only during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at BAND, and also with the same species elsewhere throughout its range in the region. An asterisk (*) below denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at BAND, as well as NPSpecies checklist field assignments, are presented in Table B-1.

Species Documented From Bandelier National Monument

*Tiger Salamander (*Ambystoma tigrinum*)

During this inventory, Tiger Salamanders were found in stock tanks in the northwestern part of the monument. Although the species, the larvae of which are used as fish bait, has been transported and introduced throughout New Mexico (Degenhardt et al. 1996), there is no reason to suspect that Tiger Salamanders at BAND are not native. The species was not reported previously from BAND (Degenhardt 1975, Guthrie 1976).

*Jemez Mountains Salamander (*Plethodon neomexicanus*)

This species, which is listed as Threatened by the state of New Mexico, is endemic to the Jemez Mountains of northern New Mexico, and part of its limited distribution lies within BAND (Ramotnik 1988). It occurs in the mixed conifer forests in the northwestern corner of the monument, and significantly, ten percent of its limited distribution is protected within BAND (Ramotnik 1988). We did not observe any Jemez Mountains Salamanders during this inventory, probably due to drought conditions during the period. They spend most of the year deep underground in fissures in the bedrock, and only come to the surface during wet weather (such as during the summer monsoon), when they can be found under rocks and rotting logs (Ramotnik 1988).

Red-spotted Toad (*Bufo punctatus*)

We did not observe this species during the present inventory. However, Degenhardt (1975) recorded it from the mesa between Lummis and Alamo Canyons, and Guthrie (1976) observed young toads in Capulin Canyon. Although apparently not common, it probably occurs in many of the lower rocky canyons, as well on mesa tops where rainwater collects in large potholes.

*Woodhouse's Toad (*Bufo woodhousii*)

This species is common along the Rio Grande at BAND, and Guthrie (1976) recorded it from lower Alamo Canyon as well.

*Canyon Treefrog (*Hyla arenicolor*)

We did not observe this species during the present inventory. They have been reported only from Alamo and Lummis canyons (Degenhardt 1975, Guthrie 1976), although they may occupy other rocky canyons with semi-permanent pools throughout the southern part of the monument.

*Western Chorus Frog (*Pseudacris triseriata*)

Although not recorded by Degenhardt (1975) or Guthrie (1976), this species was known to occur in at least one locality in the northwestern part of the monument (Steve Fettig, personal communication). We collected this species at a stock tank just southeast of the junction of the Dome Road with New Mexico State Route 4. Western Chorus Frogs probably occur throughout the mixed conifer forest in the northwestern section of the monument.

Bullfrog (*Rana catesbeiana*)

Bullfrogs, which are native to the eastern United States, have become widely established throughout the West, including in New Mexico (Degenhardt et al. 1996). Degenhardt (1975) observed Bullfrogs in White Rock Canyon at 1,615 m (5300 ft) elevation, probably near the southern monument boundary. Guthrie (1976) stated that the species did not occur within the monument, but noted that it was common in Cochiti Reservoir, and was also observed as close as the mouth of Capulin Canyon. He predicted that Bullfrogs would invade BAND once Cochiti Reservoir reached the monument boundary. We found Bullfrogs to be common along the Rio Grande, including in the large backwater areas at the mouth of Frijoles Creek. The species undoubtedly occupies the entire length of the Rio Grande within BAND, although its requirement for permanent water probably prevents it from invading the lower canyons.

*Eastern Collared Lizard (*Crotaphytus collaris*)

This species is common in rocky areas along the Rio Grande and in the lower canyons at BAND (Degenhardt 1975, Guthrie 1976). We observed six individuals during the present inventory.

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We observed only one Greater Short-horned Lizard during our inventory, on the mesa top along the ruins trail at the disjunct Tsankawi Ruins unit of BAND. Degenhardt (1975) and Guthrie (1976) each observed a single individual at campgrounds on Frijoles Mesa. Although apparently uncommon, this species probably occurs throughout much of the monument, especially in mid-elevation woodlands and mesa top areas.

*Eastern Fence Lizard (*Sceloporus undulatus*)

The Eastern Fence Lizard was the most abundant species at BAND, and we found it throughout the monument. This species was especially common in the larger canyons, such as Frijoles Canyon, where it was frequently observed on boulders, rocky outcrops, trees, and logs.

*Ornate Tree Lizard (*Urosaurus ornatus*)

Degenhardt (1975) described the Tree Lizard as being one of the most abundant and widely distributed lizards at BAND. He observed the species in White Rock, Sanchez, Medio, Capulin, Alamo, Lummis, and Frijoles canyons. Guthrie (1976) observed only "one or two" individuals, in

Alamo Canyon, but his surveys were restricted to the lower canyons within BAND. During our surveys we observed only six Tree Lizards, in middle Capulin Canyon, lower Frijoles Canyon, and near the western boundary between upper Alamo and Frijoles canyons. Although Degenhardt (1975) did not provide precise locations or numbers of individuals observed, the discrepancy between his study and ours suggests that Tree Lizards may have declined at BAND over the past ~30 years. Most of the larger canyons, including Frijoles Canyon, appear to contain ideal habitats for Tree Lizards, but we generally found only Eastern Fence Lizards in these canyons. The Tree Lizard often prefers more mesic habitats than the Eastern Fence Lizard (Stebbins 2003), and it is possible that drought could be responsible for a shift in the relative abundance of these two species.

*Many-lined Skink (*Eumeces multivirgatus*)

Although we observed only five individual Many-lined Skinks at BAND, the species is probably common throughout much of the monument, especially in the larger, more mesic canyons. We found three individuals in Frijoles Canyon and two in the upper Alamo Canyon area, near the monument's western boundary. Degenhardt (1975) and Guthrie (1976) observed this species in Frijoles and Lummis canyons, and on the mesa near Corral Hill.

Great Plains Skink (*Eumeces obsoletus*)

We observed only four Great Plains Skinks in 2002-2003, all in Frijoles Canyon near Frijoles Creek. We were unable to capture any for museum specimens. Degenhardt (1975) and Guthrie (1976) each observed only two Great Plains Skinks during their surveys, and all of these were in Frijoles Canyon as well.

*Chihuahuan Spotted Whiptail (*Cnemidophorus exsanguis*)

This unisexual whiptail species is common at BAND, especially in the larger canyons. Guthrie (1976) stated that it was not seen above 1,676 m (5500 ft) elevation, but Degenhardt (1975) previously recorded it as high as 1,829 m (6000 ft). During our surveys, we found it to be fairly common in Frijoles Canyon in the headquarters area to at least 1,859 m (6100 ft) elevation.

*Checkered Whiptail (*Cnemidophorus tesselatus*)

Although we did not observe this all-female whiptail at BAND, Degenhardt (1975) and Guthrie (1976) recorded it previously from White Rock Canyon, and Guthrie (1976) considered it rare. This species is probably restricted to the lower elevations within the monument, primarily along White Rock Canyon.

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual species was the most common whiptail observed during our surveys, and the second most abundant species overall. Plateau Striped Whiptails were common in the lower and middle canyons, such as Frijoles Canyon, but were found on mesa top areas as well. The Plateau Striped Whiptail is actually a complex of several, mostly undescribed species (Wright 1993). However, based on color pattern, all individuals we observed at BAND appeared to be *Cnemidophorus velox* proper, as did all individuals collected by Degenhardt (1975), which we examined at MSB. Other, morphologically distinct (and undescribed) species in the Plateau Striped Whiptail complex are known to occur in the general region of BAND (John Wright, personal communication).

*Ring-necked Snake (*Diadophis punctatus*)

Both Degenhardt (1975) and Guthrie (1976) observed this species, in White Rock Canyon and along lower Alamo Creek, respectively. Although we did not find any Ring-necked Snakes during our inventory, this secretive species is probably fairly common along the Rio Grande and in the lower canyons where water and subsurface moisture is present.

*Striped Whipsnake (*Masticophis taeniatus*)

We observed three Striped Whipsnakes in 2002-2003, all in the lower canyon areas (two in lower Frijoles Canyon and one along the Rio Grande). Degenhardt (1975) observed them only along the Rio Grande, and Guthrie (1976) only observed a single individual, along lower Frijoles Creek. Although apparently more common in lower elevation habitats at BAND, it is probably distributed throughout much of the monument, as it occurs in woodlands up to 2200 m (7,218 ft) elevation elsewhere in New Mexico (Degenhardt et al. 1996). Unverified sight records of a "Coachwhip" around the BAND visitor center complex (Steve Fettig, personal communication) may be this species.

Gopher Snake (*Pituophis catenifer*)

This generalist species probably occurs throughout most of the monument, except possibly in the upper elevation mixed conifer habitats (Degenhardt 1975). We observed three individuals in 2002-2003.

*Mountain Patch-nosed Snake (*Salvadora grahamiae*)

We collected a Mountain Patch-nosed Snake in lower Frijoles Canyon, and observed another along the Rio Grande near Arroyo Montoso. Guthrie (1976) observed the species in Frijoles and Alamo Canyon. This primarily diurnal species probably occurs throughout much of the southern half of the monument.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

Guthrie (1976) considered this species to be common near the mouth of Alamo Canyon. We searched specifically for Black-necked Garter Snakes in Alamo Canyon and elsewhere, but found none. Degenhardt (1975) did not record the species either, but noted that specimens had been collected just south of BAND along the Rio Grande (Appendix T). Although filling of Cochiti Reservoir may have eliminated some habitat for this species since Guthrie (1976) observed it, Black-necked Garter Snakes probably still occur in some of the lower canyons at BAND.

*Western Terrestrial Garter Snake (*Thamnophis elegans*)

This species is common in various aquatic habitats throughout BAND. We observed Western Terrestrial Garter Snakes in Frijoles and Alamo canyons, and in the vicinity of cattle tanks in the mixed conifer forest in the northwestern corner of the monument. Guthrie (1976) noted that the species was common along Frijoles Creek, but was less frequently observed in Alamo Canyon, where it seemed to be replaced by the Black-necked Garter Snake. One immature individual we observed along Frijoles Creek had recently eaten an adult male Eastern Fence Lizard.

Western Diamond-backed Rattlesnake (*Crotalus atrox*)

This was the most frequently observed snake species during our surveys. We observed 19 individual Western Diamond-backed Rattlesnakes, mostly along the Rio Grande and in the lower canyons. Degenhardt (1975) also recorded them on Frijoles Mesa, in ponderosa pine (*Pinus ponderosa*) habitat. Although much more common along the Rio Grande and in the lower canyons, this species probably occurs throughout the southern half of the monument (Degenhardt 1975).

Species That Possibly Occur at Bandelier National Monument

Couch's Spadefoot (*Scaphiopus couchii*)

This species has been collected along the Rio Grande just below Cochiti Dam (MSB 50012), and may occur as far upriver as BAND. The bleating advertisement call of the male Couch's Spadefoot is somewhat similar to that of the Woodhouse's Toad, which is the common breeding anuran along the Rio Grande at BAND.

Plains Spadefoot (*Spea bombifrons*)

The Plains Spadefoot usually inhabits grasslands, and often avoids river valleys (Degenhardt et al. 1996). This species has been collected in the vicinity of BAND (Degenhardt et al. 1996), but lack of suitable habitat may preclude its occurrence within the monument. Although the Mexican Spadefoot (below) is much more likely to occur at BAND, these two species often occur together throughout the southern Colorado Plateau region (Persons and Nowak, personal observation).

Mexican Spadefoot (*Spea multiplicata*)

This common, widespread species occupies a variety of habitats in the region (Degenhardt et al. 1996), and is much more likely to occur at BAND than the similar Plains Spadefoot (above). The Mexican Spadefoot would be expected to occur anywhere in the southern half of the monument where temporary water would provide habitat for breeding. This could include cattle tanks or potholes on the mesa tops, tinajas in the lower canyons, or temporary quiet backwaters along the Rio Grande.

Painted Turtle (*Chrysemys picta*)

This species is found along the Rio Grande from just north of Albuquerque southward, with a single specimen from upriver of BAND, near Espaola (Degenhardt et al. 1996). If Painted Turtles did occur in the monument, they would be along the Rio Grande, although the paucity of records from the area (e.g., Cochiti Reservoir) suggests they may not occupy the river in the vicinity of BAND.

Spiny Softshell (*Trionyx spiniferus*)

Degenhardt (1975) observed tracks of this species on a sand bank along the Rio Grande just south of the BAND boundary, suggesting they may occur within the monument. He also noted that the filling of Cochiti Reservoir might create additional habitat for this species at BAND.

Lesser Earless Lizard (*Holbrookia maculata*)

Although this species occurs throughout the region (Degenhardt et al. 1996), there may not be suitable habitat within the monument. Lesser Earless Lizards usually prefer open, level terrain with short vegetation cover and loose, friable soils (Degenhardt et al. 1996), habitat features in short supply in the lower elevations at BAND.

Roundtail Horned Lizard (*Phrynosoma modestum*)

This species has been recorded in the Rio Grande Valley as far north as the vicinity of BAND (Degenhardt et al. 1996). Roundtail Horned Lizards prefer gravelly or rocky soils on bajadas or on the edges of arroyos (Degenhardt et al. 1996), and probably occur in these habitats at BAND in the area of the Rio Grande and some of the lower canyons. As a defensive mechanism, this species mimics small rocks (Sherbrooke 2003).

New Mexico Whiptail (*Cnemidophorus neomexicanus*)

This unisexual whiptail occurs in the Rio Grande Valley as far north as Espanola (Wright 1971), and almost certainly occurs at BAND. It has been collected in White Rock Canyon

at the mouth of Sanchez Canyon (MSB 41041), which is only about 2.4 km (1.5 mi) south (along the Rio Grande) of the BAND boundary. Guthrie (1976) observed one or two individuals along the Rio Grande near the south monument boundary, and we may have observed this species along the Rio Grande during the present inventory as well. However, because whiptails are notoriously difficult to identify, specimens are necessary to verify these observations.

Texas Blind Snake (*Leptotyphlops dulcis*)

This tiny, secretive, fossorial species almost certainly occurs along the Rio Grande at BAND. Light soil suitable for burrowing, especially in areas with abundant surface rocks, is preferred habitat in New Mexico (Degenhardt et al. 1996).

Glossy Snake (*Arizona elegans*)

Glossy Snake has been collected near Cochiti Lake south of BAND, and the species probably occurs within the southern part of the monument. Glossy Snakes prefer areas with sandy or loamy soils, with or without rocks present (Stebbins 2003).

Racer (*Coluber constrictor*)

This quick, diurnal relative of the whipsnakes (*Masticophis*) has a spotty distribution throughout New Mexico, usually in areas near water (Degenhardt et al. 1996). Racers are found along the Rio Grande near Albuquerque, and could occur in White Rock Canyon at BAND.

Corn Snake (*Elaphe guttata*)

Numerous specimens of this species have been collected in the vicinity of BAND (Degenhardt et al. 1996), and it almost certainly occurs within the monument. In New Mexico, Corn Snakes require permanent water and good cover for retreat and hibernation (Degenhardt et al. 1996), habitat features found in many of the lower canyons (e.g., Frijoles Canyon) and along the Rio Grande at BAND.

Chihuahuan Hook-nosed Snake (*Gyalopion canum*)

This species has been collected northward in the Rio Grande Valley to just south of BAND (Degenhardt et al. 1996). Although usually associated with Chihuahuan Desertscrub vegetation, it has been found in a variety of habitats, including grassy foothills and pinyon-juniper woodlands (Degenhardt et al. 1996). If present at BAND, it probably occurs along and near the Rio Grande, in areas where there is loose soil suitable for burrowing.

Western Hog-nosed Snake (*Heterodon nasicus*)

Although generally found in open, sandy grasslands in New Mexico, this species also occurs in deserts and open woodlands that have loose soil suitable for burrowing (Degenhardt et al. 1996). The Western Hog-nosed Snake may occur along or near the Rio Grande at BAND, where suitable loose soil occurs.

Night Snake (*Hypsiglena torquata*)

This secretive, nocturnal species occurs throughout the region, and has been collected near the Rio Grande in the vicinity of BAND and up to about 2200 m (7,218 ft) elevation in New Mexico (Degenhardt et al. 1996). It almost certainly occurs throughout most of BAND, although it is probably absent from the higher elevation mixed conifer forest habitats. In areas where extensive night driving surveys are possible, this otherwise hard to find species is often revealed to be quite common (e.g., Drost et al. 2001).

Common Kingsnake (*Lampropeltis getula*)

In New Mexico, this species is primarily distributed in association with major river systems, and has been collected along the Rio Grande as far north as the vicinity of BAND (Degenhardt et al. 1996). The Common Kingsnake almost certainly occurs along the Rio Grande at BAND, and possibly in some of the lower canyons and on intervening slopes and mesas as well.

Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has a spotty distribution in New Mexico (Degenhardt et al. 1996), but its occurrence in a wide variety of habitats throughout the state suggests it could be present at BAND. If so, it would be most likely to occur in the southern half of the monument.

Coachwhip (*Masticophis flagellum*)

This species has been collected along the Rio Grande in the vicinity of BAND (Degenhardt et al. 1996), and almost certainly occurs within the monument. An unverified sight record of a “Coachwhip” around the BAND visitor center complex (Steve Fettig, personal communication) probably represents a Striped Whipsnake. Although Coachwhips have been found at higher elevations in New Mexico (Degenhardt et al. 1996), the species is probably restricted to the Rio Grande and the lower canyons at BAND.

Smooth Green Snake (*Opheodrys vernalis*)

This small, well-camouflaged species prefers grassy areas with permanent moisture (Degenhardt et al. 1996). It has been collected in the vicinity of BAND (Degenhardt et al. 1996), and probably occurs in high elevation areas in the northwestern corner of the monument. We searched specifically for this species, but dry conditions due to the severe regional drought may have limited its activity during our survey period. Future surveys should target grassy areas around springs and along the upper canyons such as Frijoles Creek in the extreme northwestern corner of the monument.

Long-nosed Snake (*Rhinocheilus lecontei*)

This desert species has been found in the Rio Grande Valley almost as far north as BAND (Degenhardt et al. 1996), and may occur within the monument in White Rock Canyon.

Western Rattlesnake (*Crotalus viridis*)

Degenhardt (1975) reported observing a Western Rattlesnake in pinyon-juniper habitat on New Mexico Highway 4 about two miles north of BAND. This widespread species almost certainly occurs at BAND, although the lack of reports from within the monument suggests that if present, it is rare. Western Rattlesnakes are most likely to be found in mid-elevation woodlands, habitats used less frequently by the Western Diamond-backed Rattlesnake at BAND.

Table B-1. Amphibian and reptile species known or expected to occur at Bandelier National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively, except that for Bullfrog nativity is "non-native."

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	SX	Present in Park	Common
Jemez Mountains Salamander	SP	Present in Park	Uncommon
Couch's Spadefoot	2	Unconfirmed	
Plains Spadefoot	1	Unconfirmed	
Mexican Spadefoot	3	Probably Present	
Red-spotted Toad	OP	Present in Park	Rare
Woodhouse's Toad	OX	Present in Park	Common
Western Chorus Frog	SX	Present in Park	Uncommon
Canyon Treefrog	SP	Present in Park	Rare
Bullfrog	OX	Present in Park	Common
Painted Turtle	1	Unconfirmed	
Spiny Softshell	3	Probably Present	
Eastern Collared Lizard	SP	Present in Park	Uncommon
Lesser Earless Lizard	1	Unconfirmed	
Greater Short-horned Lizard	SP	Present in Park	Uncommon
Roundtail Horned Lizard	3	Probably Present	
Eastern Fence Lizard	OX	Present in Park	Abundant
Ornate Tree Lizard	OX	Present in Park	Uncommon
Many-lined Skink	SX	Present in Park	Common
Great Plains Skink	OX	Present in Park	Common
Chihuahuan Spotted Whiptail	SX	Present in Park	Common
New Mexico Whiptail	3	Probably Present	
Checkered Whiptail	SP	Present in Park	Rare
Plateau Striped Whiptail	SX	Present in Park	Abundant
Texas Blind Snake	3	Probably Present	
Glossy Snake	3	Probably Present	
Racer	1	Unconfirmed	
Ring-necked Snake	SP	Present in Park	Rare
Corn Snake	3	Probably Present	
Chihuahuan Hook-nosed Snake	1	Unconfirmed	
Western Hog-nosed Snake	1	Unconfirmed	
Night Snake	3	Probably Present	
Common Kingsnake	3	Probably Present	
Milk Snake	1	Unconfirmed	

Table B-1. Amphibian and reptile species known or expected to occur at Bandelier National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively, except that for Bullfrog nativity is "non-native."—Continued

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Coachwhip	3	Probably Present	
Striped Whipsnake	OP	Present in Park	Uncommon
Smooth Green Snake	3	Probably Present	
Gopher Snake	OX	Present in Park	Common
Long-nosed Snake	2	Unconfirmed	
Mountain Patch-nosed Snake	SX	Present in Park	Common
Black-necked Garter Snake	OP	Present In Park	Rare
Western Terrestrial Garter Snake	SX	Present in Park	Common
Western Diamond-backed Rattlesnake	OX	Present in Park	Common
Western Rattlesnake	3	Probably Present	
TOTAL RANK 1	7		
TOTAL RANK 2	2		
TOTAL RANK 3	12		
TOTAL FOUND (SX, OX, SP, OP)	23		
WEIGHTED TOTAL	35.2		
ESTIMATED INVENTORY COMPLETENESS	65%		

Table B-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Bandelier National Monument, 2002-2003. GS = general survey, NGS = nocturnal general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, and RE = random encounter.

Species	GS	NGS	1-ha TACS	10-ha TACS	RE	Total
Tiger Salamander	36	1				37
Woodhouse's Toad	2				3	5
Western Chorus Frog	9					9
Bullfrog	13	2				15
Eastern Collared Lizard	6					6
Greater Short-horned Lizard	1					1
Eastern Fence Lizard	284		22	3	22	331
Ornate Tree Lizard	2		4			6
Many-lined Skink	4				1	5
Great Plains Skink	4					4
Chihuahuan Spotted Whiptail	50	1				51
Plateau Striped Whiptail	93		4		3	100
Striped Whipsnake	3					3
Gopher Snake	3					3
Mountain Patch-nosed Snake	1	1				2
Western Terrestrial Garter Snake	12					12
Western Diamond-backed Rattlesnake	12	2			5	19
TOTAL	535	7	30	3	34	609

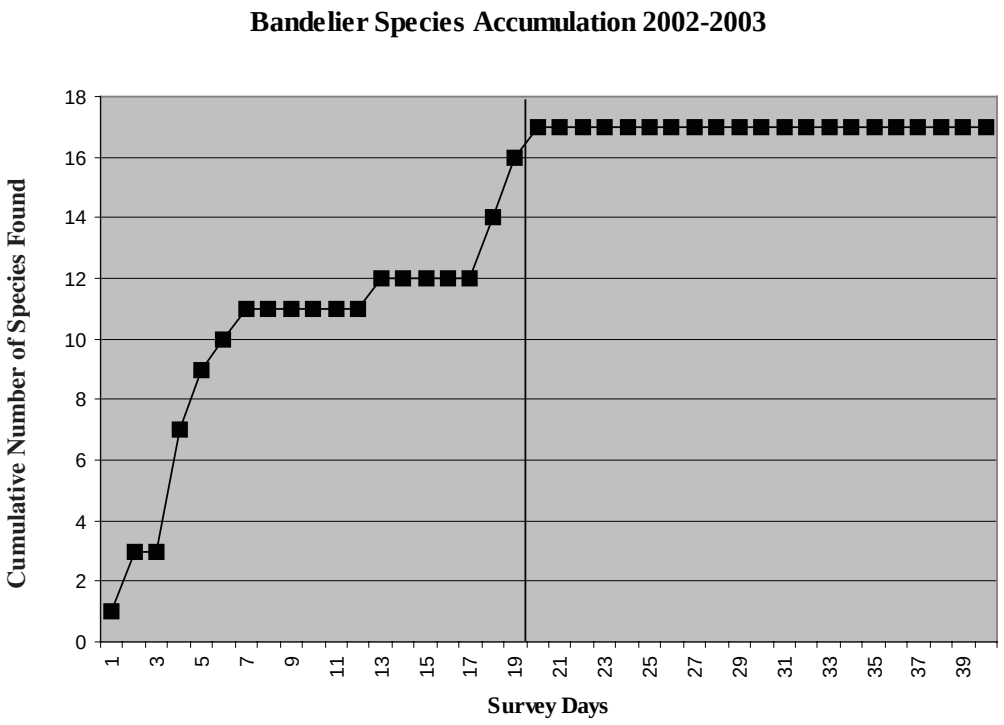

Figure B-1. Species accumulation curve for amphibians and reptiles at Bandelier National Monument, 2002-2003. Yearly survey days are separated by a vertical line through the data.

Appendix C. Canyon de Chelly National Monument (CACH)

CACH is located on the Navajo Nation, east of Chinle in northern Apache County, Arizona. Elevation ranges between 1,687 and 2,336 m (5,535-7,664 ft). The monument encompasses 37,486 ha (92,590 acres), and was established to protect prehistoric Anasazi villages. Navajo people currently live in the canyons within CACH, and the NPS and the Navajo Nation jointly administer the monument. Habitats at CACH range from forests of ponderosa pine, Douglas-fir, quaking aspen, and Gambel oak at the highest elevations to desert shrub and pinyon-juniper habitats along the canyon rims at the lower elevations. Extensive riparian zones exist within the canyons, and include a few perennial streams (Whetfields Creek, Canyon del Muerto, Coyote Wash, and Black Rock Canyon). Additional information on natural resources at CACH is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

The Navajo Department of Fish and Wildlife (Navajo Natural Heritage Program) conducted herpetofauna inventories at the three SCPN parks located on the Navajo Nation in 2002-2003. Mikesic (2005a) used 1-ha TACS plot surveys, general surveys, and night driving to survey for amphibians and reptiles at CACH. Through surveys and literature review he documented 20 species (Table C-1), with the most common being the Sagebrush Lizard, Eastern Fence Lizard, Side-blotched Lizard, and Plateau Striped Whiptail. He did not observe two species recorded previously, the Northern Leopard Frog and the Lesser Earless Lizard. While the Lesser Earless Lizard likely still occurs at CACH, the Northern Leopard Frog has probably been extirpated from the monument, as it has over most of the Navajo Nation (Mikesic 2005a).

Estimate of Inventory Completeness at CACH

By developing our own list of hypothetical species at CACH combined with the documented species list presented by Mikesic (2005a), we calculated an estimated inventory completeness of 85% (Table C-1). While there are a large number of species that may occur at CACH, only two species (Glossy Snake and Night Snake) are considered highly likely.

Sensitive Species and Threats to the Herpetofauna

Northern Leopard Frogs have virtually disappeared from the Navajo Nation (Mikesic 2005a). Historic records of Northern Leopard Frog at CACH are from Tsaile Creek (Canyon del Muerto), and non-native crayfish are abundant there now (Persons, personal observation). Crayfish have been implicated in the decline of Leopard Frogs in the many areas in the Southwest (Rosen and Schwalbe 2002).

Considerations for Future Inventory and Long-term Monitoring

Future inventory effort at CACH should focus on documenting the Glossy Snake and Night Snake, two species that almost certainly occur within the monument, using nocturnal survey methods, especially road driving. Night snakes may also be found by searching under cover objects (especially rocks) during the day. Many of the other potential species would be most likely to occur in grassland and desert scrub at CACH. Efforts focused on those habitats, most of which occur in the western part of the monument near Chinle, may find Great Plains Toad, Long-nosed Leopard Lizard, Little Striped Whiptail, Western Hog-nosed Snake, Common Kingsnake, and Milk Snake.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at CACH to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. Amphibian monitoring at CACH will primarily consist of night driving (e.g., Shafer and Juterbock 1994) along the paved roads bordering the monument on the north and south. These surveys will target "toad-like anurans," especially spadefoot toads. Amphibian monitoring may also include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites within the canyons. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At CACH,

Sagebrush Lizard, Eastern Fence Lizard, Side-blotched Lizard, and Plateau Striped Whiptail are good candidates for long-term monitoring, because they are common throughout the monument and many SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at CACH

Because we do not have first hand experience at CACH, we refer readers to Mikesic (2005a) for details of distribution and abundance of amphibian and reptile species documented from the monument. We briefly discuss the possible occurrence of other, undocumented species below. A list of all documented and hypothetical species at CACH, as well as NPSpecies checklist field assignments, are presented in Table C-1.

Species That Possibly Occur at Canyon de Chelly National Monument

Great Plains Toad (*Bufo cognatus*)

This desert and grassland species has been documented from the San Juan River region north of CACH, and throughout much of the Little Colorado River valley south of CACH (Krupa 1990, Mulcahy and Setser 2002). Therefore, it may occur in the Chinle Valley in the vicinity of the western portions of the monument.

Western Chorus Frog (*Pseudacris triseriata*)

Chorus frogs are only known in the CACH region from high elevation sites in the Chuska Mountains northeast of the monument (Mikesic 2005a). Although Mikesic (2005a) considered the possibility of its occurrence at CACH to be remote, it could possibly be found along Tsaile Creek in the eastern end of the monument.

Northern Leopard Frog (*Rana pipiens*)

A population of Northern Leopard Frogs was present in CACH in the 1960's and possibly as late as the early 1990's (CACH staff, personal communication), but the species is apparently extirpated within the monument (Mikesic 2005a). Mikesic (2005a) notes that all populations of this species in the nearby Chuska Mountains have been extirpated in the past decade, and he speculated that the CACH population was lost much earlier than this. Suitable habitat appears to exist along Tsaile Creek in the far eastern end of Canyon del Muerto, except that non-native crayfish currently inhabit this stream (personal observation). Crayfish have been implicated in declines of Leopard Frogs in the Southwest (e.g., Rosen and Schwalbe 2002).

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

Stebbins (2003) presents a more accurate distribution map for this species than given previously (Stebbins 1985), showing its occurrence in northeastern Arizona largely restricted to the lower and middle Little Colorado River valley. Because it also occurs in the San Juan River valley near the Arizona-Utah border, it is possible that the species extends its distribution in desert, shrub, and grassland habitats south along Chinle Wash, and may occur in the western portion of CACH near Chinle.

Little Striped Whiptail (*Cnemidophorus inornatus*)

In his distribution map for this species, Stebbins (2003) reported this species in the CACH area, at "Chinle." However, we examined this specimen, in the University of Arizona herpetology collection, and determined it is a misidentified Plateau Striped Whiptail. Little Striped Whiptail has a disjunct, relictual distribution throughout much of northern Arizona (Persons 2005, Persons and Wright 1999a), and could occur at or near CACH. If present in the area, it would most likely be found in grasslands and shrub habitats in the western portion of the monument, near Chinle.

Glossy Snake (*Arizona elegans*)

Mikesic (2005a) noted that earlier, unpublished surveys had found this species outside the monument boundary, in the Chinle area. Glossy Snakes are found in a variety of habitats in the region (Stebbins 2003), and almost certainly occur at CACH.

Ring-necked Snake (*Diadophis punctatus*)

This species has not been recorded from the Navajo Nation region (Stebbins 2003), but its spotty, relictual distribution throughout the Southwest suggests it could be found almost anywhere. Permanent moisture is usually required by this species (e.g., Degenhardt et al. 1996), and if isolated populations existed at CACH they would probably be in spring or seep areas, or along the more mesic watercourses such as Tsaile, Wheatfields, or Whiskey creeks.

Western Hog-nosed Snake (*Heterodon nasicus*)

The Western Hog-nosed Snake primarily inhabits open, sandy grasslands in the region (Degenhardt et al. 1996), and is only known in Arizona from the extreme southeastern part of the state (Stebbins 2003). However, the occurrence of isolated populations in the San Juan River valley near Farmington, New Mexico (Degenhardt et al. 1996) suggests it could possibly occur elsewhere in the region, including in the CACH area. Furthermore, its presence on the Navajo Nation could go unnoticed or unreported for several reasons, including its superficial resemblance in size, shape, and color pattern to

the Western Rattlesnake, low human population density in the region, and the culturally prevalent avoidance of snakes by the Navajo people.

Night Snake (*Hypsiglena torquata*)

This secretive, nocturnal species is found throughout the region, and almost certainly occurs in various habitats at CACH. Stebbins (2003) depicts a gap in the distribution of this species in northeastern Arizona, but this is probably due to inadequate collecting in the region. A Night Snake specimen was recently collected near Lukachukai, just north of CACH, during field research for an upcoming book on the snakes of Arizona (Andy Holycross, personal communication).

Common Kingsnake (*Lampropeltis getula*)

This species occurs throughout lower elevation areas of the Little Colorado River basin to the south and the San Juan River basin to the north of CACH (Stebbins 2003). The Common Kingsnake could extend its distribution southward along Chinle Wash to CACH, where it may occupy desert, grassland, or open woodland habitats.

Milk Snake (*Lampropeltis triangulum*)

This secretive species has been recorded from a number of localities in northern Arizona, mostly within the Little Colorado River basin between St. Johns, Apache County, and Wupatki National Monument, Coconino County (unpublished data). However, isolated records occur throughout the Four Corners region, including near Farmington, New Mexico (Degenhardt et al. 1996), Mesa Verde National Park, Colorado (Douglas 1966), and Hovenweep National Monument, Utah (Persons and Nowak 2004b). In Arizona, all records are from grasslands (unpublished data), but elsewhere Milk Snakes have been found in river valleys, shrublands, and coniferous woodlands (Degenhardt et al. 1996, Hammerson 1999), and could occur in almost any habitat at CACH.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

This species occurs in both the Little Colorado River valley to the south (Persons and Rosen 2001) and the San Juan River valley to the north of CACH (Stebbins 2003), and may be more widespread in the intervening region. If present at CACH, it would be expected along permanent or intermittent watercourses in the monument, such as Wheatfields, Whiskey, and Tsaile Creeks.

Table C-1. Amphibian and reptile species known or expected to occur at Canyon de Chelly National Monument. Species documentation is based on the work of Mikesic (2005a). Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	X	Present in Park	Uncommon
Plains Spadefoot	X	Present in Park	Uncommon
Mexican Spadefoot	X	Present in Park	Common
Great Plains Toad	1	Unconfirmed	
Red-spotted Toad	X	Present in Park	Common
Woodhouse's Toad	X	Present in Park	Common
Canyon Treefrog	X	Present in Park	Common
Western Chorus Frog	1	Unconfirmed	
Northern Leopard Frog	1	Historic	
Eastern Collared Lizard	X	Present in Park	Common
Long-nosed Leopard Lizard	1	Unconfirmed	
Lesser Earless Lizard	X	Present in Park	Rare
Greater Short-horned Lizard	X	Present in Park	Common
Sagebrush Lizard	X	Present in Park	Abundant
Eastern Fence Lizard	X	Present in Park	Abundant
Ornate Tree Lizard	X	Present in Park	Common
Side-blotched Lizard	X	Present in Park	Abundant
Many-lined Skink	X	Present in Park	Uncommon
Little Striped Whiptail	1	Unconfirmed	
Western Whiptail	X	Present in Park	Uncommon
Plateau Striped Whiptail	X	Present in Park	Abundant
Glossy Snake	3	Probably Present	
Ring-necked Snake	1	Unconfirmed	
Western Hog-nosed Snake	1	Unconfirmed	
Night Snake	3	Probably Present	
Common Kingsnake	1	Unconfirmed	
Milk Snake	1	Unconfirmed	
Striped Whipsnake	X	Present in Park	Uncommon
Gopher Snake	X	Present in Park	Uncommon
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	X	Present in Park	Common
Western Rattlesnake	X	Present in Park	Uncommon
TOTAL RANK 1	10		
TOTAL RANK 2	0		
TOTAL RANK 3	2		
TOTAL DOCUMENTED (X)	20		
WEIGHTED TOTAL	23.4		
ESTIMATED INVENTORY COMPLETENESS	85%		

Appendix D. Chaco Culture National Historic Park (CHCU)

CHCU is located in the San Juan River basin of northeastern New Mexico, along the San Juan-McKinley county line. Elevation ranges between 1,823 and 2,096 m (5,981-6,877 ft). The monument encompasses 13,893 ha (34,316 acres), and was established to protect a variety of prehistoric ruins, including large, complex pueblos for which the site is best known. Habitats at CHCU include Great Basin desertscrub, grassland, and pinyon-juniper woodland. Chaco Wash contains riparian habitats of cottonwood and willow, but the wash is usually dry. A series of pools near the confluence of Chaco and Escavada washes usually contain water, providing habitat for amphibians. Additional information on natural resources at CHCU is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 206 person-hours surveying for herpetofauna at CHCU in 2002-2003. Methods used, and number of person-hours spent on each method, included general surveys (122.5), nocturnal general surveys (6.8), random 1-ha TACS plot surveys (10.6), random 10-ha TACS plot surveys (8.3), and night driving (57.7). We recorded 611 individual amphibians and reptiles of 14 species during our surveys, and we documented two additional species based on our review of the literature and museum specimen records. We found two new species during the present inventory (Night Snake and Western Terrestrial Garter Snake), both of which were recorded just outside the park by Jones (1970). A summary of the total number of each species observed by each method is presented in Table D-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at CHCU

Based on our surveys at CHCU and inclusion of previously documented species we estimate an inventory completeness of 81% (Table D-1). A species accumulation curve based on our surveys in 2002-2003 (Figure D-1) suggests that we are close to reaching inventory completeness, and complements our estimate using the master list approach. Detecting the remaining species at CHCU will require much greater field effort and more targeted searches during favorable conditions. The undocumented species most likely to occur at CHCU are Red-spotted Toad, Woodhouse's Toad, Long-nosed Leopard Lizard, and Glossy Snake, and a number of other species are more remotely possible (Table D-1).

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from CHCU. We used dot distribution maps in Degenhardt et al. (1996) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to CHCU. We did not include in Appendix T specimens from CHCU that we located in museum datasets (from MSB and MVZ), as these were too numerous (hundreds of records), and consisted entirely of well-documented species (Jones 1970).

The only previous published work on amphibians and reptiles at CHCU is a reasonably thorough inventory conducted by Jones (1970). Specimens collected by Jones (1970) are primarily housed at the Museum of Southwestern Biology.

Sensitive Species and Threats to the Herpetofauna

No rare or threatened amphibian or reptile species are known from CHCU. Road mortality, especially of snakes, could potentially impact populations in the developed part of the site. Changes in the hydrology of Chaco Wash due to drought or land use practices outside CHCU could affect the availability of amphibian breeding sites. A potential extrinsic threat to the park resources includes proposed natural gas and oil drilling on Navajo lands adjacent to the park and its outliers (CHCU staff, personal communication), but the long-term and long-range effects of such practices on herpetofauna have not been well-documented.

Considerations for Future Inventory and Long-term Monitoring

If conducted, future inventory effort could focus on documenting those species most likely to occur within the historic site (Table D-2). Amphibian breeding sites in rocky areas (e.g., small canyons, mesa tops) could be searched for Red-spotted Toad, and pools in the lower section of Chaco Wash could be searched for Woodhouse's Toad. Searches in lower elevation shrub habitats near the confluence of Chaco and Escavada washes could reveal Long-nosed Leopard Lizard and Western Whiptail, and more extensive night driving may detect other, more secretive snakes.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at CHCU to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At CHCU, amphibian monitoring will primarily consist of night driving surveys (e.g. Shafer and Juterbock 1994) for spadefoot toads during the summer monsoon season. Monitoring may also include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as pools in lower Chaco Wash used for breeding by Tiger Salamanders and spadefoots. However, the NPS may wish to expand herpetofaunal monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At CHCU, Eastern Fence Lizard, Side-blotched Lizard, and Plateau Striped Whiptail may be the best candidates for long-term monitoring, because these species are common throughout the monument and at most SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at CHCU

Because we do not have data on population sizes or density of species at CHCU, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at CHCU, and also with the same species elsewhere throughout its range in the region. An asterisk (*) below denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at CHCU, as well as NPSpecies checklist field assignments, are presented in Table D-1.

Species Documented From Chaco Culture National Historic Park

*Tiger Salamander (*Ambystoma tigrinum*)

We observed only larval Tiger Salamanders at CHCU, which were common in a number of pools in Chaco Wash near its confluence with Escavada Wash. Jones (1970) found a few adult salamanders at CHCU, and found larvae to be abundant in a number of stock tanks just outside park boundaries. The species probably occurs throughout the park.

*Plains Spadefoot (*Spea bombifrons*)

We observed this species, as well as the similar Mexican Spadefoot, only on night driving surveys. Jones (1970) observed large breeding aggregations of both spadefoot species after a two day period during which 1.95 inches of rain fell at CHCU. Drought conditions prevailed during our surveys, and we did not observe any breeding activity during the summer monsoon season. We did find large numbers of tadpoles in the spring in pools in lower Chaco Wash, but their small size did not allow positive identification as spadefoot tadpoles.

*Mexican Spadefoot (*Spea multiplicata*)

Like the Plains Spadefoot, we observed this species only on night driving surveys. Interestingly, we observed relatively equal numbers of the two spadefoot species (37 Mexican Spadefoot, 26 Plains Spadefoot), whereas Jones (1970) reported that Mexican Spadefoot outnumbered Plains Spadefoot about 10 to 1, a ratio similar to that observed for the two species in the WUPA area (Persons 2001a, and unpublished data). Both spadefoot species probably occur throughout the site.

*Eastern Collared Lizard (*Crotaphytus collaris*)

This species is fairly common throughout CHCU, especially in open, rocky areas.

*Lesser Earless Lizard (*Holbrookia maculata*)

We observed only two Lesser Earless Lizards during our surveys, and Jones (1970) likewise found the species to be uncommon within the park. This species prefers open grassland habitats, especially in prairie dog colonies (Davis and Theimer 2003), and probably occurs in isolated populations throughout CHCU.

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We did not observe this widespread species during our surveys, but Jones (1970) collected five individuals within CHCU, most in mixed grassland habitat. Although apparently uncommon, Greater Short-horned Lizards probably occur throughout the park.

*Sagebrush Lizard (*Sceloporus graciosus*)

At CHCU, this species is locally common in areas with sandy soil and scattered shrubs, especially sand sage (*Artimesia filifolia*).

*Eastern Fence Lizard (*Sceloporus undulatus*)

This was the most abundant species observed during our surveys, and was found in all habitats throughout the historic park. The Eastern Fence Lizard was usually found climbing on rocks or ancient Puebloan ruins.

*Ornate Tree Lizard (*Urosaurus ornatus*)

We did not observe this species during our surveys at CHCU. Jones (1970) found it to be the least common lizard species at CHCU, recording only three individuals, all from areas with pinyon pine north of the visitor center complex.

*Side-blotched Lizard (*Uta stansburiana*)

Side-blotched Lizards were abundant at CHCU during our surveys, and it was the lizard species most frequently observed by Jones (1970). On the Colorado Plateau, this species is usually found on rocks, often in similar habitats as the Tree Lizard, although the Side-blotched Lizard is more tolerant of dry conditions (Persons, personal observation).

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual whiptail was the second most frequently observed species during our surveys, and was found in all habitats throughout the park. Although Cnemidophorus velox is actually a complex of species, some undescribed (Wright 1993), individuals at CHCU, including those collected by Jones (1970), appear to be C. velox proper (i.e., the same as those from the type locality of the species).

Glossy Snake (*Arizona elegans*)

Jones (1970) collected a single specimen of this species in a small wash about a half mile north and east of Pueblo Bonito Ruins, deposited in the museum at CHCU headquarters (Jones 1970). Its location was not mapped by Degenhardt et al. (1996), and it is unknown if the specimen still exists. Although apparently rare, Glossy Snakes may be found in any habitat at CHCU, provided that there is loose soil for burrowing.

*Night Snake (*Hypsiglena torquata*)

Jones (1970) cited a specimen (MSB 3325) collected in 1947 that had imprecise locality data ("Chaco Canyon, prob. close to T21N-R10 or 11 W"). We collected a voucher specimen of this species in 2002, found during a night driving survey of the paved park loop road. We found 10 additional Night Snakes while night driving, suggesting this strictly nocturnal species may be common at CHCU.

*Striped Whipsnake (*Masticophis taeniatus*)

Although we observed only a single Striped Whipsnake during our inventory, the species is probably common at CHCU (Jones 1970). All five specimens collected by Jones (1970) were found on the canyon floor in rincones (box canyons), as was the single individual we observed on the floor of Mockingbird Canyon.

*Gopher Snake (*Pituophis catenifer*)

As was reported by Jones (1970), this was the most frequently observed snake species during our surveys. Gopher Snakes are common at CHCU, and are found in all habitats throughout the park.

*Western Terrestrial Garter Snake (*Thamnophis elegans*)

We collected a single road killed specimen of this species (a juvenile) during our surveys, from the main park road near the south entrance and Chaco Wash. Jones (1970) did not find any Western Terrestrial Garter Snakes within CHCU, but did observe them in a stock tank along Gallo Wash outside the park boundary.

*Western Rattlesnake (*Crotalus viridis*)

The Western Rattlesnake is common at CHCU, and is probably found in all habitats throughout the park.

Species That Possibly Occur at Chaco Culture National Historic Park

Great Plains Toad (*Bufo cognatus*)

Although this species has not been found in northwestern New Mexico (Degenhardt et al. 1996), its occurrence in the San Juan River valley in southeastern Utah (Krupa 1990) suggests it could occur in the San Juan basin of New Mexico as well. If found at CHCU, it would most likely be in grassland habitats, possibly in the southwestern part of the park.

Red-spotted Toad (*Bufo punctatus*)

This widespread species is usually associated with rocky habitats (Stebbins 2003), and may occur in rocky canyon or mesa top areas at CHCU.

Woodhouse's Toad (*Bufo woodhousii*)

This species is found throughout the San Juan basin in northwestern New Mexico (Degenhardt et al. 1996), and often inhabits valleys and floodplains (Stebbins 2003). It may occur along Chaco Wash at CHCU.

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

The Long-nosed Leopard Lizard is apparently rare in northwestern New Mexico, with only one documented record from west-central San Juan County, northwest of CHCU

(Degenhardt et al. 1996). Degenhardt et al. (1996) noted that more distributional work is needed on this species in New Mexico. Suitable open, shrubby habitat is found in many areas of CHCU, particularly in the area of the confluence of Chaco and Escavada washes in the northwestern part of the park.

Little Striped Whiptail (*Cnemidophorus inornatus*)

This species has a disjunct distribution in grasslands on the southern Colorado Plateau (Persons 2005), including populations in the San Juan basin of northwestern New Mexico (Degenhardt et al. 1996). We specifically searched for this species during this inventory, but found only the Plateau Striped Whiptail. In addition, we examined all specimens of Cnemidophorus from CHCU in the herpetology collection at the Museum of Southwestern Biology, and all were Plateau Striped Whiptails as well. However, because small, isolated populations are known from the elsewhere in the region (e.g., Degenhardt et al. 1996, Drost et al. 2001), its occurrence at CHCU cannot be ruled out.

Western Whiptail (*Cnemidophorus tigris*)

The Western Whiptail occurs throughout the San Juan basin in northwestern New Mexico, including not far to the north of CHCU (Degenhardt et al. 1996). In addition, since the publication of Degenhardt et al. (1996) it has been collected near the Bisti Wilderness, northwest of CHCU (MSB 61331). If the species occurs at CHCU, it would probably be in the open, sandy, shrubby habitat along Chaco or Escavada washes in the northern part of the park.

Ring-necked Snake (*Diadophis punctatus*)

This species has not been recorded from the San Juan basin (Degenhardt et al. 1996, Stebbins 2003), but its spotty, relictual distribution throughout the Southwest suggests it could be found almost anywhere. Permanent moisture is usually required by this species (e.g., Degenhardt et al. 1996), and if isolated populations existed at CHCU they would probably be in spring or seep areas.

Western Hog-nosed Snake (*Heterodon nasicus*)

This species, which is common in eastern New Mexico, has only been documented from two localities in the San Juan basin, both in the San Juan River valley in the vicinity of Farmington (Degenhardt et al. 1996). The Western Hog-nosed Snake's superficial resemblance to the Western Rattlesnake could conceivably cause it be overlooked or avoided by many people. If populations existed at CHCU, they would probably be in areas dominated by sandy soils (Degenhardt et al. 1996), such as those areas with patches of sand sage (*Artimesia filifolia*) where Sagebrush Lizards are common.

Common Kingsnake (*Lampropeltis getula*)

This species was recently discovered in extreme northwestern New Mexico (Davenport et al. 1998), and it may be more widely distributed in the San Juan basin. Although unlikely, based on the lack of records from the region, it could conceivably occur at CHCU as well.

Milk Snake (*Lampropeltis triangulum*)

This secretive species has a spotty distribution throughout the Southwest (Stebbins 2003), and is usually found in grasslands on the southern Colorado Plateau (Nowak and Persons, unpublished data). A single record from near Farmington (Degenhardt et al. 1996) confirms its presence in the San Juan basin of New Mexico, and it may occur at CHCU as well.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

This species, which is more aquatic than the Western Terrestrial Garter Snake, has been documented from numerous localities along the San Juan and Aztec rivers in the San Juan basin of northwestern New Mexico (Degenhardt et al. 1996). Although the arid conditions at CHCU probably preclude this species from occurring there, it may be present along Chaco Wash, in areas that contain isolated pools much of the year.

Table D-1. Amphibian and reptile species known or expected to occur at Chaco Culture National Historic Park. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	SP	Present in Park	Common
Plains Spadefoot	SP	Present in Park	Uncommon
Mexican Spadefoot	SP	Present in Park	Common
Great Plains Toad	1	Unconfirmed	
Red-spotted Toad	2	Unconfirmed	
Woodhouse's Toad	3	Probably Present	
Eastern Collared Lizard	SP	Present in Park	Common
Long-nosed Leopard Lizard	2	Unconfirmed	
Lesser Earless Lizard	SP	Present in Park	Common
Greater Short-horned Lizard	SP	Present in Park	Common
Sagebrush Lizard	SP	Present in Park	Abundant
Eastern Fence Lizard	SP	Present in Park	Abundant
Ornate Tree Lizard	SP	Present in Park	Uncommon
Side-blotched Lizard	SP	Present in Park	Abundant
Little Striped Whiptail	1	Unconfirmed	
Western Whiptail	2	Unconfirmed	
Plateau Striped Whiptail	SX	Present in Park	Abundant
Glossy Snake	SP	Present in Park	Rare
Ring-necked Snake	1	Unconfirmed	
Western Hog-nosed Snake	1	Unconfirmed	
Night Snake	SX	Present in Park	Common
Common Kingsnake	1	Unconfirmed	
Milk Snake	2	Unconfirmed	
Striped Whipsnake	SP	Present in Park	Uncommon
Gopher Snake	SP	Present in Park	Common
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	SX	Present in Park	Uncommon
Western Rattlesnake	SP	Present in Park	Common
TOTAL RANK 1	6		
TOTAL RANK 2	4		
TOTAL RANK 3	1		
TOTAL FOUND (SX, OX, SP, OP)	17		
WEIGHTED TOTAL	20.9		
ESTIMATED INVENTORY COMPLETENESS	81%		

Table D-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Chaco Culture National Historic Park, 2002-2003. GS = general survey, NGS = nocturnal general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, ND = night drive, and RE = random encounter.

Species	GS	1-ha TACS	10-ha TACS	ND	RE	Total
Tiger Salamander (larvae)	100					100
Plains Spadefoot				26		26
Mexican Spadefoot				37		37
Eastern Collared Lizard	3	1			2	6
Lesser Earless Lizard	2					2
Sagebrush Lizard	19	8	7		1	35
Eastern Fence Lizard	126	4	11		3	144
Side-blotched Lizard	85	4	3		1	93
Plateau Striped Whiptail	115	8	4		2	129
Night Snake				11		11
Striped Whipsnake	1					1
Gopher Snake	5	1		6	5	17
Western Terrestrial Garter Snake				1		1
Western Rattlesnake	2	1		4	2	9
TOTAL	458	27	25	85	16	611

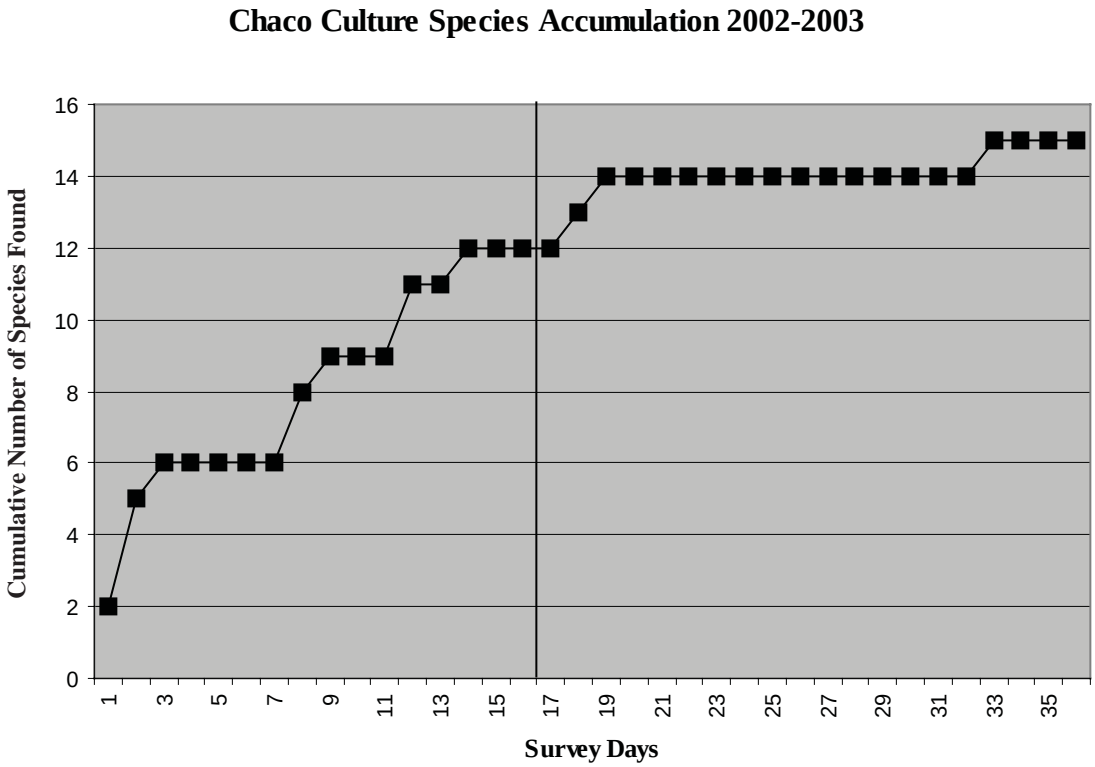

Figure D-1. Species accumulation curve for amphibians and reptiles at Chaco Culture National Historic Park, 2002-2003. Yearly survey days are separated by a vertical line through the data.

Appendix E. El Malpais National Monument (ELMA)

ELMA is located along and east of the Continental Divide just south of Grants, Cibola County, New Mexico. Elevation ranges between 1,950 and 2,554 m (6,398-8,380 ft). The monument encompasses 47,217 ha (116,626 acres), and was established to protect volcanic geologic features (e.g., lava flows, lava tubes) and ancient Puebloan ruins. Habitats at ELMA include ponderosa pine forests and pinyon-juniper woodlands. Much of the extensive lava flows are sparsely vegetated. Sandy soil grasslands and woodlands are found along the eastern edge of the monument, and slickrock habitats are found in the Sandstone Bluffs area of the monument. Additional information on natural resources at ELMA is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 119 person-hours surveying for herpetofauna at ELMA in 2002-2003. Methods used, and number of person-hours spent on each method, included general surveys (52.1), nocturnal general surveys (1.8), random 1-ha TACS plot surveys (22.8), random 10-ha TACS plot surveys (9.3), and night driving (33.4). We recorded 281 individual amphibians and reptiles of 18 species during our surveys, and documented two additional species based on our review of the literature and museum specimen records. A summary of the total number of each species observed by each method is presented in Table E-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at ELMA

Based on our surveys at ELMA and inclusion of previously documented species we estimate an inventory completeness of 78% (Table E-1). A species accumulation curve based on our surveys (Figure E-1) has not begun to level off, suggesting we are not very close to reaching inventory completeness. Detecting the remaining species at ELMA will require much greater field effort and more targeted searches during favorable conditions. Many of the undocumented species most likely to occur at ELMA are snakes, including Ring-necked Snake, Night Snake, Milk Snake, Mountain Patch-nosed Snake, and Black-tailed Rattlesnake.

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from ELMA. We used dot distribution maps in Degenhardt et al. (1996) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to ELMA. We also extracted specimen records cited in Gehlbach (1965), some of which had precise enough locality data to determine they were collected in what is now ELMA.

We found museum specimen records for three species at ELMA (Appendix T). In addition, we located specimens from nearby (or possibly within) ELMA for three species (Red-spotted Toad, Woodhouse's Toad, and Mountain Patch-nosed Snake) that have yet to be documented from the monument. We also found records of four other species (Canyon Treefrog, Many-lined Skink, Great Plains Skink, and Western Diamond-backed Rattlesnake) that have been reliably observed at ELMA, but have not been documented with specimens. Lightfoot et al. (1994) conducted an amphibian and reptile inventory at ELMA in the early 1990's, but few specimens were collected (Dave Lightfoot, personal communication). Based on this work, Alexander (2000) published a checklist of amphibians and reptiles at ELMA, but this list included many species that are not known to occur in the area, and appears to be based on a list in Lightfoot et al. (1994) of species documented from the entire of Cibola County. Gehlbach (1965) presented a thorough review of amphibians and reptiles of the Zuni Mountains region, including the area around what is now ELMA. Gehlbach (1965) included museum specimen data for all species, but many localities (e.g., "lava beds") are too imprecise to determine if they were collected within the current boundaries of ELMA.

Sensitive Species and Threats to the Herpetofauna

Most amphibians and reptiles documented from ELMA are widespread, common species. However, the Mountain Treefrog was found at only one locality near the Continental

Divide in the northwestern part of the monument, and this population is about 143 km (89 mi) distant from the closest known population in the Gila River drainage south of ELMA. Future surveys should be undertaken to determine the distribution and status of this species in and near ELMA, which because of its disjunct location may be genetically distinct from populations to the south. Road mortality along State Route 53 and State Route 117 may impact local snake populations within the monument. Extrinsic threats include long-term drought, which may affect breeding areas for amphibians.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at ELMA is only 78%, additional inventory of amphibians and reptiles may be warranted. Most of the undocumented species highly likely to occur at ELMA are snakes (Table E-1), and the best method for finding most of these would be night driving, particularly along SR 117 along the eastern edge of the monument.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at ELMA to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At ELMA, amphibian monitoring will focus on night driving surveys (e.g., Shafer and Juterbock 1994) for spadefoot toads. Amphibian monitoring at ELMA may also include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as stock tanks along SR 117 used by spadefoots, or temporary pools along CR 42 along the Continental Divide used by Mountain Treefrogs. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At ELMA, Eastern Fence Lizard and Plateau Striped Whiptail may be suitable candidates for long-term monitoring, because these species are common throughout the monument and at most SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at ELMA

Because we do not have data on population sizes or density of species at ELMA, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at ELMA, and also with the same species elsewhere throughout its range in the region. An asterisk (*) below denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at ELMA, as well as NPSpecies checklist field assignments, are presented in Table 5.

Species Documented from El Malpais National Monument

*Tiger Salamander (*Ambystoma tigrinum*)

We found larval Tiger Salamanders in a cattle tank in the Big Tubes Area of ELMA. Lightfoot et al. (1994) also recorded this species only from this region of the monument. However, Tiger Salamanders probably occur throughout the monument, both east and west of the lava flows.

*Plains Spadefoot (*Spea bombifrons*)

We found this species during night driving surveys on SR 117 on the east side of ELMA. This and the similar Mexican Spadefoot are probably common in this part of ELMA, but drought conditions during this inventory may have reduced their numbers during our surveys.

*Mexican Spadefoot (*Spea multiplicata*)

We found this species during night driving surveys on SR 117 on the east side of ELMA. This and the similar Plains Spadefoot are probably common in this part of ELMA, but drought conditions may have reduced their numbers during surveys.

Canyon Treefrog (*Hyla arenicolor*)

We did not find any Canyon Treefrogs at ELMA during our surveys in 2002-2003. However, Lightfoot et al. (1994) found them to be common throughout the monument, occurring in lava tube collapse features within the lava flows, as well as in *tinajas* and stock tanks on the east side of ELMA. Our failure to find this species may be related to the drought conditions during the inventory period. Gehlbach (1965) cited a specimen (CU 6233) collected 18.4 km (11.5 mi) SSE of Grants, and this locality may be within the current boundary of ELMA.

*Mountain Treefrog (*Hyla eximia*)

We collected adult Mountain Treefrogs in a temporary pool along CR 42 near the Continental Divide in the northwestern part of ELMA (Monatesti et al. 2005). These specimens constitute the first documented records from the region, and extend the known distribution of the species about 143 km (89 mi) NNE of the nearest locality in the Gila River basin of west-central New Mexico, near Reserve, in Catron County (Degenhardt et al. 1996). The only other report of the species from the region were specimens collected in the 1870's near Nutria, McKinley County (northwest of ELMA), but the sole existing specimen is too poorly preserved to identify to species (Gehlbach 1965), and consequently this locality was not mapped by Degenhardt et al. (1996). However, our specimens lend credence to this earlier report, and suggest that Mountain Treefrogs may be more widely distributed in the Zuni Mountains region. Interestingly, Lightfoot et al. (1994) probably observed Mountain Treefrogs during their inventory, but this treefrog was not included in the report because he was unsure of his field technician's identification (Dave Lightfoot, personal communication).

Western Chorus Frog (*Pseudacris triseriata*)

We heard Western Chorus Frogs calling from a cattle tank (Laguna Juan Garcia) west of Cerro Bandera in the northwestern part of ELMA in April 2003, but could not locate the animals. Lightfoot et al. (1994) did not report this species, and the only record from Cibola County is northwest of ELMA near the headwaters of the Zuni River (Degenhardt et al. 1996).

*Eastern Collared Lizard (*Crotaphytus collaris*)

This species is fairly common at ELMA, primarily in rocky habitats with intervening areas of open ground. Eastern Collared Lizards probably do not occur in the solidly rocky habitats within the lava flows.

*Lesser Earless Lizard (*Holbrookia maculata*)

We observed only five Lesser Earless Lizards at two localities at ELMA, in grassland on the southern edge of the monument and at the Northwest New Mexico Visitor's Center in Grants. Lightfoot et al. (1994) reported them to be among the most common lizards encountered at ELMA, but they found them only in the extreme southeastern part of the monument. Lesser Earless Lizards are probably locally common in open, sandy habitats on the edge of the lava flows at ELMA.

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We observed only two Greater Short-horned Lizards at ELMA, but this cryptic species is probably common throughout the monument, except on the lava flows.

*Eastern Fence Lizard (*Sceloporus undulatus*)

This was the most frequently observed species at ELMA during our surveys, as it was during the inventory conducted by Lightfoot et al. (1994). Eastern Fence Lizards occur throughout ELMA, especially in woodland and forest habitats where they climb on logs and trees. They are also common on the lava flows.

*Ornate Tree Lizard (*Urosaurus ornatus*)

We observed Tree Lizards on lava on both the east and west sides of the lava flow, and also on sandstone outcrops in the Sandstone Bluffs area of ELMA. This species, which often climbs on rocks (not trees), is probably found throughout the lava flows at ELMA.

Many-lined Skink (*Eumeces multivirgatus*)

Lightfoot et al. (1994) observed this species at ELMA, although we did not. Gehlbach (1965) cited a specimen (CU 5607) collected 27 km (17 mi) southwest of Grants, and this locality is probably near or within what is now ELMA. We did find it to be fairly common to the west of ELMA, at El Morro National Monument. Many-lined Skinks probably occur at ELMA primarily in the ponderosa pine habitats in the northwestern section of the monument. A mammal inventory crew reported seeing this species in a lava outcrop area on a section of the monument near the Northwest New Mexico Visitor Center in 2002, but this observation could not be confirmed, and the identification may have been confused with a juvenile Great Plains Skink.

Great Plains Skink (*Eumeces obsoletus*)

We observed this species only in the vicinity of the Northwest New Mexico Visitor's Center near Grants, but it probably occurs throughout much of the monument. Degenhardt et al. (1996) stated that this species "is a common lizard in places like the malpais at Grants." Gehlbach (1965) cited two specimens (CU 5455 and UMMZ 86623) collected 18.4 km (11.5 mi) SSE of Grants and 12.8 km (8 mi) SE of Paxton, respectively, and these localities may be within the current boundary of ELMA.

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual whiptail was the second most frequently observed species at ELMA, and was common throughout the monument, excepting on the lava flows. *Cnemidophorus velox* is actually a complex of mostly undescribed species (Wright 1993). Based on color pattern, it appears that at least two species may be present at ELMA, including both a striped, unspotted form referable to *C. velox* proper, as well as a striped and spotted form. Similar striped and spotted popula-

tions of Plateau Striped Whiptail occur in southwestern Utah, and if determined to be of separate hybrid origin (and possibly different ploidy level) than *C. velox*, these populations, and possibly those from ELMA, would become *C. innotatus* (Burger 1950).

*Striped Whipsnake (*Masticophis taeniatus*)

We observed seven individuals of this fast, diurnal species at ELMA, and it probably occurs throughout the monument. It is probably not common within the lava flow.

*Gopher Snake (*Pituophis catenifer*)

This generalist species was the most frequently observed snake at ELMA during both our surveys, and during those conducted by Lightfoot et al. (1994). The Gopher Snake probably occurs throughout the monument.

*Black-necked Garter Snake *(Thamnophis cyrtopsis)*

We found one road killed Black-necked Garter Snake on SR 117 on the eastern edge of ELMA. Lightfoot et al. (1994) did not record this species, but Degenhardt et al. (1996) plotted a specimen record from the vicinity of the eastern part of the monument, possibly also on SR 117.

Western Terrestrial Garter Snake (*Thamnophis elegans*)

We observed only a single Western Terrestrial Garter Snake at ELMA, on SR 117 in the southern part of the monument (North Pasture area). This species probably occurs throughout ELMA.

Western Diamond-backed Rattlesnake (*Crotalus atrox*)

The only Western Diamond-backed Rattlesnake we observed within ELMA was in the vicinity of the Northwest New Mexico Visitor's Center near Grants. We also found a road-killed individual on SR 117 about 6.4 km (4 mi) north of the ELMA boundary. The only Western Diamond-backed Rattlesnake observed by Lightfoot et al. (1994) was in the northeastern part of the monument as well. Gehlbach (1965) cited two specimens (CU 5591 and CWGF, no number) collected 16.6 km (10.4 mi) S and 18.4 km (11.5 mi) SSE of Grants, respectively, and these localities may be within the current boundary of ELMA. This species probably occurs within much of ELMA, although it may be absent from the higher elevation forest habitat in the western part of the monument.

*Western Rattlesnake (*Crotalus viridis*)

We only observed this widespread species during night driving surveys on SR 117, but it probably occurs throughout the monument.

Species That Possibly Occur at El Malpais National Monument

Red-spotted Toad (*Bufo punctatus*)

This species usually occurs in rocky habitats, and has been collected in the vicinity of ELMA (Degenhardt et al. 1996). Gehlbach (1965) cited a specimen (CU 5766) collected 18.4 km (11.5 mi) SSE of Grants, and this locality may be within the current boundary of ELMA. Red-spotted Toads probably occur in areas of the lava flow, but at ELMA are most likely to be found in the Sandstone Bluffs area, where they might breed in temporary mesa top potholes.

Woodhouse's Toad (*Bufo woodhousii*)

In New Mexico, this species is usually associated with river valleys and other relatively mesic habitats with sandy soil (Degenhardt et al. 1996). Although more common in the Zuni River area, isolated records near ELMA (Degenhardt et al. 1996) suggest it may occur within the monument, possibly in the sandy grasslands along SR 117, where it would probably breed in cattle tanks, roadside ditches, and other temporary pools. Gehlbach (1965) cited a specimen (UMMZ 86604) collected 12.8 km (8 mi) SE of Paxton, and this locality may be within the current boundary of ELMA.

Sagebrush Lizard (*Sceloporus graciosus*)

Sagebrush Lizards are common over most of the Colorado Plateau, and in the region closest to ELMA are almost entirely confined to Colorado Plateau drainage basins such as the Zuni and Puerco Rivers (Degenhardt et al. 1996). However, the locality plotted closest to ELMA in Degenhardt et al. (1996) appears to be just northwest of Grants, probably in the Rio San Jose drainage. Based on biogeography and habitat availability, Sagebrush Lizards could occur at ELMA. Within the monument, the most suitable habitat appears to be the sandy shrub areas in the vicinity of Sandstone Bluffs.

Chihuahuan Spotted Whiptail (*Cnemidophorus exsanguis*)

Lightfoot et al. (1996) reported this unisexual species from the Sandstone Bluffs area of ELMA, but provided no details of their observation. Without documentation, it seems most reasonable to assume that they misidentified an unusually spotted individual of the Plateau Striped Whiptail of the form referable to *C. innotatus* (see Plateau Striped Whiptail account, above). However, the species has been collected about 30 miles east-southeast of ELMA, in extreme southeastern Cibola County (Degenhardt et al. 1996) on the other side of Cebollita Mesa, and could occur within the monument. Targeted searches for this species should be conducted in the Sandstone Bluffs area.

Ring-necked Snake (*Diadophis punctatus*)

This species has a spotty, relictual distribution throughout the Southwest (Stebbins 2003), and has been collected in the vicinity of ELMA (Degenhardt et al. 1996). Bureau of Land Management staff observed a Ring-necked Snake in the Agua Fria Creek area about two miles north of the northwestern ELMA boundary (Rick Best, personal communication), and this drainage flows south into ELMA. Ring-necked Snakes probably occur as isolated populations at ELMA, in areas that have the permanent subsurface moisture required by this species (Degenhardt et al. 1996).

Corn Snake (*Elaphe guttata*)

In the ELMA region this species has been collected only from 8 km (5 mi) northwest of McCartys (MVZ 171740). This locality is probably along the Rio San Jose near the junction of Interstate 40 and SR 117. Based on habitat, the species probably does not occur on NPS lands near the Northwest New Mexico Visitor's Center, which is close to the collection locality. Corn Snakes may occur in the northern part of the monument; however in New Mexico this species is usually associated with permanent water such as streams, lakes, or springs (Degenhardt et al. 1996), reducing the likelihood of their occurrence within ELMA.

Western Hog-nosed Snake (*Heterodon nasicus*)

This species has not been recorded from the ELMA region (Degenhardt et al. 1996). However, its occurrence in the San Juan basin of northwestern New Mexico (Degenhardt et al. 1996) suggests that isolated populations could be found anywhere. If the species were present at ELMA, it would most likely be in the open, sandy habitats along the eastern edge of the monument.

Night Snake (*Hypsiglena torquata*)

Prior to our inventory, this species was not known from Cibola County (Degenhardt et al. 1996). Although we did not find any Night Snakes at ELMA, our collection of a specimen from El Morro National Monument (Persons and Nowak 2005c) provides evidence of their occurrence in the general vicinity of the monument. This secretive, nocturnal species probably occurs throughout ELMA.

Milk Snake (*Lampropeltis triangulum*)

Although there are no documented records of this species from the region, there is an unverified report of a Milk Snake sighting at El Morro National Monument, just west of ELMA (Degenhardt et al. 1996). Because the species occupies a wide variety of habitats in New Mexico (Degenhardt et al. 1996), it may occur almost anywhere within ELMA, excepting within the lava flows.

Coachwhip (*Masticophis flagellum*)

This species has been collected just east of Grants near the local terminus of its distribution, which extends up the Rio San Jose from the Rio Grande Valley (Degenhardt et al. 1996). Although the species is probably absent from most of ELMA, it may occur along the northernmost areas near SR 117, or more likely on the NPS lands in the vicinity of the Northwest New Mexico Visitor's Center.

Mountain Patch-nosed Snake (*Salvadora grahamiae*)

Gehlbach (1965) cited a specimen of this species (CU 5655) collected 16.8 km (10.5 mi) south of Grants. This locality is probably along SR 53 or SR 117, and in either case would be close to, or possibly within, ELMA. Mountain Patch-nosed Snake almost certainly occurs within the monument.

Black-tailed Rattlesnake (*Crotalus molossus*)

This rattlesnake has been collected on Mt. Taylor, just north of Grants (Gehlbach 1965), and probably occurs at ELMA as well. Black-tailed Rattlesnakes usually prefer rocky habitats, and these are abundant at ELMA. It could occur anywhere in the monument.

Table E-1. Amphibian and reptile species known or expected to occur at El Malpais National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	SX	Present in Park	Uncommon
Plains Spadefoot	SX	Present in Park	Common
Mexican Spadefoot	SX	Present in Park	Common
Red-spotted Toad	1	Unconfirmed	
Woodhouse's Toad	3	Probably Present	
Canyon Treefrog	OP	Present in Park	Uncommon
Mountain Treefrog	SX	Present in Park	Rare
Western Chorus Frog	OX	Present in Park	Uncommon
Eastern Collared Lizard	SX	Present in Park	Uncommon
Lesser Earless Lizard	SX	Present in Park	Common
Greater Short-horned Lizard	SX	Present in Park	Common
Sagebrush Lizard	1	Unconfirmed	
Eastern Fence Lizard	SX	Present in Park	Abundant
Ornate Tree Lizard	SX	Present in Park	Abundant
Many-lined Skink	OP	Present in Park	Uncommon
Great Plains Skink	OX	Present in Park	Uncommon
Chihuahuan Spotted Whiptail	2	Unconfirmed	
Plateau Striped Whiptail	SX	Present in Park	Abundant
Ring-necked Snake	3	Probably Present	
Corn Snake	1	Unconfirmed	
Western Hog-nosed Snake	1	Unconfirmed	
Night Snake	3	Probably Present	
Milk Snake	2	Unconfirmed	
Coachwhip	2	Unconfirmed	
Striped Whipsnake	SP	Present in Park	Uncommon
Gopher Snake	SX	Present in Park	Common
Mountain Patch-nosed Snake	3	Probably Present	
Black-necked Garter Snake	SX	Present in Park	Rare
Western Terrestrial Garter Snake	OX	Present in Park	Uncommon
Western Diamond-backed Rattlesnake	SP	Present in Park	Common
Black-tailed Rattlesnake	3	Probably Present	
Western Rattlesnake	SX	Present in Park	Common
TOTAL RANK 1	4		
TOTAL RANK 2	3		
TOTAL RANK 3	5		
TOTAL FOUND (SX, OX, SP, OP)	20		
WEIGHTED TOTAL	26.2		
ESTIMATED INVENTORY COMPLETENESS	76%		

Table E-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of El Malpais National Monument, 2002-2003. GS = general survey, NGS = nocturnal general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, ND = night drive, and RE = random encounter.

Species	GS	NGS	1-ha TACS	10-ha TACS	ND	RE	Total
Tiger Salamander		30					30
Plains Spadefoot					7		7
Mexican Spadefoot					4	1	5
Mountain Treefrog						4	4
Western Chorus Frog		2					2
Eastern Collared Lizard	6		1				7
Lesser Earless Lizard	2			2		1	5
Greater Short-horned Lizard	1			1			2
Eastern Fence Lizard	41		31	13		2	87
Ornate Tree Lizard	12		1				13
Great Plains Skink	5						5
Plateau Striped Whiptail	57		3	22		3	85
Striped Whipsnake	5					2	7
Gopher Snake	1				9	5	15
Black-necked Garter Snake					1		1
Western Terrestrial Garter Snake					1		1
Western Diamond-backed Rattlesnake	1						1
Western Rattlesnake					4		4
TOTAL	131	32	36	38	26	18	281

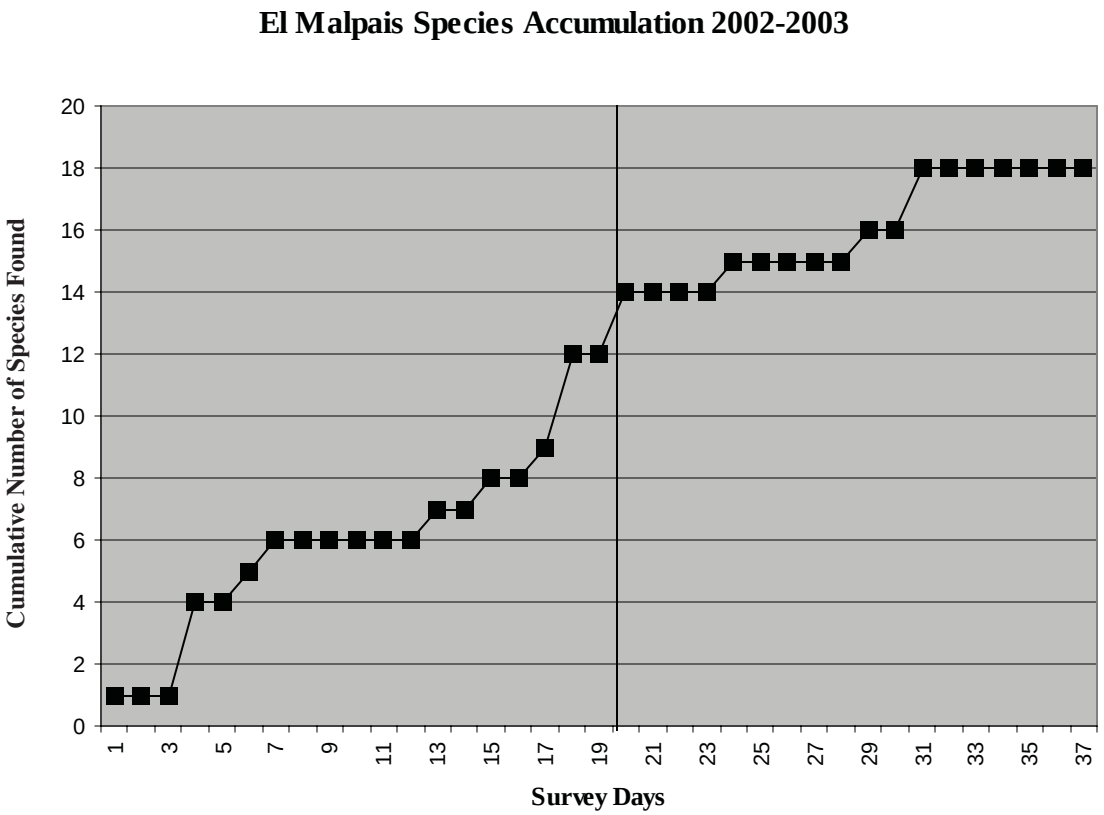

Figure 6. Species accumulation curve for amphibians and reptiles at El Malpais National Monument, 2002-2003. Yearly survey days are separated by a vertical line through the data.

Appendix F. El Morro National Monument (ELMO)

ELMO is located south of the Zuni Mountains in Cibola County, New Mexico, west of El Malpais National Monument. Elevation ranges between 2,183 and 2,304 m (7,162-7,559 ft). The monument encompasses 418 ha (1,032 acres), and was established to protect a sandstone monolith known as Inscription Rock, which bears inscriptions of Spanish explorers and more recent American settlers. Habitats at ELMO include pinyon-juniper woodland and ponderosa pine-Gambel oak forests. The large sandstone cuesta forms a box canyon, which contains a diversity of shrubby and rocky microhabitats probably important to amphibians and reptiles. A pool at the base of Inscription Rock that traps rainwater runoff has been stabilized with a retaining wall in historic times, providing a permanent source of water within the monument. Additional information on natural resources at ELMO is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 99 person-hours surveying for herpetofauna at ELMO in 2001-2003. Methods used, and number of person-hours spent on each method, included general surveys (58.2), nocturnal general surveys (7.4), random 1-ha TACS plot surveys (8.3), random 10-ha TACS plot surveys (6.2), non-random 1-ha TACS plot surveys (3.3), and night driving (15.3). We recorded 256 individual amphibians and reptiles of 12 species during our surveys, and documented five additional species based on our review of the literature and museum specimen records. A summary of the total number of each species observed by each method is presented in Table F-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at ELMO

Between our surveys at ELMO and inclusion of previously documented species we estimate an inventory completeness of 81% (Table F-1). A species accumulation curve based on our surveys (Figure F-1) has not begun to level off, suggesting we are not very close to reaching inventory completeness. Detecting the remaining species at ELMO will require much greater field effort and more targeted searches during favorable conditions.

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from ELMO. We used dot distribution maps in Degenhardt et al. (1996) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to ELMO. We also extracted specimen records cited in Gehlbach (1965), which included a number of records from ELMO.

We located museum specimen records for nine species at ELMO (Appendix T). In addition, we located a specimen of Many-lined Skink from near ELMO, a species we observed but did not voucher within the monument. Gehlbach (1965) collected specimens at ELMO, and presented a thorough review of the herpetofauna of the entire Zuni Mountains region. McCallum (1979) conducted an amphibian and reptile inventory at ELMO in 1978-1979, Stolz (1986a) summarized the herpetofauna of the monument, and Stolz (1986b) discussed the herpetofauna of the pool below Inscription Rock. Although unable to locate copies of the two Stolz reports, we did locate numerous wildlife observation cards (on file at ELMO), many of them recorded by Stolz, including details of the fish eradication and subsequent amphibian reintroductions of the pool below Inscription Rock.

Sensitive Species and Threats to the Herpetofauna

No threatened or sensitive species have been documented from ELMO, although Ring-necked Snake has a spotty distribution in the region and the ELMO population may be isolated. The discovery of Mountain Treefrog at El Malpais National Monument suggests it could occur in or near ELMO as well, and if present breeding habitats used by the species may warrant conservation attention. Road mortality may impact some snake populations near State Route 53, especially if traffic were to substantially increase in the future.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at ELMO is only 81%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort could focus on documenting snakes (e.g., Ring-necked Snake, Milk Snake, Striped Whipsnake, Mountain Patch-nosed Snake, Black-tailed Rattlesnake) that may occur within the monument, or have been observed but not collected. Without the benefit of extensive roads available for night driving surveys, locating many snake species may require substantial field effort and

different methods, such as funnel or pitfall traps. In addition, our discovery of Mountain Treefrog at El Malpais National Monument suggests that additional populations may occur in the region, possibly in and near ELMO. Searches of cattle tanks, roadside ditches, and other temporary water sources during the summer monsoon season offer the best chance of detecting Mountain Treefrog.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at ELMO to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At ELMO, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as the pool below Inscription Rock (Tiger Salamanders) and the cattle tank just across the monument boundary fence south of the visitor center area (spadefoot toads). However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At ELMO, Eastern Fence Lizard and Plateau Striped Whiptail are good candidates for long-term monitoring, because these species are common throughout the monument and at most SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at ELMO

Because we do not have data on population sizes or density of species at ELMO, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at ELMO, and also with the same species elsewhere throughout its range in the region. Status of all documented and hypothetical species at ELMO, as well as NPSpecies checklist field assignments, are presented in Table F-1. An asterisk (*) denotes a species represented by a voucher specimen.

Species Documented from El Morro National Monument

*Tiger Salamander (*Ambystoma tigrinum*)

Most of our observations of Tiger Salamanders were of large larval (probably neotenic) individuals in the pool below Inscription Rock, but we also observed terrestrial adults while night driving. Although salamanders occupied the pool early in the twentieth century (McCallum 1979), they were apparently absent during McCallum's surveys in the 1970's; he speculated this absence was due to the presence of fish which were introduced when the pool's dam was enlarged and the water level stabilized. In 1986 and 1987, the fish (yellow perch, *Perca flavescens*) were killed with Rotenone and Tiger Salamanders were reintroduced into the pool, as part of a herpetofaunal restoration plan (Stolz 1986b, unpublished park natural history observation cards). Tiger Salamanders are probably common at ELMO.

*Plains Spadefoot (*Spea bombifrons*)

We observed only four individual spadefoot toads (three of this species), likely due to the drought conditions that prevailed during the inventory period. Both spadefoot species were recorded at ELMO by Gehlbach (1965) and McCallum (1979), and Gary Stolz observed hundreds of both species after heavy rain events at ELMO in 1987 (wildlife observation cards on file at ELMO). Plains Spadefoot is probably common at ELMO.

*Mexican Spadefoot (*Spea multiplicata*)

We observed only a single Mexican Spadefoot during our surveys, but this and the Plains Spadefoot are probably both common at ELMO. Both species breed in temporary pools formed during the summer monsoon season, such as the earthen stock tank near the ELMO south boundary. Gary Stolz observed hundreds of both spadefoot species after heavy rain events at ELMO in 1987 (wildlife observation cards on file at ELMO). Mexican Spadefoot is probably common at ELMO.

Woodhouse's Toad (*Bufo woodhousii*)

We did not observe any Woodhouse's Toads during our inventory. Gehlbach (1965) did not collect any specimens from ELMO, and the only specimen he reported from the area was from what is now the northern part of El Malpais National Monument, to the east of ELMO. However, McCallum (1979) reported Woodhouse's Toads in and near the pool below Inscription Rock, and suggested they probably occur throughout the ELMO area. Four adult and approximately 100

tadpoles of Woodhouse's toad were introduced into the pool below Inscription Rock in 1986 and 1987, respectively, as part of a herpetofaunal restoration plan (Stolz 1986b, unpublished park natural history observation cards). More work is needed to determine the distribution and abundance of this species in the ELMO region.

Lesser Earless Lizard (*Holbrookia maculata*)

We did not observe this species, although McCallum (1979) found a single individual in sandy shrubland habitat at ELMO. Gehlbach (1965) did not report the species from near ELMO, although it is locally common south and east of the lava flows at El Malpais National Monument. A wildlife observation card on file at ELMO documents a sighting of Lesser Earless Lizard in 1985, along the main park road near the road to park housing. Future inventory work should focus on determining the status of Lesser Earless Lizard within and near the monument.

*Eastern Fence Lizard (*Sceloporus undulatus*)

This was the most abundant species during our surveys at ELMO, as it was during an inventory conducted by McCallum (1979). Eastern Fence Lizards are found throughout the monument, where they are frequently observed on rocks, trees, or buildings.

*Ornate Tree Lizard (*Urosaurus ornatus*)

We observed only a single Tree Lizard at ELMO, on a fallen tree in Box Canyon. McCallum (1979) described it as an uncommon resident of rock faces at ELMO, and all of their limited observations were in Box Canyon as well. Gehlbach (1965) found it restricted to rocky areas in the Zuni Mountains region, which is generally true throughout much of its range in New Mexico (Degenhardt et al. 1996).

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We observed only a single Greater Short-horned Lizard during our surveys, but this cryptic species is probably common at ELMO. McCallum (1979) described it as being fairly common in open areas within the monument.

Many-lined Skink (*Eumeces multivirgatus*)

This species was not reported previously from ELMO (McCallum 1979), although Gehlbach (1965) collected a specimen 3.2 km (2 mi) west of the monument. We found three Many-lined Skinks during our surveys: one west of Inscription Rock along the trail below the mesa, one in Box Canyon, and one near the campground. Although two of these were caught and handled, our collecting activities were restricted during this time, and as a result the species remains unvouchered from the monument.

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual whiptail was the second most common species found during our surveys. McCallum (1979) reported it to be an uncommon species, suggesting that populations may have increased since the 1970's. *Cnemidophorus velox* is actually a complex of mostly undescribed species (Wright 1993). More than one species may be present at ELMO, as it appears is the case nearby at El Malpais National Monument (ELMA), where we collected a larger sample of specimens. Future studies on the systematics of the Plateau Striped Whiptail should include large samples from the ELMO and ELMA region.

Ring-necked Snake (*Diadophis punctatus*)

This species has a spotty, relictual distribution throughout the southwest (Stebbins 2003), and has been collected in the ELMO region near El Malpais National Monument, and just south of Thoreau (Degenhardt et al. 1996, Gehlbach 1965). We located a report from 1983 of this species at ELMO (wildlife observation card on file at ELMO). The snake had been run over by a bicycle on the road to park housing, and the individual was well described ("fluorescent orange ring around neck & belly – dark grey body"). Ring-necked Snakes probably occur as isolated populations throughout the Zuni Mountains region, in areas that have the permanent subsurface moisture required by this species (Degenhardt et al. 1996).

*Night Snake (*Hypsiglena torquata*)

Prior to our surveys, this species had not been collected in Cibola County (Degenhardt et al. 1996). We collected a single individual in the ELMO campground (Persons and Nowak 2005c). This secretive, nocturnal species is found in a variety of habitats throughout the region (e.g., Degenhardt et al. 1996), and is probably common at ELMO.

Milk Snake (*Lampropeltis triangulum*)

This species has not been collected from the ELMO region, but Degenhardt et al. (1996) cited an unverified report from the monument. This observation was made in 1984 near Inscription Rock, and was reasonably well described (wildlife observation card on file at ELMO). Although in Arizona this species is largely restricted to grasslands (Nowak and Persons, unpublished data), it is found in a variety of habitats in New Mexico (Degenhardt et al. 1996), including higher elevation woodlands. It is therefore likely to occur at ELMO.

Striped Whipsnake (*Masticophis taeniatus*)

This widespread species has not been collected from the immediate vicinity of ELMO, although it has been found throughout the El Malpais National Monument area to the east and near Nutria to the north (Degenhardt et al. 1996). We located two reports of sightings of this species at ELMO

(wildlife observation cards on file at ELMO). In addition, McCallum (1979) reported an observation at ELMO of a long snake seen gliding into a hole that he suggested might have been this species. Striped Whipsnakes sometimes range up into ponderosa pine forest (personal observation), although in New Mexico they are usually associated with rocky and brushy foothills habitats, including in pinyon-juniper woodland (Degenhardt et al. 1996). Striped whipsnakes are probably uncommon at ELMO.

*Gopher Snake (*Pituophis catenifer*)

This generalist species is common at ELMO, and is probably found in every habitat within the monument.

*Western Terrestrial Garter Snake (*Thamnophis elegans*)

We observed eight Western Terrestrial Garter Snakes at ELMO, the most of any snake species seen during our inventory. Although most common in aquatic microhabitats, this species often wanders far from water, and probably occurs throughout the monument.

*Western Rattlesnake (*Crotalus viridis*)

We observed only a single Western Rattlesnake at ELMO during a night driving survey. This widespread species appears to be uncommon at ELMO, although it probably occurs in all habitats throughout the monument.

Species That Possibly Occur at El Morro National Monument

Red-spotted Toad (*Bufo punctatus*)

Although this species has been collected near Grants (Degenhardt et al. 1996, Gehlbach 1965), Gehlbach (1965) noted that it had not been found above 2,073 m (6,800 ft) elevation in the Zuni Mountains region, suggesting it may not occur at ELMO. Gary Stolz reported seeing a Red-spotted Toad at ELMO in 1986 (wildlife observation card on file at ELMO), but the individual was not well described. Because Red-spotted Toads prefer rocky habitats, if present at ELMO they would most likely occur on the mesa top, where they may breed in *tinajas* filled during the summer monsoon season.

Canyon Treefrog (*Hyla arenicolor*)

The Canyon Treefrog is fairly common in rocky habitats to the east at ELMA, and could occur at ELMO. If present, it would most likely be found breeding in *tinajas* on the mesa top (McCallum 1979).

Mountain Treefrog (*Hyla eximia*)

Prior to our discovery of this species in the northwest part of El Malpais National Monument, Mountain Treefrogs were documented in New Mexico only from the Gila River basin, about 143 km (89 mi) to the south (Degenhardt et al. 1996, Monatesti et al. 2005). Our discovery lends credence to an unverified record from the 1870's near Nutria, McKinley County, about 80 km (50 mi) northwest of ELMO. This new ELMA locality, near the Continental Divide, is only about 21 km (13 mi) east of ELMO, and suggests the species could occur near or within the monument. Mountain Treefrogs breed in temporary pools during the summer monsoon season (Degenhardt et al. 1996) and at ELMO might be found in stock tanks or roadside ditches.

Western Chorus Frog (*Pseudacris triseriata*)

This species has been collected just north of ELMO, near the headwaters of the Zuni River (Degenhardt et al. 1996). We also heard Western Chorus Frogs calling from a stock tank in the northwestern part of ELMA, just east of ELMO, during our surveys there. Tadpoles of this species were introduced into the pool below Inscription Rock in 1987 (wildlife observation card on file at ELMO), as part of a herpetofauna restoration of the pool (Stolz 1986b), but the species has not been observed since. If present at ELMO, these little frogs would most likely breed in temporary pools such as stock tanks or roadside ditches, especially ones bordered by emergent vegetation.

Eastern Collared Lizard (*Crotaphytus collaris*)

This species, which is common to the east at ELMA, has not been collected or observed in the vicinity of ELMO. Although it could occur in rocky habitats on the mesa top, the fact that this large, colorful lizard has never been reported suggests it may be absent from the monument.

Sagebrush Lizard (*Sceloporus graciosus*)

Sagebrush Lizards are common over most of the Colorado Plateau, and in the ELMO area are almost entirely confined to Colorado Plateau drainages such as the Zuni and Puerco Rivers, just west and north of the monument (Degenhardt et al. 1996). Sagebrush Lizards occupy a variety of habitats, usually with sandy soils and fairly dense shrub cover. Based on biogeography and habitat availability, Sagebrush Lizards could occur at or near ELMO.

Great Plains Skink (*Eumeces obsoletus*)

This large skink has been collected east of ELMO, near ELMA, just east of the Continental Divide. Gehlbach (1965) stated that the species probably does not occur on the Colorado Plateau to the north of the Zuni Mountains region, but based on its occurrence near El Malpais National Monument, it may also be found at ELMO. Skinks are usually associated with mesic microhabitats (Degenhardt et al. 1996, Stebbins 2003), and the occurrence of another species (Many-lined Skink) at ELMO suggests that suitable habitat may exist for the Great Plains Skink as well.

Mountain Patch-nosed Snake (*Salvadora grahamiae*)

This species has been collected south of Grants near the eastern edge of the lava flows at ELMA, but in the region has not been found west of the Continental Divide (Degenhardt et al. 1996, Gehlbach 1965). Mountain Patch-nosed Snakes are usually associated with rough or broken terrain (Degenhardt et al. 1996), and if present at ELMO would be probably be found in Box Canyon or on the rocky, brushy slopes at the base of the mesa.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

This species has been collected near the eastern edge of the ELMA lava flows (Degenhardt et al. 1996, this study), but has not been recorded elsewhere in the Zuni Mountains region. Black-necked Garter Snakes are highly aquatic (Degenhardt et al. 1996), but their occurrence at ELMA, in an area with only semi-permanent stock tanks as water sources, suggests they could occur at ELMO as well. Two reports of this species at ELMO in the 1980's (wildlife observation cards on file at ELMO) provide no details of identification, and may represent sightings of the variable Western Terrestrial Garter Snake.

Black-tailed Rattlesnake (*Crotalus molossus*)

This rattlesnake has been collected on Mt. Taylor, just north of Grants (Gehlbach 1965), but has not been found west of the Continental Divide in the ELMO region (Degenhardt et al. 1996). Black-tailed Rattlesnakes usually prefer rocky habitats, and if present at ELMO would probably be found around the mesa or in Box Canyon.

Table F-1. Amphibian and reptile species known or expected to occur at El Morro National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	SP	Present in Park	Common
Plains Spadefoot	SP	Present in Park	Common
Mexican Spadefoot	SP	Present in Park	Common
Red-spotted Toad	2	Unconfirmed	
Woodhouse's Toad	OP	Present in Park	Rare
Canyon Treefrog	1	Unconfirmed	
Mountain Treefrog	2	Unconfirmed	
Western Chorus Frog	2	Unconfirmed	
Eastern Collared Lizard	1	Unconfirmed	
Lesser Earless Lizard	OP	Present in Park	Rare
Greater Short-horned Lizard	SP	Present in Park	Uncommon
Sagebrush Lizard	2	Unconfirmed	
Eastern Fence Lizard	SP	Present in Park	Abundant
Ornate Tree Lizard	SP	Present in Park	Uncommon
Many-lined Skink	OX	Present in Park	Common
Great Plains Skink	2	Unconfirmed	
Plateau Striped Whiptail	SX	Present in Park	Abundant
Ring-necked Snake	OP	Present in Park	Rare
Night Snake	SX	Present in Park	Uncommon
Milk Snake	OP	Present in Park	Rare
Striped Whipsnake	OP	Present in Park	
Gopher Snake	SP	Present in Park	Common
Mountain Patch-nosed Snake	1	Unconfirmed	
Black-necked Garter Snake	3	Probably Present	

Table F-1. Amphibian and reptile species known or expected to occur at El Morro National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.—Continued

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Western Terrestrial Garter Snake	SP	Present in Park	Common
Black-tailed Rattlesnake	1	Unconfirmed	
Western Rattlesnake	SP	Present in Park	Uncommon
TOTAL RANK 1	4		
TOTAL RANK 2	5		
TOTAL RANK 3	1		
TOTAL FOUND (SX, OX, SP, OP)	17		
WEIGHTED TOTAL	21.0		
ESTIMATED INVENTORY COMPLETENESS	81%		

Table F-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of El Morro National Monument, 2001-2003. GS = general survey, NGS = nocturnal general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, N-R TACS = non-random 1-ha TACS plot, ND = night drive, and RE = random encounter.

Species	GS	NGS	1-ha TACS	10-ha TACS	N-R TACS	ND	RE	Total
Tiger Salamander	11	26		2		3		42
Plains Spadefoot						3		3
Mexican Spadefoot						1		1
Greater Short-horned Lizard							1	1
Eastern Fence Lizard	61		20	23	1	1	17	123
Ornate Tree Lizard	1							1
Many-lined Skink	2						1	3
Plateau Striped Whiptail	36		14	6			9	65
Night Snake						1		1
Gopher Snake	1					4	2	7
Western Terrestrial Garter Snake	3		1			3	1	8
Western Rattlesnake						1		1
TOTAL	115	26	35	31	1	17	31	256

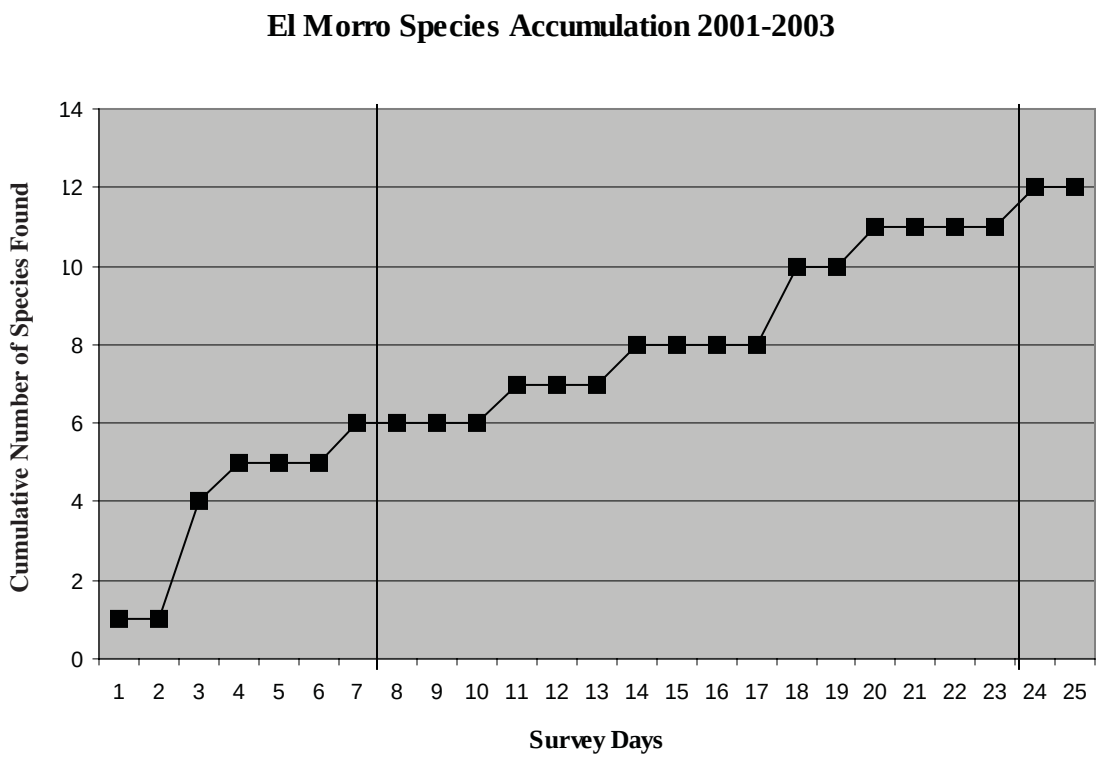

Figure 7. Species accumulation curve for amphibians and reptiles at El Morro National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix G. Glen Canyon National Recreation Area (GLCA)

GLCA is located along the Colorado River Corridor upstream of the Grand Canyon, in Coconino County, Arizona and Garfield, Kane, San Juan, and Wayne counties, Utah. Elevation ranges between 930 and 2,319 m (3,051-7,609 ft). The Recreation Area encompasses 506,459 ha (1,250,954 acres), and was established to provide recreational use of Lake Powell, created by the construction of Glen Canyon Dam at Page, Arizona. GLCA contains large expanses of sandstone canyons, and much of the area is dominated by Great Basin desertscrub. Pinyon-juniper woodlands and grasslands are also present, and riparian zones of willow and cottonwood are found along streams throughout the area. Additional information on natural resources at GLCA is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 99 person-hours surveying for herpetofauna at GLCA in 2003. Methods used, and number of person-hours spent on each method, included general surveys (87.5), nocturnal general surveys (2.7), and night driving (8.9). We recorded 1,355 individual amphibians and reptiles of 21 species during our surveys, and eight additional species (including one historic species that likely does not occur now) were documented based on our review of the literature and museum specimen records. A summary of the total number of each species observed by each method is presented in Table G-2.

Estimate of Inventory Completeness at GLCA

Between our surveys at GLCA and inclusion of previously documented species we estimate an inventory completeness of 76% (Table G-1). An asymptotic species accumulation curve (Figure G-1) suggests we are close to reaching inventory completeness. However, we know this is not the case, based on numerous species confirmed by previous collections as well as a number of undocumented species we consider highly likely to occur (Table G-1). Instead, this false asymptote suggests that we are close to detecting most of the common species using our current methods. Detecting the remaining undocumented species, many of which are small and secretive (e.g., Desert Night Lizard, Southwestern Black-headed Snake, Ring-necked Snake) will require much greater field effort and more targeted searches during favorable conditions.

Literature and Museum Specimen Data Searches

We searched specimen records from Brigham Young University (BYU), the California Academy of Sciences (CAS), the University of Kansas Museum of Natural History (KU), the Los Angeles County Museum (LACM), the Museum of Vertebrate Zoology (MVZ), the University of Texas-El Paso (UTEP), the University of Michigan Museum of Zoology (UMMZ), the University of Arizona (UAZ), the University of Utah (UU), and the USGS Biological Survey collection (USGS BS/FC, housed at MSB) for amphibians and reptiles from GLCA.

We located museum specimen records for 28 species at GLCA (Appendix T), including one species (Painted Turtle) that may be extirpated within the Recreation Area. The only general overviews of the herpetofauna of GLCA are those of Tanner (1958a) and Woodbury (1958, 1959), all of which were produced prior to the filling of Lake Powell. Platenberg et al. (2003) summarized results of the current inventory effort. Mueller et al. (1998) surveyed the Escalante River within GLCA for aquatic species, including amphibians and reptiles. Oliver (2003), in a comprehensive inventory of Grand Staircase-Escalante National Monument (GRST), included results from surveys in adjacent areas of GLCA. Craig and Pinnock (1995), Drost and Sogge (1995), and Spence (1996) all reported results of surveys for Northern Leopard Frogs at GLCA.

Sensitive Species and Threats to the Herpetofauna

Probably the rarest amphibian or reptile species at GLCA is the Northern Leopard Frog, which has declined in many parts of its range (Stebbins 2003), including at GLCA (Charles Drost, personal communication). Potential threats to this species include drought, changes in the hydrology of springs, and recreational use of frog habitat. While GLCA probably does harbor a number of regionally rare reptiles (e.g., Desert Night Lizard, Western Banded Gecko, Western Ground Snake, Southwestern Black-headed Snake), populations of these species are probably secure within the recreation area, and are unlikely to be severely impacted by human use of the area.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at GLCA is only 76%, additional inventory of amphibians and reptiles may be warranted. If future inventory efforts are conducted they could focus on documenting species considered highly likely to occur, including those that have been previously reported (e.g., Tanner 1958a) but for which specimens apparently were not collected. These include Greater Short-horned Lizard, Many-lined Skink, Plateau Striped Whiptail, Desert Night Lizard, Southwestern Black-headed Snake, and Black-necked Garter Snake. Although only one species of spadefoot toad (Great Basin Spadefoot) has been documented from GLCA, both Plains and Mexican Spadefoot may also occur, and more surveys would help determine the status of these species in and near GLCA.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at GLCA to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At GLCA, the highest priority will be monitoring of Northern Leopard Frog populations throughout the NRA. In addition, Canyon Treefrogs, which were identified as a possible indicator species for spring, seep, and tinaja communities across the network, may be included in an amphibian monitoring program at GLCA. Finally, spadefoots and true toads may be monitored through night driving, as well as through periodic visual encounter surveys of known breeding sites. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At GLCA, Side-blotched Lizard and Western Whiptail may be good candidates for monitoring, because these species are abundant throughout the NRA. Eastern Fence Lizard and Tree Lizard could also be monitored, because they are common at GLCA and many SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at GLCA

Because we do not have data on population sizes or density of species at GLCA, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at GLCA, and also with the same species elsewhere throughout its range in the region. An asterisk (*) below denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at GLCA, as well as NPSpecies checklist field assignments, are presented in Table G-1.

Species Documented from Glen Canyon National Recreation Area

*Tiger Salamander (*Ambystoma tigrinum*)

We did not observe this species in 2003. We located one museum specimen record of an individual collected along the San Juan River in GLCA. Although apparently not common, Tiger Salamanders probably occur in other parts of the recreation area, especially less-visited areas away from the Colorado and San Juan rivers, where they may breed in cattle tanks or pools in smaller side canyons.

*Great Basin Spadefoot (*Spea intermontana*)

We observed only 11 spadefoot toads during our surveys, all of which we identified as this species. Most of these were seen in Last Chance Creek. Great Basin Spadefoot probably occurs throughout much of GLCA, although many authors (e.g., Hall 1998, Stebbins 2003) depict the species as occurring only west of the Colorado River. Future surveys should be directed towards determining the distribution of this and other spadefoots in the GLCA region.

*Red-spotted Toad (*Bufo punctatus*)

We observed 181 Red-spotted Toads during our surveys. This species generally prefers rocky canyon areas (Stebbins 2003), and is abundant throughout GLCA.

*Woodhouse's Toad (*Bufo woodhousii*)

We observed 516 Woodhouse's Toads in 2003 (including many young of the year metamorphs), the most individuals of any amphibian or reptile species at GLCA. Woodhouse's Toads are abundant at GLCA, especially in sandy floodplain habitats. They were the only amphibian species observed along the lower Escalante River by Mueller et al. (1998).

*Canyon Treefrog (*Hyla arenicolor*)

We observed 24 Canyon Treefrogs at GLCA. This species is probably common in appropriate habitat (rocky canyons with permanent or semi-permanent tinajas) throughout the recreation area.

*Northern Leopard Frog (*Rana pipiens*)

Northern Leopard Frogs occur at a number of sites along and near the Colorado River at GLCA (Charles Drost, personal communication). Craig and Pinnock (1995), Drost and Sogge (1995), and Spence (1996) all reported results of surveys for Northern Leopard Frogs at GLCA, and current studies by staff of the USGS Colorado Plateau Research Station will provide detailed distribution and status information on the species in the recreation area. We observed Northern Leopard Frogs in Ribbon Canyon, Last Chance Creek, and along the Escalante River near Explorer Canyon. Populations of many species of leopard frogs in Arizona have seriously declined (Clarkson and Rorabaugh 1989), including at GLCA. For example, at the only known site in the Arizona portion of GLCA (Horseshoe Bend), Drost and Sogge (1995) recorded as many as 81 leopard frogs in a single day, whereas recent surveys have detected no more than two frogs (Charles Drost, personal communication).

*Painted Turtle (*Chrysemys picta*)

Painted Turtles apparently occurred in the Colorado River in Glen Canyon prior to the construction of Glen Canyon Dam, but have not been documented since. Woodbury (1959) recounted specimens collected in 1937 (mouth of Rock Creek), 1951 (Labyrinth Canyon), and 1958 (Face Canyon). Apparently, only the Face Canyon specimen (UAZ 39731) still exists. Populations of Painted Turtles on and near the Colorado Plateau have a spotty distribution (e.g., Degenhardt et al. 1996, Stebbins 2003), and the species is probably extirpated from GLCA.

*Great Basin Collared Lizard (*Crotaphytus bicinctores*)

We observed only seven collared lizards at GLCA, all of this species. The Great Basin Collared Lizard probably occurs throughout most of GLCA, although it has been documented primarily along and west of the Colorado River (McGuire 1996, Stebbins 2003). The Eastern Collared Lizard may replace this species along the San Juan River portion of GLCA (McGuire 1996).

*Long-nosed Leopard Lizard (*Gambelia wislizenii*)

We observed 18 Long-nosed Leopard Lizards in 2003, and the species is probably common throughout GLCA.

*Desert Horned Lizard (*Phrynosoma platyrhinos*)

We found only one Desert Horned Lizard at GLCA, at Lee's Ferry. This desert-adapted species occurs only in the extreme southern portion of GLCA (Stebbins 2003), and has been collected at Rock Creek and the Crossing of the Fathers.

*Common Chuckwalla (*Sauromalus obesus*)

We observed only five Common Chuckwallas at GLCA, in the areas around Lee's Ferry and Glen Canyon Dam. This large, herbivorous lizard only occurs in rocky areas along and near the Colorado River corridor in the GLCA region, and has been recorded as far upstream as the vicinity of Hite (Bosworth 2003, Tanner and Avery 1964). Neither Crother (2000) or Stebbins (2003) recognize subspecies of Common Chuckwalla, including the Glen Canyon Chuckwalla described by Tanner and Avery (1964).

Sagebrush Lizard (*Sceloporus graciosus*)

We detected only two Sagebrush Lizards during our surveys in 2003, both in pinyon-juniper habitat in the vicinity of Muley Point near the San Juan River, at the extreme eastern edge of GLCA. We located museum specimen records from Crossing of the Fathers and Lake Canyon. However, these are low elevation sites where Sagebrush Lizards are less likely to occur, and the identity of these specimens should be verified. Oliver (2003) recorded Sagebrush Lizards from numerous sites at Grand Staircase-Escalante National Monument just west of GLCA, and the species probably occurs in higher elevation pinyon-juniper habitats at other locations throughout the recreation area.

*Desert Spiny Lizard (*Sceloporus magister*)

This large lizard is common in rocky habitats throughout the lower elevations of GLCA. Desert Spiny Lizards can be easily observed in places such as Lee's Ferry or near Glen Canyon Dam.

*Eastern Fence Lizard (*Sceloporus undulatus*)

The Eastern Fence Lizard is abundant in many habitats across the Colorado Plateau, and is found throughout GLCA. However, it is less common than at many other SCPN parks, because Desert Spiny Lizard and Side-blotched Lizard are more common throughout the low elevation desert habitats at GLCA.

*Ornate Tree Lizard (*Urosaurus ornatus*)

The Tree Lizard is abundant throughout GLCA, and is usually found on rock faces and boulders, and less commonly on trees.

*Side-blotched Lizard (*Uta stansburiana*)

This was the most frequently observed lizard observed during our surveys, and it is particularly abundant in rocky areas throughout the lower elevation desert habitats at GLCA.

*Western Whiptail (*Cnemidophorus tigris*)

This was the second most frequently observed lizard during our surveys (after the Side-blotched Lizard), and the only species of whiptail we observed. Western Whiptails probably occur throughout GLCA, although they are most abundant in the lower elevation desert habitats.

*Western Banded Gecko (*Coleonyx variegatus*)

Until recently, this nocturnal lizard was unknown from the GLCA region, with the closest populations occurring in extreme southwestern Utah and within the central Grand Canyon (Stebbins 1985). Brennan et al. (2002) reported a Western Banded Gecko from Antelope Point within GLCA, and Persons and Nowak (2004a) discovered the species at Wupatki National Monument north of Flagstaff. Both of these reports suggest that this species may be more widespread in low elevations in the Colorado River basin in the GLCA region. All of these new records were of individuals found under sandstone slabs in Great Basin Desertscrub habitats, and the species should be searched for in similar habitats throughout the southern portion of GLCA.

*Glossy Snake (*Arizona elegans*)

We did not find any Glossy Snakes at GLCA during our surveys, and only a handful of specimens have been collected within the recreation area. All specimen records we located were from the extreme southern portion of GLCA, in the vicinity of Page and Glen Canyon Dam. Bosworth (2003) plots a record further north in GLCA, near Hall's Crossing, but does not mention it in the text. Many of the records plotted in Bosworth (2003) are based on sight records, not specimens, so the validity of this record is questionable. However, because Glossy Snakes are known from a variety of habitats nearby in Arizona, including both Great Basin Desertscrub and grassland (e.g., Drost et al. 2001, Persons 2001a), the species may occur more widely in the southern portion of GLCA.

*Night Snake (*Hypsiglena torquata*)

We observed two Night Snakes in and near GLCA, one in Coyote Gulch and one near Ticaboo. This small, nocturnal species is probably common throughout GLCA.

*Common Kingsnake (*Lampropeltis getula*)

We observed one Common Kingsnake, near Lee's Ferry. The limited number of records from the region suggests the species is uncommon, but is probably distributed throughout GLCA (Bosworth 2003).

*Striped Whipsnake (*Masticophis taeniatus*)

We observed eight Striped Whipsnakes at GLCA in 2003. This fast, diurnal species is probably common in all habitats throughout the recreation area.

*Gopher Snake (*Pituophis catenifer*)

This generalist snake species is common in most habitats throughout the Southwest, but we observed only two individuals at GLCA. Gopher Snakes probably occur throughout the recreation area.

*Long-nosed Snake (*Rhinocheilus lecontei*)

Tanner and Heinrichs (1964) first recorded the desert-adapted Long-nosed Snake from the GLCA region of southeastern Utah near Wahweap, and this is still the only portion of the recreation area where the species has been found. Oliver (2003) observed an individual in the Grand Staircase-Escalante National Monument west of GLCA. Grogan and Tanner (1974) plotted a record in San Juan County, Utah, probably near the San Juan River west of Mexican Hat, and this reference is probably the basis for the range depicted in Stebbins (2003). We could not locate a specimen from this area, and Cox and Tanner (1995) do not map this area as within the range of the species, suggesting Tanner may have later questioned the Grogan and Tanner (1974) record. However, the existence of an isolated population in Carbon County, Utah, north of GLCA (Grogan and Tanner 1974), suggests the species at least formerly occupied much of the Colorado River region in eastern Utah, and populations may exist elsewhere in the area, including within GLCA.

*Western Patch-nosed Snake (*Salvadora hexalepis*)

We observed three Western Patch-nosed Snakes at GLCA, all in the Lee's Ferry area. The species has only been recorded from the extreme southern portion of GLCA (Bosworth 2003).

Western Ground Snake (*Sonora semiannulata*)

Oliver (2003), in a survey of Grand Staircase-Escalante National Monument, recorded two Western Ground Snakes, one of which was actually found outside the monument in GLCA, west of Last Chance Bay. These constitute the first records of this species from the GLCA region (Stebbins 2003). Unfortunately, Oliver (2003) apparently did not collect these specimens, but did provide UTM coordinates, which could facilitate collecting a voucher specimen from the population in GLCA. In addition, Atwood et al. (1980) reported a Western Ground Snake on US Highway 89 seven miles southeast of Glen Canyon City (=Big Water). However, this and other specimens in the "Navajo-Kaiparowits reference collection" collected by personnel of Brigham Young University in the early 1970's (Atwood et al. 1980) have apparently been lost (Skip Skidmore, BYU, personal communication). Western

Ground Snakes could conceivably be found in a variety of habitats throughout GLCA.

*Western Terrestrial Garter Snake (*Thamnophis elegans*)

We did not observe this species during our surveys, and located only one museum specimen record from GLCA, collected in Smith Fork Canyon in 1961. Woodbury (1959) mentions a specimen collected along the Colorado River at Rock Creek during the Rainbow Bridge-Monument Valley expedition in 1937, but we did not locate a record for this specimen. Although common over most of the western United States, the Western Terrestrial Garter Snake appears to be rare at GLCA. Oliver (2003) found this species only in the western and northern portions of Grand Staircase-Escalante National Monument, with no records close to the boundary with GLCA. This species should be searched for in higher elevation aquatic habitats in the area, such as along the upper Escalante River and its tributary side canyons.

*Western Rattlesnake (*Crotalus viridis*)

We observed only five Western Rattlesnakes at GLCA; of these, three were identified to subspecies as Midget Faded Rattlesnakes (C. v. concolor). Douglas et al. (2002) recorded both Midget Faded Rattlesnakes and Grand Canyon Rattlesnakes (C. v. abyssus) from GLCA, including the first record of Grand Canyon Rattlesnake from Utah. Brennan and Holycross (2004) reported a specimen of Midget Faded Rattlesnake from Labyrinth Canyon, the first record of that subspecies from Arizona. Based on the occurrence of Prairie Rattlesnakes (C. v. viridis) on Cedar Mesa east of GLCA (Douglas et al. 2002; Persons, personal observation), that subspecies would be expected to occur along the eastern San Juan River portion of GLCA.

Species That Possibly Occur at Glen Canyon National Recreation Area

Plains Spadefoot (*Spea bombifrons*)

Stebbins (2003) maps the range of this species as lying east of the Colorado River in extreme southeastern Utah, suggesting it may occur in GLCA, especially along the San Juan River portion of the recreation area.

Mexican Spadefoot (*Spea multiplicata*)

Like the Plains Spadefoot, this species occurs in southeastern Utah east of the Colorado River (Stebbins 2003), and is often found together with the similar Plains Spadefoot in other parts of its range (personal observation). This species almost certainly occurs in the eastern part of GLCA.

Great Plains Toad (*Bufo cognatus*)

This species has been found in southeastern Utah to the north and east of GLCA (Krupa 1990), and may occur within the recreation area as well. Atwood et al. (1980) reported Great Plains Toad from Last Chance Creek in GLCA, but this and other specimens in the "Navajo-Kaiparowits reference collection" collected by personnel of Brigham Young University in the early 1970's (Atwood et al. 1980) have apparently been lost (Skip Skidmore, BYU, personal communication). Although the record of Atwood et al. (1980) may be based on a misidentification of another species, Great Plains Toads may occur at GLCA, most likely along the eastern (e.g., San Juan River region) or northern edges of the recreation area.

Bullfrog (*Rana catesbeiana*)

Bullfrogs, which are native to the eastern United States, have become widely established in the west (Stebbins 2003). Although not reported from GLCA, it is conceivable that sportsmen could introduce the species to Lake Powell, and future surveys, especially in areas inhabited by Northern Leopard Frogs, should be alert to this possibility.

Eastern Collared Lizard (*Crotaphytus collaris*)

We did not observe this species of collared lizard during our surveys in 2003. We located two specimen records for Eastern Collared Lizard at GLCA, but suspect these specimens may be misidentified. Both specimens were collected before the recognition of the Great Basin Collared Lizard as a separate species (e.g. Tanner 1958a), and were collected at Lee's Ferry and along the Colorado River below Last Chance Creek, areas known to be inhabited by the Great Basin Collared Lizard. However, the Eastern Collared Lizard has been recorded from the San Juan River region in Utah (McGuire 1996), as well as at Natural Bridges National Monument on Cedar Mesa (personal observation), and almost certainly occurs along or near the San Juan River (e.g., Muley Point) within the boundaries of GLCA.

Lesser Earless Lizard (*Holbrookia maculata*)

Hammerson (1999) plots a locality for Lesser Earless Lizard in extreme southeastern Utah, near the Colorado border, which is apparently the only report of the species from Utah. Woodbury (1958) noted its absence from GLCA, and Atwood et al. (1980) recorded the species along US Highway 89 south of Page, but not further north in GLCA. Lesser Earless Lizards usually occupy grasslands in the region, and probably do not occur in the desert habitats in the southern portion of GLCA (e.g., Lee's Ferry, Glen Canyon Dam area). Recent reptile surveys in grassland habitats at GLCA did not detect this species (Charles Drost, personal communication). If the Lesser Earless Lizard occurs at GLCA, it would be most likely to be found along the San Juan River portion of the recreation area.

Greater Short-horned Lizard (*Phrynosoma hernandesi*)

Oddly, this widespread species has not been positively recorded from GLCA. Atwood et al. (1980) reported the species from areas on Nipple Bench and near Warm Creek Bay, but these may have been misidentifications of the Desert Horned Lizard, which is known from this portion of GLCA. These and other specimens in the "Navajo-Kaiparowits reference collection" collected by personnel of Brigham Young University in the early 1970's (Atwood et al. 1980) have apparently been lost (Skip Skidmore, BYU, personal communication). Oliver (2003) only found Greater Short-horned Lizards in the northern and western parts of Grand Staircase-Escalante National Monument, and suggested the species may be absent from low elevations in the southeastern portion of the monument, i.e., adjacent to GLCA. This species almost certainly occurs in the moderate and higher elevation habitats at GLCA (e.g., upper Escalante River drainage, northern areas adjacent to Canyonlands National Park, San Juan River corridor).

Many-lined Skink (*Eumeces multivirgatus*)

This species ranges over much of the Colorado Plateau, but in Utah occurs only in the region east of the Colorado River (Stebbins 2003). If present at GLCA, it would most likely be found in more mesic habitats (canyon bottoms, pinyon-juniper woodlands) in the northern or eastern portions of the recreation area.

Plateau Striped Whiptail (*Cnemidophorus velox*)

Woodbury (1959) mentioned specimens collected at Rock Creek during the Rainbow Bridge-Monument Valley Expedition in the 1930's, and are probably those identified as "Cnemidophorus species" in the University of Utah catalog. No other specimens of this unisexual whiptail species appear to have been collected from GLCA. Oliver (2003) plotted two sightings in Grand Staircase-Escalante National Monument close to the boundary of GLCA, and the species occurs on Cedar Mesa to the east (Persons, personal observation), suggesting they probably occur at various locations throughout the recreation area.

Desert Night Lizard (*Xantusia vigilis*)

Stebbins (2003) depicted the southeastern Utah range of this small, secretive species as broadly overlapping the central portion of GLCA. However, this is based on localities just west (Trachyte Creek NW of Hite) and east (Natural Bridges National Monument) of GLCA (Tanner 1957, 1958b). These records do suggest, however, that the species may occur within the recreation area. In addition, Oliver (2003) recently discovered a population west of GLCA in Grand Staircase-Escalante National Monument, and Jim Mead (Northern Arizona University, personal communication) observed a live Desert Night Lizard in a packrat midden in Salt Creek in Canyonlands National Park, north of GLCA.

Ring-necked Snake (*Diadophis punctatus*)

Although this secretive species has not been found in Utah east of the central mountains (Cox and Tanner 1995, Stebbins 2003), it has a disjunct, spotty distribution throughout the southwest (Stebbins 2003). Isolated populations of Ring-necked Snake could conceivably occur in mesic microhabitats (along streams, near seeps or springs) almost anywhere in GLCA.

Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has a disjunct distribution in the Colorado Plateau region, occupying primarily grassland habitats in northern Arizona and higher elevation woodlands in the mountains of central Utah. Although the species has not been reported from the immediate vicinity of GLCA (Stebbins 2003), it could conceivably occur almost anywhere in the recreation area. An unverified sight record from Hovenweep National Monument in extreme southeastern Utah (Persons and Nowak 2004b) suggests the species could be found in the San Juan River portion of GLCA.

Southwestern Black-headed Snake (*Tantilla hobartsmithi*)

Cole and Hardy (1981) cited specimens from the Henry Mountains as the only records of this species near GLCA. Bosworth (2003) plotted additional localities, including one in the vicinity of Hall's Creek, possibly within GLCA. However, Bosworth (2003) did not include data on these locality dots, and these may include unverified sight records as well as specimens. Tim Graham (USGS Canyonlands Research Station, Moab, Utah, personal communication) has captured Southwestern Black-headed Snakes in pitfall traps in Salt Creek in Canyonlands National Park, just north of GLCA. It seems likely that isolated populations of this small, secretive species occur within the recreation area.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

While there are no specimens of this species from GLCA, it is known to occur in the Moab area north of the recreation area and along the San Juan River in southeastern Utah (Stebbins 2003). Woodbury (1958) reported an observation made by an observer he believed credible, in Smith Fork Canyon, within what is now GLCA. The Black-necked Garter Snake almost certainly occurs within GLCA.

Table G-1. Amphibian and reptile species known or expected to occur at Glen Canyon National Recreation Area. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, except for Bullfrog, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively. If found, the Bullfrog would be non-native for residency.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	SP	Present in Park	Uncommon
Plains Spadefoot	2	Unconfirmed	
Great Basin Spadefoot	SP	Present in Park	Uncommon
Mexican Spadefoot	3	Probably Present	
Great Plains Toad	2	Unconfirmed	
Red-spotted Toad	SP	Present in Park	Abundant
Woodhouse's Toad	SP	Present in Park	Abundant
Canyon Treefrog	SP	Present in Park	Common
Bullfrog	1	Unconfirmed	
Northern Leopard Frog	SP	Present in Park	Uncommon
Painted Turtle	1	Historic	Rare
Great Basin Collared Lizard	SP	Present in Park	Common
Eastern Collared Lizard	3	Probably Present	
Long-nosed Leopard Lizard	SP	Present in Park	Common
Lesser Earless Lizard	1	Unconfirmed	
Greater Short-horned Lizard	3	Probably Present	
Desert Horned Lizard	SP	Present in Park	Uncommon
Common Chuckwalla	SP	Present in Park	Common
Sagebrush Lizard	SP	Present in Park	Uncommon
Desert Spiny Lizard	SP	Present in Park	Abundant
Eastern Fence Lizard	SP	Present in Park	Abundant
Ornate Tree Lizard	SP	Present in Park	Abundant
Side-blotched Lizard	SP	Present in Park	Abundant
Many-lined Skink	2	Unconfirmed	
Western Whiptail	SP	Present in Park	Abundant
Plateau Striped Whiptail	3	Probably Present	
Desert Night Lizard	3	Probably Present	
Western Banded Gecko	SP	Present in Park	Rare
Glossy Snake	SP	Present in Park	Uncommon
Ring-necked Snake	2	Unconfirmed	
Night Snake	SP	Present in Park	Common
Common Kingsnake	SP	Present in Park	Uncommon
Milk Snake	1	Unconfirmed	
Striped Whipsnake	SP	Present in Park	Common
Gopher Snake	SP	Present in Park	Uncommon
Long-nosed Snake	SP	Present in Park	Rare
Western Patch-nosed Snake	SP	Present in Park	Uncommon
Western Ground Snake	OP	Present in Park	Rare
Southwestern Black-headed Snake	3	Probably Present	
Black-necked Garter Snake	3	Probably Present	
Western Terrestrial Garter Snake	SP	Present in Park	Rare
Western Rattlesnake	SP	Present in Park	Common
TOTAL RANK 1	4		
TOTAL RANK 2	4		
TOTAL RANK 3	7		
TOTAL FOUND (SX, OX, SP, OP)	27		
WEIGHTED TOTAL	35.5		
ESTIMATED INVENTORY COMPLETENESS	76%		

Table G-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Glen Canyon National Recreation Area in 2003. GS = general survey, NGS = nocturnal general survey, ND = night drive, and RE = random encounter.

Species	GS	NGS	ND	RE	Total
Great Basin Spadefoot		4		7	11
Red-spotted Toad	160	9	5	7	181
Woodhouse's Toad	156	27	1	332	516
Canyon Treefrog	14	4		5	23
Northern Leopard Frog	20			4	24
Great Basin Collared Lizard	5			2	7
Long-nosed Leopard Lizard	2		1	15	18
Desert Horned Lizard	1				1
Common Chuckwalla	1			4	5
Sagebrush Lizard	2				2
Desert Spiny Lizard	44			14	58
Eastern Fence Lizard	25			8	33
Ornate Tree Lizard	48			9	57
Side-blotched Lizard	203			59	262
Western Whiptail	107			29	136
Night Snake				2	2
Common Kingsnake	1				1
Striped Whipsnake	4			4	8
Gopher Snake	1			1	2
Western Patch-nosed Snake	1			2	3
Western Rattlesnake	1		2	2	5
TOTAL	796	44	9	506	1,355

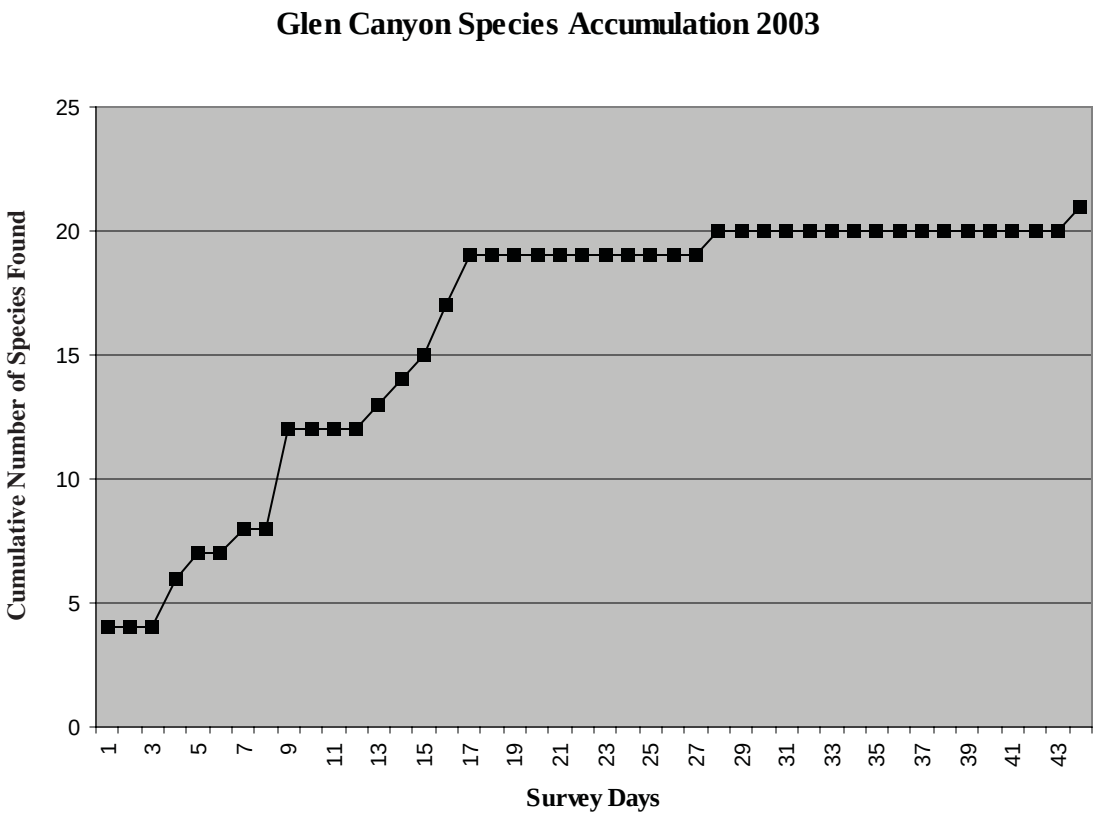

Figure G-1. Species accumulation curve for amphibians and reptiles at Glen Canyon National Recreation Area, 2003.

Appendix H. Grand Canyon National Park (GRCA)

GRCA is located in north-central Arizona, along 445 km (278 mi) of the Colorado River. Elevation ranges between 348 and 2,798 m (1,142-9,180 ft). The park encompasses 489,529 ha (1,209,137 acres), and was established to protect a very large canyon. Habitats at GRCA range from desertscrub plant communities within the canyon showing affinities to three North American deserts (Mojave, Sonoran, Great Basin), to pinyon-juniper woodlands and ponderosa pine and spruce-fir forests on the canyon rims. Additional information on natural resources at GRCA is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We did not conduct fieldwork at GRCA during the present inventory project. For completeness, however, we have attempted to summarize what is known about the occurrence of amphibians and reptiles at this and other unfunded parks in the SCPN. Through literature review and personal communication with other herpetologists, we consider 43 species to be documented within GRCA, with one additional species (Northern Leopard Frog) likely extirpated from the park (Table H-1). Undocumented species that may occur within the park are discussed below. While most documented species are represented by voucher specimens, we have made no attempt to verify this, and leave the job of conducting a comprehensive inventory of amphibians and reptiles at GRCA to future researchers.

Miller et al. (1982) provided the most recent comprehensive overview of the park's herpetofauna. Earlier overviews include Dodge (1938), Durham (1956), McKee and Bogert (1934), and Tomko (1975). Distributional notes on amphibians and reptiles in GRCA include Brown (2000a, b, c, 2003), Johnson and Carothers (1983a, b), and Wright and Lowe (1993). Tomko (1976a, b) and Warren and Schwalbe (1985) studied the ecological aspects of the lizard fauna along the Colorado River in GRCA.

Estimate of Inventory Completeness at GRCA

Based on species documented in the literature and our evaluation of hypothetical species, we estimate an inventory completeness of 84% for GRCA (Table H-1). Most of the undocumented species likely to occur at GRCA are known from very nearby, and may only occur at the extreme edge of the park in one or more areas. Those species we consider most likely to be found within GRCA include Mexican Spadefoot, Great Plains Toad, Long-nosed Leopard Lizard, Lesser Earless Lizard, Glossy Snake, Western Diamond-backed Rattlesnake, and Mojave Rattlesnake.

Sensitive Species and Threats to the Herpetofauna

Northern Leopard Frogs have been previously documented from the park (at Cardenas Marsh and Ribbon Falls), but may now be extirpated (Charles Drost, personal communication). Recently, leopard frogs were discovered at a number of sites in Surprise Canyon, in the western part of GRCA, and preliminary genetic analyses suggest these may be Lowland Leopard Frogs (Charles Drost, personal communication). Relict Leopard Frog, which is a candidate species for listing under the federal Endangered Species Act, could possibly occur in the extreme western Grand Canyon. Potential threats to leopard frogs in GRCA include drought, disease, catastrophic flood events, and recreational use of frog habitats. Desert Tortoise, a federally threatened species, was documented from extreme western GRCA in the 1970's (Tom Van Devender, personal communication), but its current status within the park is unknown.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at GRCA is only 84%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort should focus on documenting species considered highly likely to occur, i.e., those with a probability ranking of 3 in Table H-1. In addition, many species are known from only one or two localities within the park (e.g., Desert Night Lizard, Little Striped Whiptail, Long-nosed Snake, Ring-necked Snake), and future work could help to better determine the distribution and status of these species within GRCA.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at GRCA to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location,

preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At GRCA, amphibian monitoring would likely include all known leopard frog populations (currently limited to the recently discovered populations in Surprise Canyon) and Canyon Treefrogs in tinaja habitats throughout the park. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At GRCA, potential target species could include Eastern Fence Lizard, Side-blotched Lizard, Ornate Tree Lizard, and Western Whiptail, because these species are common throughout much of the park and many other SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at GRCA

Because we do not have much first-hand experience at GRCA, we obtained information on species documentation from the literature (e.g., Brown 2000a, b, c; 2003, Miller et al. 1982, Tomko 1975). We briefly discuss the possible occurrence of other, undocumented species below. A list of all documented and hypothetical species at GRCA, as well as NPSpecies checklist field assignments, are also presented in Table H-1.

Species That Possibly Occur at Grand Canyon National Park

Plains Spadefoot (*Spea bombifrons*)

This species is found throughout much of northeastern Arizona (Stebbins 2003), and may occur along the eastern edge of GRCA.

Mexican Spadefoot (*Spea multiplicata*)

This spadefoot is widespread in the GRCA region south and east of the Colorado River (Stebbins 2003), and almost certainly occurs within the park.

Sonoran Desert Toad (*Bufo alvarius*)

Stebbins (2003) mentions and maps a sight record from Seventyfive Mile Creek in eastern GRCA, far from its known range in southern Arizona and along the lower Colorado River valley. It seems unlikely that populations of this very large toad would exist virtually unnoticed along the Colorado River in GRCA, and we suspect this record may be in error.

Great Plains Toad (*Bufo cognatus*)

This species is distributed widely in the GRCA region, and it seems likely that it occurs somewhere within the park. Ross (1999) reported a specimen collected in 1938 from "Robinson's Dam, Cataract (= Havasu) Canyon", which he described as the first record for the GRCA area. We have been unable to find this locality on USGS topographic maps or in various place name books, and therefore cannot determine how close this locality is to the boundaries of GRCA.

Bullfrog (*Rana catesbeiana*)

This species, native to the eastern United States, has become widely established in the Southwest (Stebbins 2003). Although Bullfrogs have not been reported from GRCA, they could conceivably be introduced at various locations in the park (cattle tanks, quiet backwaters along the Colorado River, permanent pools in side canyons).

Relict Leopard Frog (*Rana onca*)

This species is found in the Lake Mead-Virgin River region just west of GRCA. Leopard frogs discovered recently in Surprise Canyon in western GRCA were initially thought, based on geographic proximity, to be this species, but genetic analysis suggests these frogs are Lowland Leopard Frogs (Lisa Gelczis, USGS Colorado Plateau Research Station, personal communication). Isolated populations of Relict Leopard Frogs may occur in extreme western GRCA.

Northern Leopard Frog (*Rana pipiens*)

Tomko (1975) first reported this species from GRCA, at Cardenas Marsh near river mile 71, and this is the only record noted by Miller et al. (1982). This population is apparently extirpated (Charles Drost, personal communication). Mike Sredl (Arizona Game and Fish Department) observed a Northern Leopard Frog at Ribbon Falls along Bright Angel Creek in 1987, which was the last known sighting of this species in the park (Charles Drost, personal communication).

Desert Iguana (*Dipsosaurus dorsalis*)

Miller et al. (1982) suggest the Desert Iguana could occur in the western Grand Canyon, but the detailed dot distribution map in Hulse (1992) indicates the species has not been found particularly close to GRCA. Although possible, it seems unlikely this large, diurnal lizard would be overlooked in the park.

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

This widespread species is found throughout the GRCA region (Stebbins 2003), and probably occurs in desert or other

shrub dominated habitats somewhere within the park, especially in the western portion or along or near the Colorado River between Lee's Ferry and the Little Colorado River.

Lesser Earless Lizard (*Holbrookia maculata*)

This small, ground-dwelling species is widespread in Northern Arizona, and is found both north and south of GRCA (Stebbins 2003). The Lesser Earless Lizard is usually found in shrub or grassland habitats in the region, and could occur in a number of areas in the park.

Long-tailed Brush Lizard (*Urosaurus graciosus*)

Miller et al. (1982) listed this species as possibly occurring in the western portion of GRCA, but the detailed distribution map in Vitt and Dickson (1988) indicates that Long-tailed Brush Lizards have not been found east of the immediate Colorado and Virgin rivers along the Arizona-Nevada border. However, targeted surveys in the extreme western GRCA could help determine if undiscovered populations of this small, cryptic species do indeed exist in the desert corridor along the Colorado River.

Glossy Snake (*Arizona elegans*)

Glossy Snakes occur throughout the region of the eastern Grand Canyon (Stebbins 2003), and almost certainly occur within the park in this area.

Milk Snake (*Lampropeltis triangulum*)

Milk Snakes have a spotty distribution in Northern Arizona, where they usually occur in grassland habitats. In Utah, however, they often occur in higher elevation woodlands in the central mountains. Although Milk Snakes have not been reported from GRCA, their disjunct distribution throughout the region suggests they could be found almost anywhere.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

This species has not been reported from GRCA, but its occurrence in the San Juan River region of southeastern Utah (Stebbins 2003) and the Little Colorado River valley of northeastern Arizona (Persons and Rosen 2001), as well as an unsubstantiated report from the Colorado River in southern GLCA (Woodbury 1959), suggest the species could be found in GRCA.

Western Diamond-backed Rattlesnake (*Crotalus atrox*)

Brown (2000a) reported Western Diamond-backed Rattlesnake from "Grand Canyon, confluence of Diamond Creek and Colorado River: river mile 225.7," a locality probably just outside the boundaries of the park. Unless the Colorado River has constituted an impenetrable barrier to dispersal, Western Diamond-backed Rattlesnakes likely occur within GRCA on the north side of the river in this area as well.

Mojave Rattlesnake (*Crotalus scutulatus*)

Brown (2003) reported a Mojave Rattlesnake from "Hualapai Indian Reservation, Quartermaster Point, 0.8 km from the Colorado River: river mile 260.5 L," the first record from within Grand Canyon. This record suggests the species probably occurs nearby within the park as well.

Table H-1. Amphibian and reptile species known or expected to occur at Grand Canyon National Park. Documentation of species occurrence is based on numerous literature sources (e.g., Brown (2000a, b, c, 2003, Miller et al. 1982, Tomko 1975). Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	X	Present in Park	Common
Plains Spadefoot	2	Unconfirmed	
Great Basin Spadefoot	X	Present in Park	Common
Mexican Spadefoot	3	Probably Present	
Sonoran Desert Toad	2	Unconfirmed	
Great Plains Toad	3	Probably Present	
Red-spotted Toad	X	Present in Park	Abundant
Woodhouse's Toad	X	Present in Park	Abundant
Canyon Treefrog	X	Present in Park	Abundant
Bullfrog	1	Unconfirmed	
Relict Leopard Frog	1	Unconfirmed	
Northern Leopard Frog	2	Historic	
Lowland Leopard Frog	X	Present in Park	Rare
Desert Tortoise	X	Present in Park	Rare
Zebra-tailed Lizard	X	Present in Park	Uncommon
Great Basin Collared Lizard	X	Present in Park	Common
Eastern Collared Lizard	X	Present in Park	Common
Desert Iguana	1	Unconfirmed	
Long-nosed Leopard Lizard	3	Probably Present	
Lesser Earless Lizard	3	Probably Present	
Greater Short-horned Lizard	X	Present in Park	Common
Desert Horned Lizard	X	Present in Park	Uncommon
Common Chuckwalla	X	Present in Park	Common
Sagebrush Lizard	X	Present in Park	Abundant
Desert Spiny Lizard	X	Present in Park	Abundant
Eastern Fence Lizard	X	Present in Park	Abundant
Long-tailed Brush Lizard	1	Unconfirmed	
Ornate Tree Lizard	X	Present in Park	Abundant
Side-blotched Lizard	X	Present in Park	Abundant
Many-lined Skink	X	Present in Park	Rare
Western Skink	X	Present in Park	Common
Little Striped Whiptail	X	Present in Park	Rare
Western Whiptail	X	Present in Park	Abundant
Plateau Striped Whiptail	X	Present in Park	Common
Desert Night Lizard	X	Present in Park	Rare
Western Banded Gecko	X	Present in Park	Uncommon
Gila Monster	X	Present in Park	Rare
Western Blind Snake	X	Present in Park	Rare
Glossy Snake	3	Probably Present	
Ring-necked Snake	X	Present in Park	Rare
Night Snake	X	Present in Park	Uncommon
Common Kingsnake	X	Present in Park	Uncommon
Sonoran Mountain Kingsnake	X	Present in Park	Uncommon
Milk Snake	1	Unconfirmed	
Coachwhip	X	Present in Park	Uncommon
Striped Whipsnake	X	Present in Park	Common

Table H-1. Amphibian and reptile species known or expected to occur at Grand Canyon National Park. Documentation of species occurrence is based on numerous literature sources (e.g., Brown (2000a, b, c, 2003, Miller et al. 1982, Tomko 1975). Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.—Continued

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Gopher Snake	X	Present in Park	Common
Long-nosed Snake	X	Present in Park	Rare
Western Patch-nosed Snake	X	Present in Park	Uncommon
Western Ground Snake	X	Present in Park	Rare
Southwestern Black-headed Snake	X	Present in Park	Rare
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	X	Present in Park	Common
Western Lyre Snake	X	Present in Park	Rare
Western Diamond-backed Rattlesnake	3	Probably Present	
Speckled Rattlesnake	X	Present in Park	Common
Black-tailed Rattlesnake	X	Present in Park	Uncommon
Mojave Rattlesnake	3	Probably Present	
Western Rattlesnake	X	Present in Park	Common
TOTAL RANK 1	6		
TOTAL RANK 2	3		
TOTAL RANK 3	7		
TOTAL DOCUMENTED	43		
WEIGHTED TOTAL	51.3		
ESTIMATED INVENTORY COMPLETENESS	84%		

Appendix I. Hubbell Trading Post National Historic Site (HUTR)

HUTR is located near Ganado, on the Navajo Nation in northeastern Arizona. Elevation ranges between 1,920 and 1,946 m (6,300-6,385 ft). The historic site encompasses 65 ha (160 acres), and was established to protect the historic Hubbell Trading Post, which is still active. Habitats at HUTR are dominated by various shrub communities, as well as pinyon-juniper woodland. An intermittent wash, Pueblo Colorado Wash, runs through the site. Additional information on natural resources at HUTR is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

The Navajo Department of Fish and Wildlife (Navajo Natural Heritage Program) conducted herpetofauna inventories at the three SCPN parks located on the Navajo Nation in 2002-2003. Mikesic (2005b) used 1-ha TACS plot surveys, general surveys, and night driving to survey for amphibians and reptiles at HUTR. Through his own surveys and literature review he documented 11 species (Table I-1), with the most common being the Woodhouse's Toad, Sagebrush Lizard, and Plateau Striped Whiptail.

Estimate of Inventory Completeness at HUTR

Based on our own list of hypothetical species at HUTR, we calculated an estimated inventory completeness of 69% (Table I-1).

Sensitive Species and Threats to the Herpetofauna

No sensitive amphibian or reptile species have been documented from HUTR.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at HUTR is only 69%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort should focus on documenting species most likely to occur, i.e., Tiger Salamander, Greater Short-horned Lizard, Glossy Snake, Night Snake, and Striped Whipsnake.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at HUTR to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At HUTR, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as areas in Pueblo Colorado Wash where Woodhouse's Toads are common. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At HUTR, Sagebrush Lizards and Plateau Striped Whiptail may be good candidates for monitoring, because these species are common throughout the site and at many SCPN parks (especially Plateau Striped Whiptail), making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at HUTR

Because we do not have first-hand experience at HUTR, we refer readers to Mikesic (2005b) for details of distribution and abundance of amphibian and reptile species documented from the historic site. We briefly discuss the possible occurrence of other, undocumented species below. A list of all documented and hypothetical species at HUTR, as well as NPSpecies checklist field assignments, are presented in Table I-1.

Species That Possibly Occur at Hubbell Trading Post National Historic Site

Tiger Salamander (*Ambystoma tigrinum*)

Tiger Salamanders are common over most of the Colorado Plateau, including in areas without permanent water such as Petrified Forest National Park south of HUTR (Drost et al. 2001). Pools within Pueblo Colorado Wash may not be large enough or persist long enough for Tiger Salamanders to breed within the site. However, adults, who probably travel long distances to breed, may be present on and near HUTR.

Red-spotted Toad (*Bufo punctatus*)

The Red-spotted Toad is found throughout the region, but usually prefers rocky habitats, and is therefore unlikely to occur within HUTR.

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

This lizard occurs in the Little Colorado River valley south of HUTR, as well in the San Juan River valley to the north, but has not been found near HUTR (Stebbins 2003). Although unlikely, it is possible that undiscovered populations of Long-nosed Leopard Lizard exist in the HUTR area.

Greater Short-horned Lizard (*Phrynosoma hernandesi*)

The Greater Short-horned Lizard is common over most of the Colorado Plateau (Stebbins 2003), and almost certainly occurs at HUTR.

Ornate Tree Lizard (*Urosaurus ornatus*)

This widespread species is common at CACH to the north of HUTR (Mikesic 2005a), but its preference for rocky, bouldery habitats suggests it probably does not occur within HUTR.

Side-blotched Lizard (*Uta stansburiana*)

Like the Tree Lizard, the Side-blotched Lizard prefers rocky habitats in the southern Colorado Plateau region. Although common elsewhere in the region, including north of HUTR at CACH (Mikesic 2005a) and south of HUTR at PEFO (Drost et al. 2001), the lack of suitable habitat suggests it is probably absent from HUTR.

Glossy Snake (*Arizona elegans*)

The Glossy Snake is found throughout the Navajo Nation region in northeastern Arizona (Stebbins 2003), and is fairly common south of HUTR at PEFO (Drost et al. 2001). This species prefers loose, sandy soil suitable for burrowing, and almost certainly occurs at HUTR.

Ring-necked Snake (*Diadophis punctatus*)

Although not known from the vicinity of HUTR (Stebbins 2003), this secretive species has a spotty distribution throughout the Southwest, and could occur almost anywhere suitable mesic microhabitats exist. At HUTR, the species would be most likely to occur near Pueblo Colorado Wash, where permanent subsurface moisture is available.

Night Snake (*Hypsiglena torquata*)

Stebbins (2003) depicts the range of this widespread, strictly nocturnal species as being absent from much of the Navajo Nation, including the vicinity of HUTR. However, recent records from elsewhere on the Navajo Nation (Andy Holycross, personal communication) suggest this gap in the range is merely a survey artifact. Night Snake was one of the most common snakes found while night driving at PEFO (Drost et al. 2001), and almost certainly occurs at HUTR.

Milk Snake (*Lampropeltis triangulum*)

This species has a disjunct distribution in grasslands on the southern Colorado Plateau (Stebbins 2003), and is known from a number of areas in the Little Colorado River valley south of HUTR, including PEFO (Drost et al. 2001). While Milk Snakes have not been recorded in the vicinity of HUTR, this secretive species could occur at the site.

Striped Whipsnake (*Masticophis taeniatus*)

The Striped Whipsnake is widespread and common over most of the Colorado Plateau (Stebbins 2003), and almost certainly occurs at HUTR.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

Black-necked Garter Snakes are known from the Little Colorado River Valley south of HUTR (Persons and Rosen 2001) and the San Juan River area north of HUTR (Stebbins 2003), and isolated populations may exist on the Navajo Nation in between. Because Western Terrestrial Garter Snakes are known from HUTR, habitat may be suitable for Black-necked Garter Snakes as well.

Table I-1. Amphibian and reptile species known or expected to occur at Hubbell Trading Post National Historic Site. Species documentation is based on the work of Mikesic (2005b). Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	2	Unconfirmed	
Plains Spadefoot	X	Present in Park	Common
Mexican Spadefoot	X	Present in Park	Common
Red-spotted Toad	1	Unconfirmed	
Woodhouse's Toad	X	Present in Park	Common
Eastern Collared Lizard	X	Present in Park	Uncommon
Long-nosed Leopard Lizard	1	Unconfirmed	
Lesser Earless Lizard	X	Present in Park	Uncommon
Greater Short-horned Lizard	3	Probably Present	
Sagebrush Lizard	X	Present in Park	Abundant
Eastern Fence Lizard	X	Present in Park	Common
Ornate Tree Lizard	1	Unconfirmed	
Side-blotched Lizard	1	Unconfirmed	
Plateau Striped Whiptail	X	Present in Park	Abundant
Glossy Snake	3	Probably Present	
Ring-necked Snake	1	Unconfirmed	
Night Snake	3	Probably Present	
Milk Snake	1	Unconfirmed	
Striped Whipsnake	3	Probably Present	
Gopher Snake	X	Present in Park	Common
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	X	Present in Park	Common
Western Rattlesnake	X	Present in Park	Uncommon
TOTAL RANK 1	7		
TOTAL RANK 2	1		
TOTAL RANK 3	4		
TOTAL DOCUMENTED (X)	11		
WEIGHTED TOTAL	16.0		
ESTIMATED INVENTORY COMPLETENESS	69%		

Appendix J. Mesa Verde National Park (MEVE)

MEVE is located on Mesa Verde, in Montezuma County in extreme southwestern Colorado. Elevation ranges between 1,833 and 2,613 m (6,014-8,573 ft). The park encompasses 21,504 ha (53,115 acres), and was established to protect ancient Puebloan cliff dwellings and other archaeological sites. Pinyon-juniper woodland and chaparral are the dominant vegetation types at MEVE. Numerous canyons drain from the mesa to the Mancos River, which forms the park's eastern boundary. Additional information on natural resources at MEVE is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We did not conduct fieldwork at MEVE during the present inventory project. For completeness, however, we have attempted to summarize what is known about the occurrence of amphibians and reptiles at this and other unfunded parks in the SCPN. Through literature review and communication with staff at MEVE, we consider 19 species to be documented within MEVE, with one additional species (Northern Leopard Frog) likely extirpated from the park. We present a list of these species (Table J-1), and briefly discuss additional undocumented species that may occur within the park below.

Estimate of Inventory Completeness at MEVE

Based on our own list of hypothetical species at MEVE, we calculated an estimated inventory completeness of 90% (Table J-1).

Sensitive Species and Threats to the Herpetofauna

Northern Leopard Frogs historically were common along the Mancos River at MEVE (Douglas 1966), but were extirpated in the 1970's (Marilyn Colyer, personal communication). The park has initial plans to reintroduce frogs into this area, but has so far been unable to locate a suitable, nearby source population (Marilyn Colyer, personal communication). Potential threats to the herpetofauna at MEVE include drought and wildfire, which may affect some species (e.g., Smooth Green Snake) characteristically found in mesic microhabitats.

Considerations for Future Inventory and Long-term Monitoring

The NPS may wish to target amphibians in any additional herpetofauna inventory work conducted at MEVE, as Mexican Spadefoot and Western Chorus Frog may both occur in the park. Although apparently extirpated from the park, other areas of the Mancos River outside MEVE could be surveyed for Northern Leopard Frog, in the hope of locating a nearby population that could be used to supply frogs for a reintroduction effort in the park. Potential undocumented snake species will probably, if present, be detected opportunistically by park staff or other researchers.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at MEVE to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At MEVE, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of potential breeding sites in canyons and along the Mancos River. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the group best reptile group suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At MEVE, common lizards (we suspect these include Plateau Striped Whiptail and Eastern Fence Lizard) may be good candidates for monitoring because these species are common throughout most SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at MEVE

Because we do not have first hand experience at MEVE, we refer readers to Douglas (1966) for details of distribution and abundance of amphibian and reptile species documented from the monument. We briefly discuss the possible occurrence of other, undocumented species below. A list of all documented and hypothetical species at MEVE, as well as NPSpecies checklist field assignments, are presented in Table J-1.

Species That Possibly Occur at Mesa Verde National Park

Plains Spadefoot (*Spea bombifrons*)

This species has not been recorded from the MEVE area (Hammerson 1999), but is known from pinyon-juniper habit near Hovenweep National Monument in extreme southeastern Utah (Persons and Nowak 2004b). The Plains Spadefoot often coexists with the similar Mexican Spadefoot, and if the latter is found at MEVE, it is possible that this species could occur there as well.

Mexican Spadefoot (*Spea multiplicata*)

Douglas (1966) suggested that the Mexican Spadefoot probably occurs along the Mancos River adjacent to MEVE. This species is widespread in the region, and is much more likely to occur at MEVE than is the similar Plains Spadefoot.

Western Chorus Frog (*Pseudacris triseriata*)

This tiny frog is widespread in the MEVE region (Hammerson 1999), and may occur within the park, although the lack of verified sightings suggests it would have a restricted distribution. This species usually breeds in quiet, temporary pools (cattle tanks, roadside ditches, etc.) with emergent or dense bank vegetation.

Northern Leopard Frog (*Rana pipiens*)

Douglas (1966) described the Northern Leopard Frog as common along the Mancos River on the east boundary of MEVE. However, the species has since disappeared from the park, possibly due to the widespread use of mosquito control pesticides in the region in the 1970's, when populations declined throughout Montezuma County (Marilyn Colyer, MEVE, personal communication). The NPS has plans to reintroduce Northern Leopard Frogs at MEVE, but has been unable to locate a nearby source population with adequate numbers of frogs (Marilyn Colyer, personal communication).

Racer (*Coluber constrictor*)

This species is only known from a single locality in southwestern Colorado, along the Animas River just north of the Colorado border (Hammerson 1999). However, Racers occupy similar shrubland and riparian habitats as those available at MEVE (Hammerson 1999), and could conceivably occur in the park, especially along the Mancos River.

Ring-necked Snake (*Diadophis punctatus*)

Although this species has not been documented from the MEVE area, it has a spotty, disjunct distribution throughout the Southwest (Stebbins 2003), and could conceivably occur almost anywhere. If isolated populations occur at MEVE, they would most likely be in areas with permanent subsurface moisture, such as along the Mancos River.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

The Black-necked Garter Snake has not been recorded from the immediate vicinity of MEVE, but has been found elsewhere in southwestern Colorado. If present at MEVE, it would most likely occur along the Mancos River within the park.

Table J-1. Amphibian and reptile species known or expected to occur at Mesa Verde National Park. Documentation of species occurrence is primarily based on Douglas (1966) and personal communications with Marilyn Colyer (NPS). Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	X	Present in Park	Uncommon
Plains Spadefoot	1	Unconfirmed	
Mexican Spadefoot	3	Probably Present	
Red-spotted Toad	X	Present in Park	Uncommon
Woodhouse's Toad	X	Present in Park	Uncommon
Western Chorus Frog	2	Unconfirmed	
Northern Leopard Frog	1	Historic	
Eastern Collared Lizard	X	Present in Park	Common
Lesser Earless Lizard	X	Present in Park	Rare
Greater Short-horned Lizard	X	Present in Park	Common
Sagebrush Lizard	X	Present in Park	Abundant
Eastern Fence Lizard	X	Present in Park	Abundant
Ornate Tree Lizard	X	Present in Park	Common
Side-blotched Lizard	X	Present in Park	Uncommon
Many-lined Skink	X	Present in Park	Rare
Plateau Striped Whiptail	X	Present in Park	Common
Racer	1	Unconfirmed	
Ring-necked Snake	1	Unconfirmed	
Night Snake	X	Present in Park	Uncommon
Milk Snake	X	Present in Park	Rare
Striped Whipsnake	X	Present in Park	Common
Smooth Green Snake	X	Present in Park	Rare
Gopher Snake	X	Present in Park	Common
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	X	Present in Park	Common
Western Rattlesnake	X	Present in Park	Common
TOTAL RANK 1	5		
TOTAL RANK 2	1		
TOTAL RANK 3	1		
TOTAL DOCUMENTED	19		
WEIGHTED TOTAL	21.2		
ESTIMATED INVENTORY COMPLETENESS	90%		

Appendix K. Navajo National Monument (NAVA)

NAVA is located on the northwestern part of the Navajo Nation, in Coconino County, Arizona. The monument consists of three separate units (Betatakin, Keet Seel, and Inscription House), and was established to protect ancient Anasazi ruins found at these sites. The monument encompasses 244 ha (603 acres), and elevation ranges between 1,658 and 2,294 m (5,440-7,527 ft). Habitats at NAVA include ponderosa pine and mixed-conifer forests, pinyon-juniper woodlands, and sagebrush and saltbush shrub communities. Numerous springs, seeps, and streams are located within the monument. Additional information on natural resources at NAVA is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

The Navajo Department of Fish and Wildlife (Navajo Natural Heritage Program) conducted herpetofauna inventories at the three SCPN parks located on the Navajo Nation in 2002-2003. Mikesic (2005c) used 1-ha TACS plot surveys, general surveys, and night driving to survey for amphibians and reptiles at NAVA. Through his own surveys and literature review Mikesic (2005c) documented 16 species (Table K-1), with the most common being the Woodhouse's Toad, Sagebrush Lizard, and Plateau Striped Whiptail. He did not observe one species (Canyon Treefrog) reported previously, and he did observe an Eastern Collared Lizard west of the Inscription House unit, outside the boundary of NAVA. The most significant discovery made by Mikesic (2005c) was of a small population of Northern Leopard Frogs at the Inscription House unit, a species that has been virtually eliminated from the Navajo Nation (Mikesic 2005c).

Estimate of Inventory Completeness at NAVA

Based on our own list of hypothetical species at NAVA, we calculated an estimated inventory completeness of 71% (Table K-1).

Sensitive Species and Threats to the Herpetofauna

Mikesic (2005c) documented Northern Leopard Frog from the Inscription House unit of NAVA, and noted that natural flood events could easily destroy this habitat through sedimentation of the pool where the frogs were found. Sedimentation is a natural process that was probably responsible for creating the pool habitat. However, because Northern Leopard Frogs have drastically declined over the entire Navajo Nation in recent decades, Mikesic (2005c) recommended that protection of this population be a high management priority. Potential extrinsic threats to other amphibians and reptiles include drought and continued lowering of the local water table (Thomas et al. 2004), which could reduce water availability for amphibian breeding.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at NAVA is only 71%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort may wish to target species most likely to occur, including Tiger Salamander, Eastern Collared Lizard, Many-lined Skink, Glossy Snake, Night Snake, and Western Terrestrial Garter Snake. Without the benefit of extensive roads available for night driving surveys, locating many snake species may require substantial field effort and different methods, such as funnel or pitfall traps.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at NAVA to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. The highest priority for amphibian monitoring is the small population of Northern Leopard Frogs at Inscription House. Amphibian monitoring at NAVA may also include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At NAVA, Sagebrush Lizard and Plateau Striped Whiptail may be good candidates for

monitoring, because these species are common throughout the monument and at many SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at NAVA

Because we do not have first hand experience at NAVA, we refer readers to Mikesic (2005c) for details of distribution and abundance of amphibian and reptile species documented from the monument. We briefly discuss the possible occurrence of other, undocumented species below. A list of all documented and hypothetical species at NAVA, as well as NPSpecies checklist field assignments, are also presented in Table K-1.

Species That Possibly Occur at Navajo National Monument

Tiger Salamander (*Ambystoma tigrinum*)

Tiger Salamanders are common over most of the Colorado Plateau (Stebbins 2003), and almost certainly occur at one or more units of NAVA.

Great Plains Toad (*Bufo cognatus*)

This species has been documented from the general vicinity of NAVA (Krupa 1990). However, it usually occurs in lower elevation grassland habitats in the region, making its occurrence within the monument unlikely.

Eastern Collared Lizard (*Crotaphytus collaris*)

Mikesic (2005c) observed this species just west of the Inscription House Ruin unit of NAVA, outside monument boundaries. It almost certainly occurs within the monument as well.

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

This species occurs in the NAVA area (Stebbins 2003), but usually in lower elevation desert habitats. Long-nosed Leopard Lizards are sometimes found in juniper grassland habitats north of Flagstaff, Arizona (Persons and Nowak, personal observation), and could conceivably occur in the lowest elevation shrub dominated habitats at NAVA.

Lesser Earless Lizard (*Holbrookia maculata*)

Lesser Earless Lizards are widespread in the NAVA area (Stebbins 2003), and could occur in open shrub habitats within the monument.

Many-lined Skink (*Eumeces multivirgatus*)

The Many-lined Skink occurs on the eastern Colorado Plateau, including in the NAVA region (Stebbins 2003), and probably occurs within the monument, especially in more mesic microhabitats, such as near washes or under surface debris (logs, etc.) in pinyon-juniper woodland habitats.

Glossy Snake (*Arizona elegans*)

Glossy Snakes occur throughout the NAVA area (Stebbins 2003), and probably occur at one or more units within the monument. This species prefers loose, sandy soil for burrowing.

Ring-necked Snake (*Diadophis punctatus*)

Although this species has not been documented from the NAVA area, it has a spotty, disjunct distribution throughout the Southwest (Stebbins 2003), and could conceivably occur almost anywhere. If isolated populations occur at NAVA, they would most likely be in areas with permanent subsurface moisture, such as near seeps or springs.

Night Snake (*Hypsiglena torquata*)

This small, strictly nocturnal species occurs over most of the Colorado Plateau (Stebbins 2003), and almost certainly occurs at NAVA.

Common Kingsnake (*Lampropeltis getula*)

This species occurs in the general vicinity of NAVA (Stebbins 2003), but has been found only in lower elevation desert and grassland habitats in the region. Although possible, the Common Kingsnake probably does not occur at NAVA.

Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has a spotty distribution in the southern Colorado Plateau region (Stebbins 2003), and could occur almost anywhere. In Arizona, it is found in grassland habitats, while in Utah and western Colorado it is also found in higher elevation pinyon-juniper woodlands, suggesting it could occur in those habitats at NAVA.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

In the Navajo Nation region this species is known from the Little Colorado and San Juan river valleys, and an isolated population could conceivably occur at one or more units of NAVA. If garter snakes are found at NAVA, however, they are more likely to be the much more widespread Western Terrestrial Garter Snake.

Western Terrestrial Garter Snake (*Thamnophis elegans*)

This garter snake is common in a variety of habitats across the Colorado Plateau, and is more terrestrial than most other species (Stebbins 2003). The Western Terrestrial Garter Snake probably occurs at NAVA.

Table K-1. Amphibian and reptile species known or expected to occur at Navajo National Monument. Species documentation is based on the work of Mikesic (2005c). Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	3	Probably Present	
Plains Spadefoot	X	Present in Park	Uncommon
Mexican Spadefoot	X	Present in Park	Common
Great Plains Toad	1	Unconfirmed	
Red-spotted Toad	X	Present in Park	Uncommon
Woodhouse's Toad	X	Present in Park	Common
Canyon Treefrog	X	Present in Park	Rare
Northern Leopard Frog	X	Present in Park	Rare
Eastern Collared Lizard	3	Probably Present	
Long-nosed Leopard Lizard	1	Unconfirmed	
Lesser Earless Lizard	2	Unconfirmed	
Greater Short-horned Lizard	X	Present in Park	Uncommon
Sagebrush Lizard	X	Present in Park	Abundant
Eastern Fence Lizard	X	Present in Park	Abundant
Ornate Tree Lizard	X	Present in Park	Common
Side-blotched Lizard	X	Present in Park	Common
Many-lined Skink	3	Probably Present	
Western Whiptail	X	Present in Park	Uncommon
Plateau Striped Whiptail	X	Present in Park	Abundant
Glossy Snake	3	Probably Present	
Ring-necked Snake	1	Unconfirmed	
Night Snake	3	Probably Present	
Common Kingsnake	1	Unconfirmed	
Milk Snake	1	Unconfirmed	
Striped Whipsnake	X	Present in Park	Uncommon
Gopher Snake	X	Present in Park	Uncommon
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	3	Probably Present	
Western Rattlesnake	X	Present in Park	Uncommon
TOTAL RANK 1	6		
TOTAL RANK 2	1		
TOTAL RANK 3	6		
TOTAL DOCUMENTED (X)	16		
WEIGHTED TOTAL	22.5		
ESTIMATED INVENTORY COMPLETENESS	71%		

Appendix L. Petrified Forest National Park (PEFO)

PEFO is located in northeastern Arizona, straddling the Navajo-Apache county line. Elevation ranges between 1,618 and 1,891 m (5,309-6,204 ft). The park encompasses 38,439 ha (94,944 acres), and was established to protect the abundant Triassic-era petrified wooden resources. Habitats at PEFO include sparsely vegetated badlands, grasslands and shrub grasslands, and juniper woodland (on Chinde Mesa in the northern end of the park). The normally dry Puerco River runs through the park, supporting a cottonwood-willow-tamarisk riparian zone. Additional information on natural resources at PEFO is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We did not conduct fieldwork at PEFO as part of the present inventory project. For completeness, however, we have attempted to summarize what is known about the occurrence of amphibians and reptiles at this and other unfunded parks in the SCPN. Information on species documentation is taken from recent amphibian and reptile inventory work at PEFO (Drost et al. 1999, 2001, Nowak 2003, Nowak and Persons 2000, Persons 2001b, Persons and Wright 1999a, 1999b). Details of abundance and distribution of species at PEFO can be found in these reports.

Estimate of Inventory Completeness at PEFO

Based on previously documented species and evaluation of potentially occurring species, we estimate inventory completeness to be 94% for amphibians and reptiles at PEFO (Table L-1).

Sensitive Species and Threats to the Herpetofauna

The grasslands at PEFO harbor a number of regionally rare species, including Couch's Spadefoot, Little Striped Whiptail, and Milk Snake. Illegal collecting could potentially impact Milk Snake populations within the park, because the occurrence of the species in the park is widely known among herpetoculturists, and collecting could be facilitated by the presence of the paved park road. Road mortality of snakes is currently not severe due to the policy of nighttime road closure (Drost et al. 1999); closing the road slightly earlier in order to avoid the predictable mass exodus of visitors at dusk could reduce mortality further. The New Mexico Whiptail exists as an introduced population along the Puerco River at PEFO (Persons and Wright 1999b), and this population could potentially spread, possibly affecting other whiptail lizard species in and near the park.

Considerations for Future Inventory and Long-term Monitoring

At 94%, inventory completeness at PEFO is the second highest in the SCPN. Long-nosed Leopard Lizard is the only undocumented species that almost certainly occurs within the park, and any future inventory effort may wish to target this species. Other species (all snakes) listed as hypothetical will, if present, probably be found incidentally by park staff or other researchers. While voucher specimens exist for many species at PEFO, it would be valuable to collect specimens (e.g., when found dead on the road) of Couch's Spadefoot and Milk Snake, two species which are known from only a few localities in the region.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at PEFO to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At PEFO, the primary monitoring method for amphibians would be night driving surveys along the paved park road. Drost et al. (1999, 2001) found this to be an extremely effective method for observing all amphibian species known from the park, and PEFO would be an ideal park to help develop this survey technique as a long-term monitoring method in the SCPN. Amphibian monitoring may also include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as backwater pools along and near the Puerco River. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained

searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At PEFO, Sagebrush Lizards, Eastern Fence Lizards, and Plateau Striped Whiptails may be good candidates for long-term monitoring, because these species are common throughout the park and at most other SCPN parks, making network-wide comparisons possible. In addition, the NPS may wish to monitor the introduced population of New Mexico Whiptail along the Puerco River in order to determine if this population is spreading, and if management actions should be undertaken to control it.

Species Accounts of Amphibians and Reptiles at PEFO

Details of distribution and abundance of amphibian and reptile species documented from the park can be found in Drost et al. (1999, 2001) and Nowak and Persons (2000). We briefly discuss the possible occurrence of other, undocumented species below. A list of all documented and hypothetical species at PEFO, as well as NPSpecies checklist field assignments, are presented in Table L-1.

Species That Possibly Occur at Petrified Forest National Park

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

This is the only undocumented species that has a high probability of occurring within PEFO. Suitable habitat for this species exists throughout the park, and Drost et al. (2001) observed an individual only 8 km (5 mi) west of the PEFO boundary, in contiguous floodplain habitat along the Puerco River.

Western Ground Snake (*Sonora semiannulata*)

The Western Ground Snake has not been documented from the vicinity of PEFO, but isolated populations exist in other areas on the Colorado Plateau (Stebbins 2003). Persons (1999) reported a specimen from Wupatki National Monument west of PEFO, suggesting the species could be found further up the Little Colorado River valley as well.

Southwestern Black-headed Snake (*Tantilla hobartsmithi*)

This species has not been documented from northeastern Arizona, but isolated populations in southern Utah and western Colorado suggest this small, secretive snake could be found almost anywhere.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

This species has been found near the Little Colorado River west of Holbrook, Arizona (Persons and Rosen 2001), not far from PEFO. Although the Puerco River is often dry where it runs through PEFO, there is a slight chance that this species might occur in low numbers within the park there, especially in wetter periods when nearby populations could expand their range.

Western Terrestrial Garter Snake (*Thamnophis elegans*)

The Western Terrestrial Garter Snake occurs throughout the PEFO region, and could conceivably occur along the Puerco River within the park.

Table L-1. Amphibian and reptile species known or expected to occur at Petrified Forest National Park. Species documentation is based on Drost et al. (1999, 2001). Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively, except for New Mexico Whiptail, whose nativity is "non-native."

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	X	Present in Park	Uncommon
Couch's Spadefoot	X	Present in Park	Uncommon
Plains Spadefoot	X	Present in Park	Common
Mexican Spadefoot	X	Present in Park	Abundant
Great Plains Toad	X	Present in Park	Abundant
Red-spotted Toad	X	Present in Park	Uncommon
Woodhouse's Toad	X	Present in Park	Uncommon
Eastern Collared Lizard	X	Present in Park	Common
Long-nosed Leopard Lizard	3	Probably Present	
Lesser Earless Lizard	X	Present in Park	Common
Greater Short-horned Lizard	X	Present in Park	Common
Sagebrush Lizard	X	Present in Park	Abundant
Eastern Fence Lizard	X	Present in Park	Abundant
Side-blotched Lizard	X	Present in Park	Common
Little Striped Whiptail	X	Present in Park	Rare
New Mexico Whiptail	X	Present in Park	Rare
Plateau Striped Whiptail	X	Present in Park	Abundant
Glossy Snake	X	Present in Park	Common
Night Snake	X	Present in Park	Common
Common Kingsnake	X	Present in Park	Uncommon
Milk Snake	X	Present in Park	Uncommon
Striped Whipsnake	X	Present in Park	Common
Gopher Snake	X	Present in Park	Common
Western Ground Snake	1	Unconfirmed	
Southwestern Black-headed Snake	1	Unconfirmed	
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	1	Unconfirmed	
Western Rattlesnake	X	Present in Park	Common
TOTAL RANK 1	4		
TOTAL RANK 2	0		
TOTAL RANK 3	1		
TOTAL DOCUMENTED (X)	23		
WEIGHTED TOTAL	24.5		
ESTIMATED INVENTORY COMPLETENESS	94%		

Appendix M. Petroglyph National Monument (PETR)

PETR is located on the western edge of the city of Albuquerque, Bernalillo County, New Mexico, and is jointly owned and managed by the NPS, the state of New Mexico, and the city of Albuquerque. Elevation ranges between 1,519 and 1,838 m (4,984-6,030 ft). The monument encompasses 2,918 ha (7,207 acres), and was established to protect large concentrations of ancient petroglyphs. The western part of PETR consists of grassland habitats and isolated volcanic cinder cones (The Volcanoes), and these habitats are separated from the lower, eastern sand scrub habitats by a prominent rocky, basalt escarpment. A small, disjunct section of the monument is located near the Rio Grande, but does not contain any true riparian habitat. Additional information on natural resources at PETR is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 150 person-hours surveying for herpetofauna at PETR in 2001-2003. Methods used, and number of person-hours spent on each method, included general surveys (92.3), nocturnal general surveys (9.6), random 1-ha TACS plot surveys (26.9), random 10-ha TACS plot surveys (9.1), non-random 1-ha TACS plot surveys (11.1), and night driving (0.5). We recorded 487 individual amphibians and reptiles of 19 species during our surveys. Five additional species were documented based on our review of the literature and museum specimen records, and one species (Texas Blind Snake) was collected for us by another researcher working in the monument. A summary of the total number of each species observed by each method is presented in Table M-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at PETR

Between our surveys at PETR and inclusion of previously documented species we estimate an inventory completeness of 79% (Table M-1). An asymptotic species accumulation curve based on our surveys in 2001-2003 (Figure M-1) suggests we are close to reaching inventory completeness. However, we believe this is a false asymptote that suggests only that we are close to detecting most of the common species using our current methods. We have documentation of seven additional species not included in Figure M-1 (museum records, random encounters made during the study period by park staff and other researchers), and there are six more species that are highly likely (i.e., rank of “3” in Table M-1) to occur within the monument. Thus, detecting the remaining species at PETR would require much greater field effort and more targeted searches during favorable conditions.

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from PETR. We used dot distribution maps in Degenhardt et al. (1996) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to PETR. We located museum specimen records for 12 species at PETR (Appendix T), and we observed all but one of these species (Night Snake) during our surveys.

The only previous literature on the amphibians and reptiles of PETR is Parmenter et al. (1996). They reported, from both field surveys and museum specimen records, a number of species not observed by us. However, some of these reports are suspect. For example, Parmenter et al. (1996) reported three species of garter snakes along the escarpment within PETR, which we believe is unlikely given the dry conditions in these areas. In addition, their list of museum records was larger than ours, likely because they included records from the “West Mesa” area of Albuquerque, an area much larger than the actual boundaries of PETR. In addition, their search criteria probably yielded records of specimens collected along the Rio Grande, which contains habitats not found within PETR. Thus, they included many species usually associated with aquatic or riparian habitats in Albuquerque, such as garter snakes and Racer.

Sensitive Species and Threats to the Herpetofauna

The Western Box Turtle is at the edge of its range near Albuquerque (Degenhardt et al. 1996, Stebbins 2003), and this long-lived species may be impacted by habitat fragmentation by roads and housing around PETR (Dodd 2002). Collecting of adult Western Box Turtles, which are popular as pets, may occur at PETR, and could impact populations within the monument. Similarly, the Massasauga may occur as a relatively isolated population at PETR due to habitat fragmentation and urban development, and could be impacted by collecting or road mortality along Paseo del Volcan in the Volcanoes area. Road mortality probably impacts populations of many snake and amphibian species at PETR, particularly along the monument’s eastern boundary (Unser Boulevard).

Because of its location within Albuquerque, illegal snake collecting may impact the heavily used Rinconada Canyon area as well as surrounding roads. On one occasion, we observed a gentleman leaving Rinconada Canyon armed with a pistol and a pair of snake tongs. On another occasion, we found an empty aquarium which had presumably contained some sort of live reptile, near a trailhead in the Volcanoes area. This suggests that illegal dumping of exotic herpetofauna may become a problem for the park as well if populations of non-native species become established.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at PETR is only 79%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory could focus on documenting amphibians (Tiger Salamander, spadefoots, and true toads), Chihuahuan Hook-nosed Snake, and Common Kingsnake. Without the benefit of extensive roads suitable for night driving surveys, locating these and other snakes may require substantial field effort and different methods, such as funnel or pitfall traps.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at PETR to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At PETR, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of breeding sites (if located) or other areas (such as along roads bordering the monument) where amphibians can be found on rainy nights during the summer monsoon season. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At PETR, Eastern Fence Lizard, Side-blotched Lizard, and New Mexico Whiptail may be good candidates for long-term monitoring, because these species are common throughout the monument. In addition, the Eastern Fence Lizard and Side-blotched Lizard are also common at many SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at PETR

Because we do not have data on population sizes or density of species at PETR, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at PETR, and also with the same species elsewhere throughout its range in the region. An asterisk (*) denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at PETR, as well as NPSpecies checklist field assignments, are presented in Table M-1.

Species Documented from Petroglyph National Monument

Mexican Spadefoot (*Spea multiplicata*)

We observed only two Mexican Spadefoots, along Unser Boulevard adjacent to PETR, on a rainy night during the summer monsoon season. This widespread species probably occurs throughout PETR, although breeding sites within the monument itself may be limited. The persistent drought during the study period was likely responsible for our failure to detect many amphibians at PETR.

Western Box Turtle (*Terrapene ornata*)

We did not observe this species during our surveys, but Mike Medrano (personal communication) has photographed Western Box Turtles at PETR, and has seen them in Rinconada Canyon. Although uncommon, they probably occur throughout the monument.

*Eastern Collared Lizard (*Crotaphytus collaris*)

Eastern Collared Lizards prefer rocky areas interspersed with open areas for running (Stebbins 2003), and are common along the escarpment at PETR.

*Long-nosed Leopard Lizard (*Gambelia wislizenii*)

This relative of the Eastern Collared Lizard prefers flat, open terrain with widely spaced shrubs used for cover and prey ambush (Stebbins 2003). Long-nosed Leopard Lizards probably occur both above and below the escarpment at PETR, and are particularly common in Rinconada Canyon.

*Lesser Earless Lizard (*Holbrookia maculata*)

We observed only a single Lesser Earless Lizard during our surveys, found in the Volcanoes area of PETR. All three specimens located at MSB were collected in the Volcanoes area as well. This species is probably uncommon throughout the grasslands above the escarpment at PETR.

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We found three Greater Short-horned Lizards at PETR, all in the Volcanoes area. Mike Medrano (personal communication) has observed them below the escarpment as well.

*Roundtail Horned Lizard (*Phrynosoma modestum*)

We observed only two Roundtail Horned Lizards in 2001-2003, but this small, cryptic species is probably common throughout the monument. This species is considered a "rock mimic" (Stebbins 2003).

*Eastern Fence Lizard (*Sceloporus undulatus*)

Eastern Fence Lizards are common in rocky areas throughout the PETR, and are especially abundant along the escarpment. Parmenter et al. (1996) noted that some local populations within PETR are melanistic, matching the dark lava rock of their surroundings.

*Side-blotched Lizard (*Uta stansburiana*)

This small, ground-dwelling lizard was the most abundant species during our surveys at PETR, occurring throughout the monument.

*Great Plains Skink (*Eumeces obsoletus*)

We observed five Great Plains Skinks during our surveys: four in Rinconada Canyon and one near Lareda Arroyo in the mesa top grasslands above the escarpment. This large skink is probably common throughout the monument.

*Little Striped Whiptail (*Cnemidophorus inornatus*)

We found the Little Striped Whiptail only in the mesa top grasslands, a habitat it shares with the more abundant and widely distributed (within PETR) New Mexico Whiptail. The Little Striped Whiptail is one of the two parental species of the hybrid-derived New Mexico Whiptail.

*New Mexico Whiptail (*Cnemidophorus neomexicanus*)

This unisexual whiptail is abundant throughout PETR, especially in the sandy shrub habitats below the escarpment, where it is the only whiptail species present.

*Texas Blind Snake (*Leptotyphlops dulcis*)

Rich Anderson collected a surface active Texas Blind Snake for us in Rinconada Canyon, which was the first verified record for PETR, and also the first specimen west of the Rio Grande in Bernalillo County (Degenhardt et al. 1996).

*Glossy Snake (*Arizona elegans*)

We only observed a single Glossy Snake during our surveys, on Paseo del Volcan south of the PETR boundary (but in contiguous habitat). Mike Medrano collected a road-killed Glossy Snake from near the PETR visitor center as well, indicating that this species occurs both above and below the escarpment at PETR.

*Ring-necked Snake (*Diadophis punctatus*)

We collected a surface active Ring-necked Snake during a random TACS plot in the mesa top grassland, the first record of this species at PETR.

Western Hog-nosed Snake (*Heterodon nasicus*)

Although we did not observe any Western Hog-nosed Snakes during the present inventory, Mike Medrano (personal communication) has seen this species in the sandy shrub habitat near the PETR visitor center, as well as in grassland habitat near the west boundary in the Volcanoes area. This species is probably common throughout the monument, wherever loose soil is available for burrowing.

*Night Snake (*Hypsiglena torquata*)

We did not observe this small, strictly nocturnal species during our surveys, but we did locate a museum specimen record from what is now PETR. This widespread species probably occurs throughout the monument.

*Coachwhip (*Masticophis flagellum*)

This large, fast snake was the second-most common snake found during our surveys. We saw Coachwhips both above and below the escarpment, and it probably occurs throughout the monument.

*Striped Whipsnake (*Masticophis taeniatus*)

We observed the Striped Whipsnake in Rinconada Canyon, and above the escarpment in the Southern Geologic Window unit. This species is probably common throughout the monument, although less so than the similar Coachwhip.

*Gopher Snake (*Pituophis catenifer*)

We only observed two individuals of this widespread species at PETR. Although uncommon at PETR, this species occurs in all habitats throughout the monument (Mike Medrano, personal communication).

Long-nosed Snake (*Rhinocheilus lecontei*)

Mike Medrano observed and photographed two Long-nosed Snakes near Butte Volcano in 2001, the only observation made during this inventory. This species probably occurs throughout the monument.

Plains Black-headed Snake (*Tantilla nigriceps*)

Rich Anderson, a biology teacher at a local Albuquerque College, reported capturing a Plains Black-headed Snake in an arthropod pitfall trap in Rinconada Canyon. This small, secretive species is probably common at PETR, although it is unknown whether it occurs above the escarpment.

Western Diamond-backed Rattlesnake (*Crotalus atrox*)

This was the most frequently observed snake species during our surveys, with most observations being from Rinconada Canyon. This large rattlesnake is not known to occur in the mesa top grassland habitat at PETR (Mike Medrano, personal communication).

*Western Rattlesnake (*Crotalus viridis*)

We observed only a single Western Rattlesnake during our surveys, which we found in the Volcanoes area. Mike Medrano (personal communication) has observed this species only along and above the escarpment at PETR.

Massasauga (*Sistrurus catenatus*)

We did not observe this small rattlesnake during our surveys, but Mike Medrano (personal communication) has seen them near the PETR west boundary, in the Volcanoes area. Although no specimens exist from PETR, a number of Massasaugas have been collected west of the Volcanoes, primarily along the road to the shooting range, west of Paseo del Volcan. This species is uncommon in the grasslands at PETR, where, as in other areas in the Southwest, it probably utilized the burrows of the Banner-tailed Kangaroo Rat.

Species That Possibly Occur at Petroglyph National Monument

Tiger Salamander (Ambystoma tigrinum)

Parmenter et al. (1996) listed Tiger Salamander as occurring at PETR, although we did not locate any specimen records from the monument. This species probably occurs in the monument at least a transient, as discussed by Parmenter et al. (1996), but it is unlikely to breed within the boundaries of PETR.

Couch's Spadefoot (*Scaphiopus couchii*)

Although Parmenter et al. (1996) listed Couch's Spadefoot as occurring at PETR, we did not locate any specimen records from the monument. We did not find any potential breeding sites for this or other amphibians within the monument during our inventory, but in wetter periods temporary pools likely form in places, such as along the base of the escarpment. This species is common in the Albuquerque area, and almost certainly occurs within PETR.

Plains Spadefoot (*Spea bombifrons*)

Parmenter et al. (1996) listed Plains Spadefoot as occurring at PETR, although we did not locate any specimen records from the monument. This species is common in the Albuquerque area, and almost certainly occurs at PETR.

Great Plains Toad (*Bufo cognatus*)

Parmenter et al. (1996) listed Great Plains Toad as occurring at PETR, although we did not locate any specimen records from the monument. This large toad is common in the Rio Grande Valley in the Albuquerque area, and probably occurs at PETR.

Red-spotted Toad (*Bufo punctatus*)

Parmenter et al. (1996) did not observe this species at PETR, although it may occur along the rocky habitats of the escarpment, provided temporary pools used as breeding sites are available in some years.

Woodhouse's Toad (*Bufo woodhousii*)

Although Parmenter et al. (1996) listed Woodhouse's Toad as occurring at PETR, we did not locate any specimen records from the monument. This large toad is common in the Rio Grande Valley in the Albuquerque area, and almost certainly occurs at PETR.

Ornate Tree Lizard (*Urosaurus ornatus*)

This small lizard usually occupies rocky habitats in the region (Degenhardt et al. 1996), and we had initially expected to find it on the escarpment at PETR. Parmenter et al. (1996) did not observe this species either, suggesting it is probably absent from the monument.

Chihuahuan Spotted Whiptail (*Cnemidophorus exsanguis*)

This usisexual whiptail is common in some areas along the Rio Grande in Albuquerque (John Wright, personal communication), and may occur at the disjunct unit of PETR near the Rio Grande. However, in limited surveys there we observed only the ubiquitous New Mexico Whiptail.

Racer (*Coluber constrictor*)

Parmenter et al. (1996) listed this species as occurring at PETR, but this is probably based on museum records of the species near the Rio Grande, outside the boundaries of PETR. This species may possibly occur at the small, disjunct section of PETR located near the Rio Grande.

Chihuahuan Hook-nosed Snake (*Gyalopion canum*)

This nocturnal, desert-adapted species is found in the Rio Grande Valley in the Albuquerque area (Degenhardt et al. 1996), and probably occurs in the sandy shrub habitats at PETR, such as in Rinconada Canyon.

Common Kingsnake (*Lampropeltis getula*)

The Common Kingsnake occurs in the Rio Grande Valley in the Albuquerque area, and occupies a wide variety of habitats in New Mexico (Degenhardt et al. 1996), and probably occurs throughout PETR.

Milk Snake (*Lampropeltis triangulum*)

This secretive species has not been recorded from the vicinity of PETR, but isolated records in a variety of habitats throughout the state (Degenhardt et al. 1996) suggest it could be found almost anywhere.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

Parmenter et al. (1996) included this and two other garter snake species as occurring at PETR, probably based on records from the Albuquerque area along the Rio Grande. Parmenter et al. (1996) stated that all three garter snakes "are generally found in the denser vegetation along the base of the escarpments, particularly near canyons where precipitation collects and the environment is somewhat wetter." However, these areas within PETR are normally still very dry, and do not appear to be suitable garter snake habitat. In addition, Mike Medrano (personal communication) has never observed garter snakes within the monument. This and other garter snakes could conceivably occur as transients in the small, disjunct unit of PETR near the Rio Grande.

Western Terrestrial Garter Snake (*Thamnophis elegans*)

Like the other garter snakes mentioned by Parmenter et al. (1996) as occurring at PETR, this species almost certainly does not occur within the main section of the monument, but could occur as a transient in the small, disjunct unit of PETR near the Rio Grande.

Checkered Garter Snake (*Thamnophis marcianus*)

Parmenter et al. (1996) did not include this species on their list of garter snakes found at PETR, but as with other garter snakes, it may occur as a transient within the small, disjunct unit of PETR near the Rio Grande.

Common Garter Snake (*Thamnophis sirtalis*)

Like the other garter snakes mentioned by Parmenter et al. (1996) as occurring at PETR, this species almost certainly does not occur within the main section of the monument, but could occur as a transient in the small, disjunct unit of PETR near the Rio Grande. This species seldom leaves moist river valley habitats in New Mexico (Degenhardt et al. 1996), and is the least likely species of garter snake to occur at PETR, even in the Rio Grande unit.

Table M-1. Amphibian and reptile species known or expected to occur at Petroglyph National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	2	Unconfirmed	
Couch's Spadefoot	3	Probably Present	
Plains Spadefoot	3	Probably Present	
Mexican Spadefoot	OX	Present in Park	Uncommon
Great Plains Toad	2	Unconfirmed	
Red-spotted Toad	1	Unconfirmed	
Woodhouse's Toad	3	Probably Present	
Western Box Turtle	OP	Present in Park	Rare
Eastern Collared Lizard	SP	Present in Park	Uncommon
Long-nosed Leopard Lizard	SP	Present in Park	Common
Lesser Earless Lizard	SP	Present in Park	Uncommon
Greater Short-horned Lizard	SP	Present in Park	Uncommon
Roundtail Horned Lizard	SX	Present in Park	Uncommon
Eastern Fence Lizard	SX	Present in Park	Abundant
Ornate Tree Lizard	1	Unconfirmed	
Side-blotched Lizard	SX	Present in Park	Abundant
Great Plains Skink	SX	Present in Park	Common
Chihuahuan Spotted Whiptail	1	Unconfirmed	
Little Striped Whiptail	SX	Present in Park	Uncommon
New Mexico Whiptail	SP	Present in Park	Abundant
Texas Blind Snake	SX	Present in Park	Uncommon
Glossy Snake	SX	Present in Park	Uncommon
Racer	1	Unconfirmed	
Ring-necked Snake	SX	Present in Park	Rare
Chihuahuan Hook-nosed Snake	3	Probably Present	
Western Hog-nosed Snake	OP	Present in Park	Uncommon
Night Snake	SP	Present in Park	Uncommon
Common Kingsnake	3	Probably Present	
Milk Snake	1	Unconfirmed	
Coachwhip	SX	Present in Park	Common
Striped Whipsnake	SX	Present in Park	Common
Gopher Snake	SP	Present in Park	Common
Long-nosed Snake	OX	Present in Park	Uncommon
Plains Black-headed Snake	OP	Present in Park	Uncommon
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	1	Unconfirmed	
Checkered Garter Snake	1	Unconfirmed	
Common Garter Snake	1	Unconfirmed	
Western Diamond-backed Rattlesnake	OX	Present in Park	Common
Western Rattlesnake	SP	Present in Park	Uncommon
Massasauga	OP	Present in Park	Rare
TOTAL RANK 1	9		
TOTAL RANK 2	2		
TOTAL RANK 3	5		
TOTAL FOUND (SX, OX, SP, OP)	25		
WEIGHTED TOTAL	31.7		
ESTIMATED INVENTORY COMPLETENESS	79%		

Table M-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Petroglyph National Monument, 2001-2003. GS = general survey, NGS = nocturnal general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, N-R TACS = non-random 1-ha TACS plot, ND = night drive, and RE = random encounter.

Species	GS	NGS	1-ha TACS	10-ha TACS	N-R TACS	ND	RE	Total
Mexican Spadefoot		2						2
Eastern Collared Lizard	5			3				8
Long-nosed Leopard Lizard	7			1	2		1	11
Lesser Earless Lizard	1							1
Greater Short-horned Lizard	2						1	3
Roundtail Horned Lizard				1	1			2
Eastern Fence Lizard	50		1	1	1		2	55
Side-blotched Lizard	146		14	20	11		15	206
Great Plains Skink	4		1					5
Little Striped Whiptail	9							9
New Mexican Whiptail	61		20	37	17		28	163
Glossy Snake							1	1
Ring-necked Snake			1					1
Coachwhip	2		1				2	5
Striped Whipsnake	3							3
Gopher Snake				1				1
Long-nosed Snake							2	2
Western Diamond-backed Rattlesnake	4	2			2	1		9
Western Rattlesnake	1							1
TOTAL	295	4	38	64	34	1	52	487

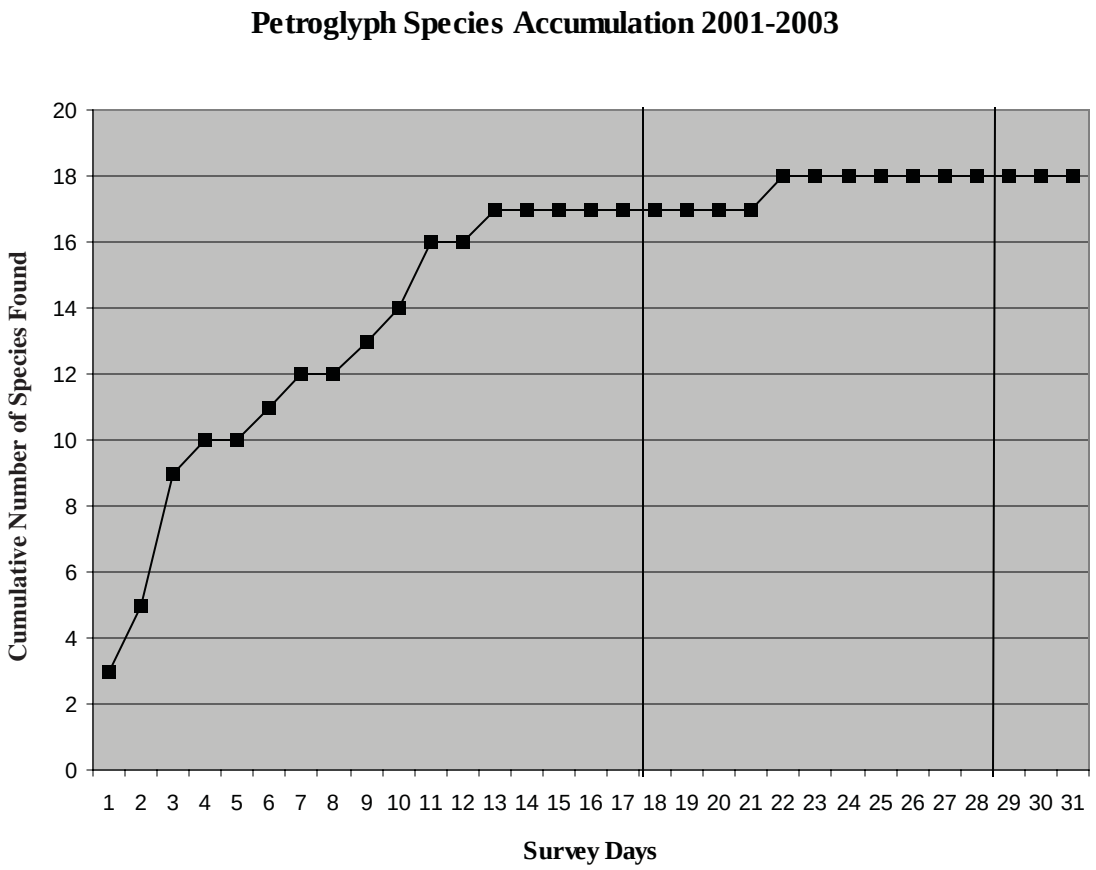

Figure M-1. Species accumulation curve for amphibians and reptiles at Petroglyph National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix N. Rainbow Bridge National Monument (RABR)

RABR is located adjacent to Lake Powell in San Juan County, Utah, just northwest of Navajo Mountain. Elevation ranges between 1,129 and 1,492 m (3,704-4,895 ft). The monument encompasses 67 ha (165 acres), and was established to protect the world's largest natural bridge. Desert shrub plant communities and exposed sandstone geologic features dominate habitats at RABR. Additional information on natural resources at RABR is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We did not conduct fieldwork at RABR during the present inventory project. For completeness, however, we have attempted to summarize what is known about the occurrence of amphibians and reptiles at this and other unfunded parks in the SCPN. Through searching museum specimen records, we documented nine amphibian and reptile species from RABR. Almost all of these were collected as part of the Rainbow Bridge-Monument Valley Expedition in the 1930's (Eaton 1935), before the construction of Glen Canyon Dam and the eventual filling of Lake Powell to the level of RABR. Most of the species collected previously are common, widespread taxa that probably still occur at the monument. However, the Northern Leopard Frog has declined in many parts of the Southwest (e.g., Clarkson and Rorabaugh 1989), including at GLCA (Charles Drost, personal communication). A list of all documented and hypothetical species at RABR, as well as NPSpecies checklist field assignments, is presented in Table N-1.

Estimate of Inventory Completeness at RABR

Based on species documented from museum specimen records (Appendix T) and our assessment of possible but undocumented species, we estimate inventory completeness for amphibians and reptiles at RABR to be 46% (Table N-1). Because we did not visit the monument, this figure should be considered a very rough estimate. Our assignments of the probabilities of occurrence of undocumented species are based on distribution of species in the RABR area, and could change after careful evaluation of available microhabitats.

Literature and Museum Specimen Data Searches

We searched specimen records from Brigham Young University (BYU), the California Academy of Sciences (CAS), the University of Kansas Museum of Natural History (KU), the Los Angeles County Museum (LACM), the Museum of Vertebrate Zoology (MVZ), the University of Texas-El Paso (UTEP), the University of Michigan Museum of Zoology (UMMZ), the University of Arizona (UAZ), the University of Utah (UU), and the USGS Biological Survey collection (USGS BS/FC, housed at MSB) for amphibians and reptiles from RABR.

Museum records of specimens collected at RABR are found in Appendix T. We located museum specimen records for nine species at RABR, almost all of which were collected during the Rainbow Bridge-Monument Valley Expedition in the 1930's (Eaton 1935). The only general overview of the herpetofauna of RABR is that of Eaton (1935).

Sensitive Species and Threats to the Herpetofauna

The only sensitive species documented from RABR is the Northern Leopard Frog. However, this species was collected in 1933, well before the creation of Lake Powell, and aquatic habitats in Bridge Canyon within RABR have likely changed. It is unknown whether Northern Leopard Frogs are extant at RABR.

Considerations for Future Inventory and Long-term Monitoring

Estimated inventory completeness at RABR is only 46%. In addition, most of the specimens upon which documentation of species occurrence was made were collected in the 1930's, and some of those species (especially amphibians) may have been affected by the creation of Lake Powell. Therefore, we recommend that more effort be directed towards inventory before commencement of long-term monitoring of amphibians and reptiles at RABR.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at RABR to assist in documenting new species. This can be as simple as saving animals found dead, taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Dead animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At RABR, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At RABR, likely candidate species include Side-blotched Lizard, Eastern Fence Lizard, and Western Whiptail, because these species are probably common in the monument and at many SCPN parks, making network-wide comparisons possible.

Table N-1. Amphibian and reptile species known or expected to occur at Rainbow Bridge National Monument. Species documentation is based on Eaton (1935) and museum specimen records. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, 3 = high probability, and X = documented. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively. Because there have been no systematic herpetofauna surveys of Rainbow Bridge, and because we have not visited the site to evaluate habitats for potential amphibians and reptiles, ranking of undocumented species is preliminary.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	1	Unconfirmed	
Plains Spadefoot	1	Unconfirmed	
Great Basin Spadefoot	3	Probably Present	
Mexican Spadefoot	1	Unconfirmed	
Red-spotted Toad	X	Present in Park	No data
Woodhouse's Toad	X	Present in Park	No data
Canyon Treefrog	1	Unconfirmed	
Northern Leopard Frog	X	Present in Park	No data
Great Basin Collared Lizard	X	Present in Park	No data
Eastern Collared Lizard	1	Unconfirmed	
Long-nosed Leopard Lizard	3	Probably Present	
Greater Short-horned Lizard	3	Probably Present	
Desert Horned Lizard	1	Unconfirmed	
Common Chuckwalla	2	Unconfirmed	
Desert Spiny Lizard	X	Present in Park	No data
Eastern Fence Lizard	X	Present in Park	No data
Ornate Tree Lizard	2	Unconfirmed	
Side-blotched Lizard	X	Present in Park	No data
Western Whiptail	X	Present in Park	No data
Desert Night Lizard	1	Unconfirmed	
Western Banded Gecko	1	Unconfirmed	
Glossy Snake	2	Unconfirmed	
Night Snake	X	Present in Park	No data
Common Kingsnake	2	Unconfirmed	
Striped Whipsnake	3	Probably Present	
Gopher Snake	3	Probably Present	
Long-nosed Snake	1	Unconfirmed	
Western Patch-nosed Snake	3	Probably Present	
Western Ground Snake	1	Unconfirmed	
Southwestern Black-headed Snake	1	Unconfirmed	
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	2	Unconfirmed	
Western Rattlesnake	3	Probably Present	
TOTAL RANK 1	12		
TOTAL RANK 2	5		
TOTAL RANK 3	7		
TOTAL DOCUMENTED	9		
WEIGHTED TOTAL	19.4		
ESTIMATED INVENTORY COMPLETENESS	46%		

Appendix O. Salinas Pueblo Missions National Monument

SAPU consists of three separate units (Abó, Gran Quivira, and Quarai) located in Torrance County, New Mexico; the southernmost unit, Gran Quivira, straddles the Torrance-Socorro County line. Elevation ranges between 1,815 and 2,058 m (5,955-6,752 ft). The monument encompasses 433 ha (1,070 acres), and was established to protect prehistoric pueblo and historic Franciscan mission ruins. Habitats at SAPU are dominated by pinyon-juniper woodland. The Quarai and Abo units both contain drainages with permanent water, at least as large pools, and Quarai supports a dense riparian area of willows and cottonwoods. Abó is characterized by rough, broken terrain with numerous rocky washes, whereas soils at the other two units are predominantly sandy. Additional information on natural resources at SAPU is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 182 person-hours surveying for herpetofauna at SAPU in 2001-2003. Methods used, and number of person-hours spent on each method, included general surveys (114.4), nocturnal general surveys (25.9), non-random 1-ha TACS plot surveys (19.5), and night driving (22.2). We recorded 576 individual amphibians and reptiles of 22 species during our surveys. No additional species were documented based on our review of the literature and museum specimen records. A summary of the total number of each species observed by each method is presented in Table O-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at SAPU

Based on our surveys at SAPU and inclusion of previously documented species we estimate an inventory completeness of 73% (Table O-1). Although a species accumulation curve based on our surveys (Figure O-1) suggests we are close to reaching inventory completeness, we believe this asymptote reflects only that we are close to detecting most of the common species using our current methods. Detecting the remaining species at SAPU will require much greater field effort and more targeted searches during favorable conditions. Many of the undocumented species likely to occur at SAPU are snakes, including many uncommon or secretive species like Ring-necked Snake, Milk Snake, and Plains Black-headed Snake.

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from SAPU. We used dot distribution maps in Degenhardt et al. (1996) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to SAPU.

Museum records of specimens collected at SAPU prior to this study are found in Appendix T. All three species reported from museums were also found during our surveys. The only previous inventory of amphibians and reptiles at SAPU is that of Scott (1979), which included only the Gran Quivira unit. Scott (1979) reported observing four species during two survey days, and presented a monument species list which included species documented by specimens and based on unverified observations, presumably by NPS personnel. The only other publication relating to the herpetofauna at SAPU is Howell and Wood (1957), which detailed rattlesnake observations at Gran Quivira from 1954 to 1956.

Sensitive Species and Threats to the Herpetofauna

No sensitive amphibian or reptile species have been documented from SAPU. The Abó and Quarai units contain permanent water used as amphibian breeding sites, and these could be impacted by drought, local water table draw-down, contamination, or the introduction of non-native species. Bullfrogs have been collected in the Quarai area at Manzano Lake (MSB 12467), and we recommend that the monument watch for the presence of this exotic species in the permanent pools at Quarai and Abó. The unexcavated ruins at Gran Quivira provide overwintering sites for rattlesnakes (Howell and Wood 1957, Scott 1979), and any future development of these ruins (e.g., excavation and stabilization) could destroy the habitat and impact local snake populations.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at SAPU is only 73%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort should

focus on documenting those species with the greatest likelihood of occurring at SAPU, including Western Chorus Frog, Greater Short-horned Lizard, and a number of snakes. Without the benefit of extensive roads available for night driving surveys, locating many snake species may require substantial field effort and different methods, such as funnel or pitfall traps.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at SAPU to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At SAPU, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as the pools in Canyon Espinoso at Abó and the stream running through Quarai. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At SAPU, Eastern Fence Lizard may be the best candidate for monitoring, because this species is common at all three units of the monument and at most SCPN parks, making network-wide comparisons possible. Whiptails are also common at SAPU (Little Striped Whiptail at Gran Quivira and Chihuahuan Spotted Whiptail at Abó; whiptails are uncommon at Quarai), as they are at most SCPN parks, and could also be included in lizard monitoring at the monument.

Species Accounts of Amphibians and Reptiles at SAPU

Because we do not have data on population sizes or density of species at SAPU, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at SAPU, and also with the same species elsewhere throughout its range in the region. An asterisk (*) denotes a species represented by a voucher specimen. Locations in parentheses indicate park units in which each species has been observed, and collected. Status data for all documented and hypothetical species at SAPU, as well as NPSpecies checklist field assignments, are presented in Table O-1.

Species Documented from Salinas Pueblo Missions National Monument

*Tiger Salamander (*Ambystoma tigrinum*) (*Abó, Gran Quivira, Quarai)

Tiger Salamanders were common at the Abó unit, in the permanent pools in Canyon Espinoso. We observed a few transformed individuals, but most were large, neotenic salamanders. We did not observe this species at Gran Quivira, but a specimen was previously collected there, from a "garage floor." At Quarai, we captured a Western Terrestrial Garter Snake that had recently eaten a larval Tiger Salamander.

*Mexican Spadefoot (*Spea multiplicata*) (*Abó)

We observed this spadefoot only at Abó, during night driving surveys in and near the monument. This widespread species, which frequently co-occurs with the Plains Spadefoot, is probably common at the other SAPU units as well.

*Plains Spadefoot (*Spea bombifrons*) (Gran Quivira, *Quarai)

The Plains Spadefoot is often found together with the similar Mexican Spadefoot in the region, although it is usually less common. It probably occurs at all three SAPU units.

*Red-spotted Toad (*Bufo punctatus*) (*Abó)

Red-spotted Toads prefer rocky habitats (Stebbins 2003), and we found them only along the rocky washes at the Abó unit of SAPU. The voucher specimen we collected has been reported as a new county record for Torrance County (Persons and Nowak 2005a).

Woodhouse's Toad (*Bufo woodhousii*) (Quarai)

We observed only a single Woodhouse's Toad, during a night driving survey near the Quarai unit. While this species is common in the Rio Grande Valley to the west, there is only one documented record from Torrance County, in the vicinity of the Abó unit of SAPU (Degenhardt et al. 1996). Woodhouse's Toads may occur at all three units of SAPU.

*Eastern Collared Lizard (*Crotaphytus collaris*) (*Abó, Quarai)

We found Eastern Collared Lizards to be common in the rocky canyons at Abó, and on the rocky slopes along the Spanish Corral Trail. Because we did not observe this large, conspicuous lizard in apparently suitable habitat in the ruins area at Gran Quivira, it may be absent from that unit.

Lesser Earless Lizard (*Holbrookia maculata*) (Gran Quivira)

We observed only a single juvenile Lesser Earless Lizard, at the Gran Quivira unit. The species has been documented from throughout the SAPU region (Degenhardt et al. 1996). Although the Quarai unit does not contain suitable flat, open habitat for this species, it may occur at the Abó unit.

*Roundtail Horned Lizard (*Phrynosoma modestum*) (*Abó)

We collected a Roundtail Horned Lizard from a rocky wash near Canyon Espinoso at the Abó unit, which is a new Torrance County record for the species (Persons and Nowak 2005b). This "rock mimic" is generally found on rocky soils (Degenhardt et al. 1996), and at SAPU the greatest amount of suitable habitat appears to be at the Abó unit. It probably does not occur at Gran Quivira, which lies in a region dominated by sandy soils, but it could occur in the uplands at Quarai.

*Eastern Fence Lizard (*Sceloporus undulatus*) (*Abó, *Gran Quivira, *Quarai)

This is perhaps the most abundant, widespread, and conspicuous lizard on the Colorado Plateau, and is common at all three SAPU units. This was the most frequently observed species during our surveys. The Eastern Fence Lizard is usually found off the ground, such as on rocks, logs, trees, or human-made structures.

*Ornate Tree Lizard (*Urosaurus ornatus*) (*Abó)

Over much of its range, including in New Mexico, the Tree Lizard is usually found on rocks such as boulders and canyon walls (Degenhardt et al. 1996). We found Tree Lizards throughout the rocky washes at the Abó unit of SAPU, where they were fairly common.

*Great Plains Skink (*Eumeces obsoletus*) (*Quarai)

We found two Great Plains Skinks at the Quarai unit, and park staff told us of additional sightings there as well. The only other record of this species from Torrance County is in the southeastern corner of the county, far from SAPU (Degenhardt et al. 1996). Scott (1979) reported an unverified sighting of Great Plains Skink from Gran Quivira. This large skink occurs in a wide variety of habitats in New Mexico (Degenhardt et al. 1996), and probably occurs at all three units of SAPU.

*Little Striped Whiptail (*Cnemidophorus inornatus*) (Abó, *Gran Quivira)

This whiptail species is widespread in much of southern New Mexico, usually occurring in grasslands with sandy soils (Degenhardt et al. 1996). The Little Striped Whiptail was abundant throughout the Gran Quivira unit, where it was the only whiptail species recorded. At the Abó unit, it was rare, being far outnumbered by the unisexual Chihuahuan Spotted Whiptail, which prefers the rockier, broken terrain dominant there. A brief survey in the sandy, weedy habitat along the railroad tracks just south of US Highway 60 near the Abó unit found only Little Striped Whiptails, which were common there.

*Chihuahuan Spotted Whiptail (*Cnemidophorus exsanguis*) (*Abó, Quarai)

This unisexual whiptail was abundant throughout the Abó unit, which is dominated by rocky, broken terrain often utilized by this species. We also found Chihuahuan Spotted Whiptails near the ruins at the Quarai unit, but they were uncommon there.

*Night Snake (*Hypsiglena torquata*) (*Abó, *Gran Quivira)

This small, strictly nocturnal species is widespread in the region (Degenhardt et al. 1996, Stebbins 2003), and almost certainly occurs at all three units of SAPU. We found Night Snakes at Abó and Gran Quivira during night driving surveys. The specimen collected at Gran Quivira had recently eaten a clutch of lizard eggs, as well as an adult male Eastern Fence Lizard.

*Glossy Snake (*Arizona elegans*) (*Gran Quivira)

We observed only a single Glossy Snake at SAPU, on the road at the Gran Quivira unit. This species prefers habitats with sandy soils suitable for burrowing, and so may be absent from the other two units of SAPU.

*Striped Whipsnake (*Masticophis taeniatus*) (*Gran Quivira)

We observed eight Striped Whipsnakes at SAPU, all at Gran Quivira. This widespread species probably occurs at the other two units of SAPU as well.

*Gopher Snake (*Pituophis catenifer*) (*Gran Quivira, Quarai)

We observed 15 Gopher Snakes at SAPU, but none at the Abó unit. However, this widespread, generalist species almost certainly occurs there as well.

*Black-necked Garter Snake (*Thamnophis cyrtopsis*) (*Abó)

This highly aquatic garter snake is found in a variety of habitats in New Mexico (Degenhardt et al. 1996). We found this species only at the Abó unit, among the rocky pools in and near Canyon Espinoso. Although Black-necked Garter Snake may occur in the stream habitat at the Quarai unit, we only found the Western Terrestrial Garter Snake there.

*Western Terrestrial Garter Snake (*Thamnophis cyrtopsis*) (Abó, *Quarai)

This widespread, generalist garter snake was common at both SAPU units with aquatic habitats, Abó and Quarai. It was abundant along the stream at Quarai, where it was the only garter snake species observed.

*Lined Snake (*Tropidoclonion lineatum*) (*Quarai)

This small relative of the garter snakes primarily occupies the Great Plains, but isolated populations occur to as far west as the SAPU area of New Mexico (Degenhardt et al. 1996, Stebbins 2003). We collected a Lined Snake on the Quarai entrance road. Although not within the bounds of the monument, the dense, grassy habitat is contiguous, and the species almost certainly occurs within the unit. This species has a relatively high moisture requirement (Degenhardt et al. 1996), and is probably common in the area near the stream at Quarai.

Western Diamond-backed Rattlesnake (*Crotalus atrox*) (Abó, Gran Quivira)

We observed only one Western Diamond-backed Rattlesnake, at the Abó unit. Cindy Ramotnik (USGS, Museum of Southwestern Biology) observed one there during mammal surveys in 2002, and NPS personnel at Abó reported seeing this species regularly over the years in the developed part of the monument (e.g., ruins, visitor center area). Although we only observed Western Rattlesnakes at Gran Quivira, Howell and Wood (1957) reported seeing a single Western Diamond-backed Rattlesnake and 143 Western Rattlesnakes between 1954 and 1956. Given the widespread distribution of the species in southern New Mexico (Degenhardt et al. 1996), we have no reason to doubt this observation, but recommend that future researchers attempt to determine the current status of Western Diamond-backed Rattlesnake at Gran Quivira.

Western Rattlesnake (*Crotalus viridis*) (Gran Quivira)

This species, often called Prairie Rattlesnake, is found in a variety of habitats throughout New Mexico (Degenhardt et al. 1996), and probably occurs at every unit of SAPU. We observed eight Western Rattlesnakes, all at Gran Quivira. The unexcavated portion of the Gran Quivira ruins is an overwintering site for this species (Scott 1979, Howell and Wood 1979), and may be important habitat for rattlesnakes from an area larger than the monument itself. Scott (1979) noted that the population using this overwintering site has apparently declined since the report of Howell and Wood (1957), and suggested that killing of snakes by NPS staff over the years was likely responsible.

Species That Possibly Occur at Salinas Pueblo Missions National Monument

Western Chorus Frog (*Pseudacris triseriata*)

This tiny frog is found in the higher elevations of northern New Mexico, and in the Rio Grande Valley of central New Mexico, but has not been documented from the SAPU area (Degenhardt et al. 1996). Although unlikely to occur at Abó or Gran Quivira due to the lack of suitable aquatic habitat, such as grassy pools or marshes (Stebbins 2003), the habitat at Quarai appears ideal, where quiet pools are surrounded by dense emergent vegetation. Although we never heard or saw this species, NPS staff at Quarai described hearing what was probably the call of Western Chorus Frog.

Western Box Turtle (*Terrapene ornata*)

This small, terrestrial turtle has not been collected in the SAPU area, but is common in many other parts of New Mexico (Degenhardt et al. 1996). Although they probably do not occur at Abó or Quarai, the sandy soils present throughout Gran Quivira suggest Western Box Turtles may be present there.

Long-nosed Leopard Lizard (*Gambelia wislizenii*)

This large lizard is found in a variety of open habitats in New Mexico (Degenhardt et al. 1996). Although it has not been recorded from Torrance County (Degenhardt et al. 1996), this area of New Mexico has been under-sampled, as evidenced by new county records and range extensions resulting from our surveys at SAPU. While most of the habitats available at Quarai are too grassy and dense, suitable open habitats are found at both Abó and Gran Quivira, and the species may eventually be found at one of those units.

Greater Short-horned Lizard (*Phrynosoma hernandesi*)

This widespread horned lizard species has been documented from throughout the SAPU area of New Mexico (Degenhardt et al. 1996). Scott (1979) reported observing a Greater Short-horned Lizard at Gran Quivira, but this record was not documented with a specimen. Although apparently uncommon, the Greater Short-horned Lizard probably occurs at every unit of SAPU.

New Mexico Whiptail (*Cnemidophorus neomexicanus*)

This unisexual whiptail is largely restricted to the Rio Grande Valley of New Mexico and Texas (Degenhardt et al. 1996, Stebbins 2003). A specimen was collected in the 1960's 1.6 km (1 mi) west of Scholle (MSB 11713), only a few miles west of the Abó unit of SAPU. The New Mexico Whiptail often occupies sandy, disturbed, weedy habitats (Degenhardt

et al. 1996, and personal observation), and could conceivably occur east to the vicinity of Abó in such habitats along US 60 and the railroad right-of-way. However, it is still unlikely that the species would ever become common within the monument, due to the presence of primarily upland habitats dominated by the Chihuahuan Spotted Whiptail.

Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual whiptail is widespread in northern New Mexico, often occupying pinyon-juniper woodlands (Degenhardt et al. 1996). Based on range and habitat, this species may occur at the Abó or Quarai units of SAPU, although we searched specifically for them and found only Chihuahuan Spotted and Little Striped whiptails at those sites.

Texas Blind Snake (*Leptotyphlops dulcis*)

This tiny, burrowing species has not been documented from Torrance County, but has been collected in northeastern Socorro County just west of the Abó area (Degenhardt et al. 1996), suggesting it could be found at that unit of SAPU. Texas Blind Snakes are found in a variety of habitats in New Mexico, usually at sites with loose soil for burrowing, but also with surface rocks used for cover (Degenhardt et al. 1996).

Racer (*Coluber constrictor*)

The Racer is uncommon in New Mexico, but has been found at sites scattered across the state (Degenhardt et al. 1996), suggesting it could occur almost anywhere suitable habitat is present. In the arid parts of New Mexico, water is usually present where Racers are found (Degenhardt et al. 1996), and habitats at the Quarai unit of SAPU appear suitable.

Ring-necked Snake (*Diadophis punctatus*)

This small, secretive species has been collected throughout New Mexico, including in the vicinity of the Abó unit of SAPU (Degenhardt et al. 1996). This snake requires above or below ground moisture (Degenhardt et al. 1996), which would make it less likely to occur at Gran Quivira. However, it probably occurs at both the Abó and Quarai units of SAPU.

Western Hog-nosed Snake (*Heterodon nasicus*)

Although this species primarily inhabits sandy grasslands, it has been found in a variety of habitats in New Mexico where loose soil for burrowing is available (Degenhardt et al. 1996). Habitat at Gran Quivira appears ideal, and NPS staff at SAPU told us they have seen Western Hog-nosed Snakes there, but the species has not been adequately documented from the monument.

Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has a spotty distribution throughout New Mexico, but has been collected from a number of locations in Torrance County, including in the general vicinity of the Quarai unit (Degenhardt et al. 1996). The species occupies a variety of habitats in New Mexico (Degenhardt et al. 1996), and probably occurs at all three units of SAPU.

Mountain Patch-nosed Snake (*Salvadora grahamiae*)

Degenhardt et al. (1996) did not plot any records of this species from Torrance County. Subsequently, Christman et al. (1998) reported a specimen collected on US Highway 60, about 18 km (11 mi) east of its junction with State Route 47 in Torrence County, a locality probably very close to the junction of the entrance road to the Abó unit. This species, which prefers rough, broken terrain of arroyos or other rocky areas (Degenhardt et al. 1996) almost certainly occurs at the Abó unit of SAPU, and may occur at Quarai as well.

Plains Black-headed Snake (*Tantilla nigriceps*)

Although this species has not been documented in Torrance County (Degenhardt et al. 1996), it may extend its distribution eastward along the US Highway 60 corridor from the Rio Grande Valley to the area of the Abó unit of SAPU. The Plains Black-headed Snake sometimes inhabits rocky slopes in New Mexico, further suggesting it could possibly occur at Abó.

Black-tailed Rattlesnake (*Crotalus molossus*)

Christman and Painter (1998) reported this species from Priest Canyon, in the southern Manzano Mountains just northwest of the Abó unit of SAPU. The Black-tailed Rattlesnake is somewhat of an ecological generalist, and has been found in a variety of habitats in New Mexico (Degenhardt et al. 1996). In Arizona, this species is often found in rough, broken terrain, including washes and rocky canyons (Persons and Nowak, personal observation). The habitat at Abó appears suitable for this species, and it may eventually be found there. It is less likely, but possible, that it occurs at the Quarai unit as well.

Massasauga (*Sistrurus catenatus*)

This small rattlesnake primarily occurs in sandy grassland habitats in New Mexico, and has not been documented from the SAPU area (Degenhardt et al. 1996). However, because a number of range extensions have been reported recently in the region, including some from the present inventory, the lack of records from Torrance County may be a function of the area being herpetologically under-sampled. Because of its preference for sandy soils, the Massasauga could possibly occur at the Gran Quivira unit of SAPU.

Table O-1. Amphibian and reptile species known or expected to occur at Salinas Pueblo Missions National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpeciesPark Status	NPSpeciesAbundance
Tiger Salamander	SX	Present in Park	Common
Plains Spadefoot	SX	Present in Park	Uncommon
Mexican Spadefoot	SX	Present in Park	Uncommon
Red-spotted Toad	SX	Present in Park	Uncommon
Woodhouse's Toad	OX	Present in Park	Uncommon
Western Chorus Frog	3	Probably Present	
Western Box Turtle	1	Unconfirmed	
Eastern Collared Lizard	SX	Present in Park	Common
Long-nosed Leopard Lizard	1	Unconfirmed	
Lesser Earless Lizard	OX	Present in Park	Rare
Greater Short-horned Lizard	3	Probably Present	
Roundtail Horned Lizard	SX	Present in Park	Common
Eastern Fence Lizard	SX	Present in Park	Abundant
Ornate Tree Lizard	SX	Present in Park	Common
Great Plains Skink	SX	Present in Park	Common
Chihuahuan Spotted Whiptail	SX	Present in Park	Abundant
Little Striped Whiptail	SX	Present in Park	Abundant
New Mexico Whiptail	2	Unconfirmed	
Plateau Striped Whiptail	1	Unconfirmed	
Texas Blind Snake	1	Unconfirmed	
Glossy Snake	SX	Present in Park	Uncommon
Racer	1	Unconfirmed	
Ring-necked Snake	3	Probably Present	
Western Hog-nosed Snake	3	Probably Present	
Night Snake	SX	Present in Park	Uncommon
Milk Snake	3	Probably Present	
Striped Whipsnake	OX	Present in Park	Common
Gopher Snake	SX	Present in Park	Common
Mountain Patch-nosed Snake	3	Probably Present	
Plains Black-headed Snake	3	Probably Present	
Black-necked Garter Snake	SX	Present in Park	Common
Western Terrestrial Garter Snake	SX	Present in Park	Common
Lined Snake	SX	Present in Park	Uncommon
Western Diamond-backed Rattlesnake	OX	Present in Park	Common
Black-tailed Rattlesnake	2	Unconfirmed	
Western Rattlesnake	OX	Present in Park	Common
Massasauga	2	Unconfirmed	
TOTAL RANK 1	5		
TOTAL RANK 2	3		
TOTAL RANK 3	7		
TOTAL FOUND (SX, OX, SP, OP)	22		
WEIGHTED TOTAL	30.2		
ESTIMATED INVENTORY COMPLETENESS	73%		

Table O-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Salinas Pueblo Missions National Monument, 2001-2003. GS = general survey, NGS = nocturnal general survey, N-R TACS = non-random 1-ha time-area constrained search (TACS) plot, ND = night drive, and RE = random encounter.

Species	GS	NGS	N-R TACS	ND	RE	Total
Tiger Salamander	34	85			1	120
Plains Spadefoot		1		16		17
Mexican Spadefoot				7		7
Red-spotted Toad	1	3				4
Woodhouse's Toad				1		1
Eastern Collared Lizard	10		4			14
Lesser Earless Lizard	1					1
Roundtail Horned Lizard	1					1
Eastern Fence Lizard	130		17	2	6	155
Ornate Tree Lizard	14					14
Great Plains Skink	1				1	2
Chihuahuan Spotted Whiptail	48		11		1	60
Little Striped Whiptail	109		3		3	115
Glossy Snake				1		1
Night Snake				2		2
Striped Whipsnake	5		2		1	8
Gopher Snake	8		1	2	4	15
Black-necked Garter Snake	5	1	1			7
Western Terrestrial Garter Snake	17	1	1	1	2	22
Lined Snake				1		1
Western Diamond-backed Rattlesnake				1		1
Western Rattlesnake	6			2		8
TOTAL	390	91	40	36	19	576

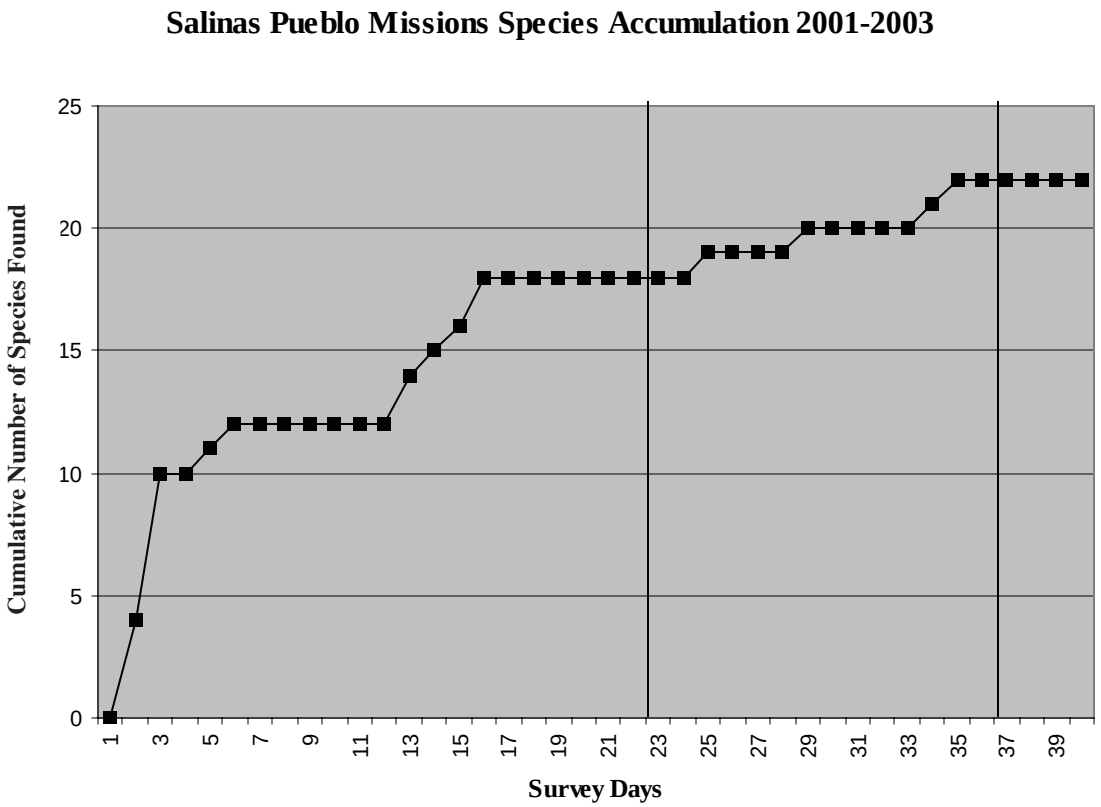

Figure O-1. Species accumulation curve for amphibians and reptiles at Salinas Pueblo Missions National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix P. Sunset Crater Volcano National Monument (SUCR)

SUCR is located just north of Flagstaff, in Coconino County, Arizona. Elevation ranges between 2,076 and 2,441 m (6,811-8,009 ft). The monument encompasses 1,226 ha (3,028 acres), and was established to protect an impressive volcanic cinder cone (Sunset Crater) and associated lava fields. Habitats at SUCR include ponderosa pine forest, small stands of aspen and pinyon-juniper woodland, and extensive volcanic features. Soils are dominated by deep layers of volcanic cinders, primarily deposited during the eruption of Sunset Crater in 1064 A.D. There is almost no surface water at SUCR, with the exception of very small temporary catchments within the lava flows. Additional information on natural resources at SUCR is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 31 person-hours surveying for herpetofauna at SUCR in 2001-2003. Methods used, and number of person-hours spent on each method, included general surveys (5.3), random 1-ha TACS plot surveys (11.7), random 10-ha TACS plot surveys (7.0), and night driving (6.8). We recorded 51 individual amphibians and reptiles of four species during our surveys, and we considered one additional species to be documented based on a previous sighting by one of us. A summary of the total number of each species observed by each method is presented in Table P-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at SUCR

Based on our surveys at SUCR and inclusion of previously documented species, we estimate an inventory completeness of 54% (Table P-1). Although a species accumulation curve based on our surveys (Figure P-1) suggests we are close to reaching inventory completeness, we believe this asymptote reflects only that we are close to detecting most of the common species using our current methods. Detecting the remaining species at SUCR will require much greater field effort and more targeted searches during exceptionally favorable conditions. Many of the undocumented species likely to occur at SUCR are snakes, including Night Snake, Sonoran Mountain Kingsnake, and Western Rattlesnake.

Literature and Museum Specimen Data Searches

We searched records from Coconino County, Arizona from the American Museum of Natural History (AMNH), Arizona State University (ASU), Brigham Young University (BYU), California Academy of Sciences (CAS), The Carnegie Museum (CM), University of Colorado Museum (CU), University of Kansas Museum of Natural History (KU), Los Angeles County Museum (LACM), Museum of Comparative Zoology (MCZ), Museum of Northern Arizona (MNA), Museum of Southwestern Biology, University of New Mexico (MSB), Museum of Vertebrate Zoology (MVZ), Northern Arizona University (NAU), United States National Museum (USNM), University of Arizona (UAZ), University of Michigan Museum of Zoology (UMMZ), University of Texas at El Paso (UTEP), and the Flagstaff Area National Monuments vertebrate collection (SUCR).

We located museum records of specimens collected prior to this study for three species at SUCR (Appendix T), all of species that we found during our surveys in 2001-2003. Bateman (1976) reviewed museum specimens and presented a combined checklist for SUCR and WUPA, reducing its value for either monument individually. In their overview of amphibians and reptiles in the Flagstaff, Arizona area, Aitchison and Tomko (1974) reported only one species (Eastern Fence Lizard) from SUCR.

Sensitive Species and Threats to the Herpetofauna

Only five reptile species have been documented from SUCR, none of which are considered sensitive. Road mortality could potentially impact snake populations at SUCR.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at SUCR is only 54%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory efforts could focus on documenting Many-lined Skink and a number of snakes (e.g., Sonoran Mountain Kingsnake, Striped Whipsnake, Western Rattlesnake) with a high likelihood of occurring at SUCR. Locating these species may require substantial field effort and different methods, such as funnel or pitfall traps.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff

at SUCR to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. However, we did not locate any amphibians, or potential amphibian breeding sites at SUCR, and the monument may in fact harbor no amphibians, making it unique within the SCPN in this regard. The NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At SUCR, Eastern Fence Lizard and Tree Lizard may be good candidates for monitoring, because these species are common throughout the monument and at most SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at SUCR

Because we do not have data on population sizes or density of species at SUCR, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at SUCR, and also with the same species elsewhere throughout its range in the region. An asterisk (*) denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at SUCR, as well as NPSpecies checklist field assignments, are presented in Table P-1.

Species Documented from Sunset Crater Volcano National Monument

*Eastern Fence Lizard (*Sceloporus undulatus*)

This was the most frequently observed species at SUCR, and one of the only two abundant species in the monument. The Eastern Fence lizard was found in all habitats at SUCR, including rocky, lava flow areas and forested habitats, where it was frequently observed on trees and downed logs.

*Ornate Tree Lizard (*Urosaurus ornatus*)

This species was almost as abundant as the Eastern Fence Lizard, but was primarily restricted to basalt rocks in the lava flow areas. Ornate Tree Lizards are often found in mesic, rocky settings such as canyons, and the lava flows at SUCR are more mesic than the surrounding ponderosa pine forest.

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We found two Greater Short-horned Lizards at SUCR. Although uncommon, this cryptic species probably occurs throughout the monument, except on the lava flows themselves.

*Plateau Striped Whiptail (*Cnemidophorus velox*)

We observed six Plateau Striped Whiptails at SUCR, in ponderosa pine forest habitats with an understory of scattered large shrubs such as rabbitbrush and apache plume. This unisexual whiptail is widespread in a variety of habitats throughout northern Arizona, and is probably at its upper elevational limit at SUCR.

Gopher Snake (*Pituophis catenifer*)

We observed no snakes of any species at SUCR in 2001-2003, possibly due to drought conditions during the period. However, one of us (TBP) observed a road-killed Gopher Snake on FR 545 within SUCR in 1996, supporting the numerous previous (but poorly described) natural history observations on file at the Flagstaff Area National Monuments headquarters.

Species That Possibly Occur at Sunset Crater Volcano National Monument

Tiger Salamander (*Ambystoma tigrinum*)

NPS staff reported seeing an adult Tiger Salamander near the SUCR visitor center (fide Tim Graham, USGS Canyonlands Research Station), about 1.6 km (1 mi) west of the SUCR boundary. The visitor center is situated near an area (Bonito Park) with soils that probably retain subsurface moisture, which would likely provide more suitable habitat than the cinder soils found within the monument proper. Tiger Salamanders may occur within SUCR as transients.

Mexican Spadefoot (*Spea multiplicata*)

This is the most widespread anuran in the Flagstaff area, and occurs in a variety of habitats, including extremely dry ones such as the desert and grassland areas at nearby Wupatki National Monument. Even during the monsoon seasons in

2001-2003 we did not observe any temporary pools at SUCR, and the lack of potential breeding sites may preclude this, or any amphibian, from occurring within the monument.

Many-lined Skink (*Eumeces multivirgatus*)

This species is found in the ponderosa pine forest habitats in the Flagstaff, Arizona area, and almost certainly occurs at SUCR. Because this skink prefers areas with subsurface moisture (Stebbins 2003), it would most likely be found at SUCR in the more mesic microhabitats along the edges of the lava flows, where buried lava probably traps water and slows the drying of the overlying cinder soils. The most promising sites would be microhabitats such as these that also contain an abundance of rotting logs under which skinks would likely be found.

Night Snake (*Hypsiglena torquata*)

This small, strictly nocturnal species occurs in a variety of habitats in the region (Stebbins 2003). Night Snakes are common in the Cinder Hills just east of SUCR (Persons, personal observation), and may occur within the monument as well.

Sonoran Mountain Kingsnake (*Lampropeltis pyromelana*)

This colorful snake is found in pine forest habitats in the Flagstaff, Arizona area, and probably occurs, at least in small numbers, throughout SUCR. One of us (TBP) observed a road-killed Sonoran Mountain Kingsnake on US Highway 89 near the Schultz Pass Road, about 3 km (4.8 mi) west of SUCR.

Striped Whipsnake (*Masticophis taeniatus*)

This widespread, diurnal species is found in a wide variety of habitats (Stebbins 2003), including ponderosa pine forests in the Flagstaff area (personal observation), and probably occurs at SUCR.

Western Terrestrial Garter Snake (*Thamnophis elegans*)

This garter snake is abundant in a wide variety of aquatic habitats throughout northern Arizona (Persons and Nowak, personal observation), and is also highly terrestrial in its habits (Stebbins 2003). Although habitats within SUCR may be too dry to support populations of this species, it may pass through the monument from nearby areas with more mesic, forested habitats or earthen stock tanks, which are often used by these snakes.

Western Rattlesnake (*Crotalus viridis*)

Although we know of no recent sightings of rattlesnakes at SUCR, monument natural history observation cards on file at the Flagstaff Area National Monuments headquarters report four rattlesnake sightings in or near SUCR between 1960 and 1981. Two of these reported size measurements (or estimates) of “31 inches” and “three feet long.” These lengths are longer than those normally attained by the widespread “Hopi” subspecies of Western Rattlesnake (C. v. nuntius), and suggest these sightings were of the larger Arizona Black Rattlesnake (C. v. cerberus), which is considered by some authors (e.g., Douglas et al. 2002, Pook et al. 2000) to be a separate species.

Table P-1. Amphibian and reptile species known or expected to occur at Sunset Crater Volcano National Monument. Ranking of probability of species occurrence (“Rank”) is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the “hardest” evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are “breeder” and “native,” respectively.

Species	Rank	NPSpeciesPark Status	NPSpeciesAbundance
Tiger Salamander	1	Unconfirmed	
Mexican Spadefoot	1	Unconfirmed	
Greater Short-horned Lizard	SX	Present in Park	Uncommon
Eastern Fence Lizard	SX	Present in Park	Abundant
Ornate Tree Lizard	SX	Present in Park	Abundant
Many-lined Skink	3	Probably Present	
Plateau Striped Whiptail	SX	Present in Park	Uncommon
Night Snake	2	Unconfirmed	
Sonoran Mountain Kingsnake	3	Probably Present	
Striped Whipsnake	3	Probably Present	
Gopher Snake	OP	Present in Park	Uncommon
Western Terrestrial Garter Snake	1	Unconfirmed	
Western Rattlesnake	3	Probably Present	
TOTAL RANK 1	3		
TOTAL RANK 2	1		
TOTAL RANK 3	4		
TOTAL FOUND (SX, OX, SP, OP)	5		
WEIGHTED TOTAL	9.3		
ESTIMATED INVENTORY COMPLETENESS	54%		

Table P-2. Number of individuals of each species observed by each survey method during a herpetofauna inventory of Sunset Crater Volcano National Monument, 2001-2003. GS = general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, and RE = random encounter.

Species	GS	1-ha TACS	10-ha TACS	RE	Total
Greater Short-horned Lizard		1	1		2
Eastern Fence Lizard	7	11	4		22
Ornate Tree Lizard	6	15			21
Plateau Striped Whiptail	1	3	1	1	6
TOTAL	14	30	6	1	51

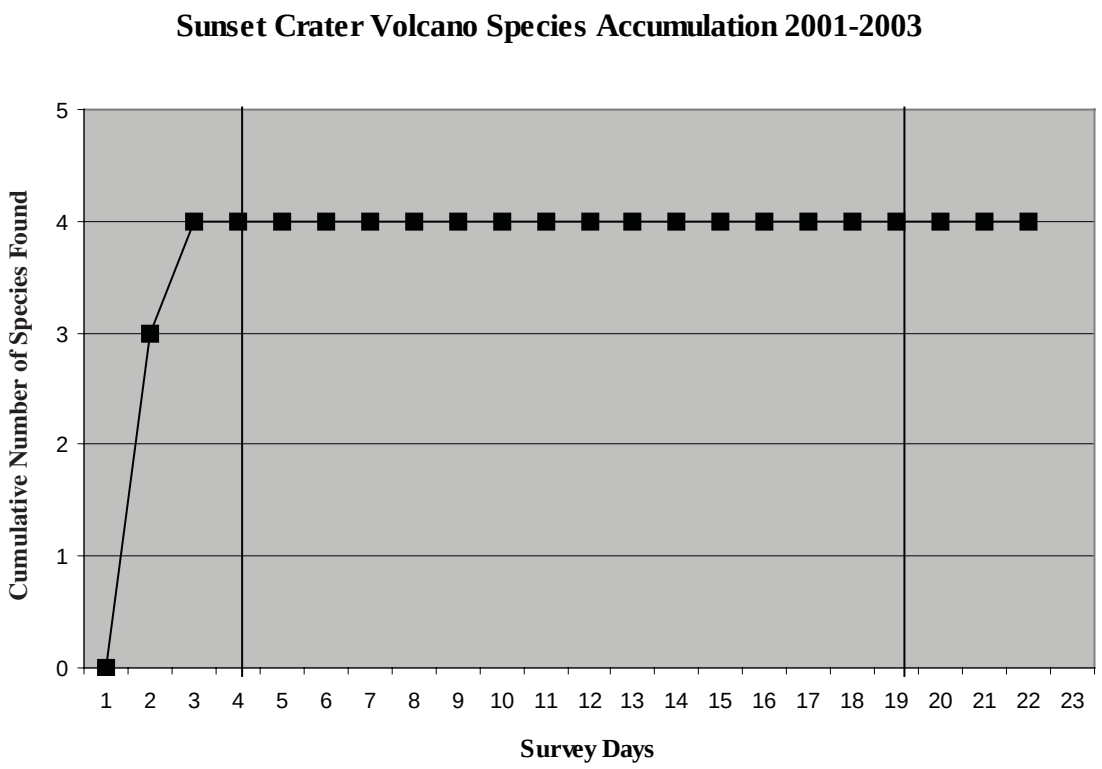

Figure P-1. Species accumulation curve for amphibians and reptiles at Sunset Crater Volcano National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix Q. Walnut Canyon National Monument (WACA)

WACA is located just east of Flagstaff, in Coconino County, Arizona. Elevation ranges between 1,896 and 2,106 m (6,221-6,910 ft). The monument encompasses 1,468 ha (3,626 acres), and was established to protect ancient cliff dwellings within the canyon. The canyon rims are characterized by ponderosa pine forest and pinyon-juniper woodland, while the canyon bottom contains dense riparian growth in areas. North-facing steep canyon slopes harbor Douglas fir and Gambel oak communities, while south facing slopes are dominated by open pinyon-juniper woodland with an understory of shrubs, yuccas, and agaves more characteristic of many lower elevation Mogollon Rim habitats. The only permanent water is a series of tinajas in Cherry Canyon, a tributary to Walnut Canyon. Additional information on natural resources at WACA is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 114 person-hours surveying for herpetofauna at WACA in 2001-2003. Methods used, and number of person-hours spent on each method, included general surveys (78.9), nocturnal general surveys (0.8), random 1-ha TACS plot surveys (15.7), random 10-ha TACS plot surveys (10.9), and night driving (7.4). We recorded 592 individual amphibians and reptiles of eleven species during our surveys, and three additional species were documented based on our review of the literature and museum specimen records. A summary of the total number of each species observed by each method is presented in Table Q-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at WACA

Based on our surveys at WACA and inclusion of previously documented species we estimate an inventory completeness of 70% (Table Q-1). Although a species accumulation curve based on our surveys (Figure Q-1) suggests we are close to reaching inventory completeness, we believe this asymptote reflects only that we are close to detecting most of the common species using our current methods. Detecting the remaining species at WACA will require much greater field effort and more targeted searches during favorable conditions. Many of the undocumented species likely to occur at WACA are snakes, including Night Snake, Striped Whipsnake, Western Patch-nosed Snake, and Black-tailed Rattlesnake. Great Plains Skink and Madrean Alligator Lizard, as well as the Black-tailed Rattlesnake, are potential species that are associated with central Arizona Mogollon Rim habitats.

Literature and Museum Specimen Data Searches

We searched specimen records from Coconino County, Arizona from the American Museum of Natural History (AMNH), Arizona State University (ASU), Brigham Young University (BYU), California Academy of Sciences (CAS), The Carnegie Museum (CM), University of Colorado Museum (CU), University of Kansas Museum of Natural History (KU), Los Angeles County Museum (LACM), Museum of Comparative Zoology (MCZ), Museum of Northern Arizona (MNA), Museum of Southwestern Biology, University of New Mexico (MSB), Museum of Vertebrate Zoology (MVZ), Northern Arizona University (NAU), United States National Museum (USNM), University of Arizona (UAZ), University of Michigan Museum of Zoology (UMMZ), University of Texas at El Paso (UTEP), and the Flagstaff Area National Monuments vertebrate collection (WACA).

We located museum records of specimens collected prior to this study for nine species at WACA (Appendix T). Three of these (Greater Short-horned Lizard, Many-lined Skink, and Ring-necked Snake) were species we did not detect in 2001-2003. Persons and Bradley (2000) reported this specimen of Ring-necked Snake as a range extension, being the first record in Coconino County, and also the first record in eastern Arizona above the Mogollon Rim. There are no previous reports or publications on the amphibians and reptiles of WACA. Aitchison and Tomko (1974) reviewed specimen records from the Flagstaff, Arizona area, but did not include any records from WACA.

Sensitive Species and Threats to the Herpetofauna

The populations of Canyon Treefrog and Little Striped Whiptail at WACA appear to be isolated. The Little Striped Whiptail is probably secure and normal management or recreational uses of the canyon are unlikely to impact the WACA population. The Canyon Treefrog occurs in a series of permanent tinajas along a short stretch of Cherry Canyon, and any changes in the hydrology or water quality of this site could impact the frogs. Sonoran Mountain Kingsnakes are common at WACA, and this colorful species is frequently collected for the pet trade. Therefore, there is the possibility of illegal snake

collecting at WACA, given its relatively high visitation rate and location near the city of Flagstaff.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at WACA is only 70%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort could focus on documenting amphibians (especially Red-spotted Toad), Great Plains Skink and Madrean Alligator Lizard, and numerous snakes (Table Q-1). Without the benefit of extensive roads available for night driving surveys, locating many snake species may require substantial field effort. Funnel traps or pitfall traps may be more effective at documenting some snakes, and would also be good methods to use for Great Plains Skink and Madrean Alligator Lizard.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at WACA to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At WACA, the highest priority would be monitoring of the Canyon Treefrog population in the tinajas in Cherry Canyon, as this species is proposed as a monitoring target in this habitat across the SCPN. Amphibian monitoring may also include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites. Location of these sites may be more easily determined during non-drought conditions. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At WACA, Eastern Fence Lizard, Ornate Tree Lizard, and Plateau Striped Whiptail may be good candidates for monitoring, because these species are common throughout the monument and at many SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at WACA

Because we do not have data on population sizes or density of species at WACA, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at WACA, and also with the same species elsewhere throughout its range in the region. An asterisk (*) denotes a species represented by a voucher specimen. The status of all documented and hypothetical species at WACA, and NPSpecies checklist field assignments, are presented in Table Q-1.

Species Documented from Walnut Canyon National Monument

*Canyon Treefrog (*Hyla arenicolor*)

We were pleased and surprised to discover a population of Canyon Treefrogs in Cherry Canyon. The frogs were found in a small area in upper Cherry Canyon that contains a number of large tinajas, some of which retain water year-round. We also collected a Canyon Treefrog from the WACA sewage lagoon, north of the visitor center and residence area. Canyon Treefrogs at WACA are probably isolated, as the closest known populations are in Pumphouse Wash near Kachina Village (about 16 km [10 mi] southwest of WACA) and Turkey Tanks in San Francisco Wash (about 13 km [8 mi] northeast of WACA). Both of these sites are separated from WACA by dry forests and woodlands, and dry drainages that do not have permanent or near-permanent pools. We searched all of WACA, as well as Cherry Canyon south outside the monument, but found no additional Canyon Treefrogs or suitable habitat.

*Mexican Spadefoot (*Spea multiplicata*)

We found four Mexican Spadefoots at WACA, the first record of this species from the monument. We located them while night driving on the monument entrance road and by following their mating calls to the WACA sewage lagoon. This widespread species probably occurs throughout the monument, and our failure to detect it elsewhere is probably the result of drought conditions that prevailed during the inventory period.

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We did not observe any Greater Short-horned Lizards at WACA in 2001-2003. However, we located three previously collected specimens collected, and WACA natural history

observation cards (on file at the Flagstaff Area National Monuments headquarters) contain many observations of this species. This cryptic lizard is probably common throughout the monument.

*Eastern Fence Lizard (*Sceloporus undulatus*)

This was the most abundant species observed, and was found in all habitats throughout the monument. On many surveys, we observed only this species and the Ornate Tree Lizard.

*Ornate Tree Lizard (*Urosaurus ornatus*)

This was the second-most frequently observed species at WACA. The Ornate Tree Lizard was primarily found in rocky microhabitats within the canyon, and it was abundant in these areas.

*Many-lined Skink (*Eumeces multivirgatus*)

We did not find Many-lined Skinks at WACA, but we did locate a record of a specimen collected in 1931 by well-known herpetologist Charles Bogert. Mary Blasing (former NPS ranger at WACA) also observed what she believed to be a Many-lined Skink in the monument. This small, secretive species probably occurs throughout the monument, and may be more common than the few sightings suggest.

*Little Striped Whiptail (*Cnemidophorus inornatus*)

Although previously known to occur in the grasslands northeast of Flagstaff (e.g., Wright and Lowe 1993), we were surprised to find this species at WACA. Little Striped Whiptails were locally common in brushy habitats in the canyon bottom and in small side canyons in the eastern part of the monument, roughly east (downstream) of Santa Fe Dam. The Little Striped Whiptail has a disjunct, relictual distribution in Arizona (Persons 2005), and the population at WACA appears to be isolated from the much more widespread grassland-inhabiting populations north and east of Flagstaff (Persons, unpublished data).

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual whiptail species is widespread over much of the Colorado Plateau, and we found it together with the Little Striped Whiptail in the eastern part of WACA. Whiptails, probably of this species, have also been seen on the canyon rim near the visitor center (natural history observation cards on file at the Flagstaff Area National Monuments headquarters). The Plateau Striped Whiptail is actually a complex of mostly undescribed species, possibly including both diploid and triploid lineages (Wright 1993). Specimens we collected at WACA may, based on color pattern, represent two distinct species (unpublished data). We recommend that any future studies on the systematics of the Plateau Striped Whiptail complex include samples from the WACA area.

*Ring-necked Snake (Diadophis punctatus)

We did not find this species in 2001-2003, but its presence at WACA is verified with a specimen. Persons and Bradley (2000) reported this as a range extension, being the first record in Coconino County and in eastern Arizona above the Mogollon Rim. In addition, natural history observation cards on file at the Flagstaff Area National Monuments headquarters contain a number of reliable sightings from the 1950's, 1960's, and 1970's. These sightings, as well as the single specimen, were all from the visitor center and headquarters area and along the nearby Island Trail. The lack of recent reports, combined with our failure to locate the species, suggests Ring-necked Snakes may be rare at WACA.

*Sonoran Mountain Kingsnake (*Lampropeltis pyromelana*)

Although we only found two individual Sonoran Mountain Kingsnakes in 2001-2003, it is probably common at WACA. Frequent reports by visitors in the headquarters area and on the Island and Rim trails (natural history observation cards on file at the Flagstaff Area National Monuments headquarters), and our sightings near Cherry Canyon and east of Santa Fe Dam), indicate that this species probably occurs in all habitats throughout the monument.

*Gopher Snake (*Pituophis catenifer*)

We observed only two Gopher Snakes in 2001-2003, but this widespread species is common in varied habitats throughout the region, and is probably common throughout WACA as well.

*Western Terrestrial Garter Snake (*Thamnophis elegans*)

We observed 10 Western Terrestrial Garter Snakes in 2001-2003, the most of any snake species at WACA. We found this widespread snake both on the canyon rim (entrance road) and in the canyon bottom. On multiple occasions we found these snakes in the tinajas in Cherry Canyon, where they undoubtedly prey on the Canyon Treefrogs that live there. The Western Terrestrial Garter Snake is probably common throughout the monument.

*Western Rattlesnake (*Crotalus viridis*)

We found only two Western Rattlesnakes at WACA in 2001-2003. One of these was in the canyon bottom near Santa Fe Dam, and the other was a road kill on the entrance road. Both of these snakes were referable to the widespread "Hopi" subspecies (C. v. nuntius). However, the Arizona Black Rattlesnake (C. v. cerberus) occurs nearby in the Flagstaff area, and may occur at WACA as well. Some authors (e.g., Douglas et al. 2002) consider the Arizona Black Rattlesnake to be a separate species. One of us (EMN) is currently working with NAU graduate student Justin Schofer on a project involving searching for Arizona Black Rattlesnakes at WACA and other NPS units in Arizona. In 2004, one rattlesnake was caught near the visitor center that appeared, based on color pattern,

to be intermediate between these two subspecies, and genetic analysis will be performed using blood from this snake. NPS staff photographed another rattlesnake in 2004 in the same area, and this snake also appeared intermediate between the two subspecies in some aspects of color pattern. Further research is needed to determine the genetic affinities of WACA Western Rattlesnakes.

Species That Possibly Occur at Walnut Canyon National Monument

Plains Spadefoot (*Spea bombifrons*)

The Plains Spadefoot is not as common or widespread as the closely related Mexican Spadefoot, but the two species co-occur at a number of sites in northern Arizona, including north and east of Flagstaff (Persons and Nowak, personal observation). Based on habitat, we would expect this species to possibly occur in the eastern part of WACA, especially in the wide, sandy areas of the bottom of Walnut Canyon. The persistent drought during the study period was likely responsible for our failure to detect amphibians in this habitat.

Red-spotted Toad (*Bufo punctatus*)

This widespread species is usually found in rocky, canyon habitats (Stebbins 2003), and we had expected to find it at WACA. The permanent tinajas in Cherry Canyon appear to be suitable habitat, but repeated visits detected no toads or toad tadpoles. Due to the current drought, other potential temporary pool breeding sites did not occur in 2001-2003. For example, a large pool often forms at the eastern base of the old Santa Fe Dam, in an area of the canyon where Red-spotted Toads might occur, but this pool never filled during the monsoon season in any year of our inventory.

Mountain Treefrog (*Hyla eximia*)

In Arizona, this small treefrog primarily occurs along the Mogollon Rim highlands, including numerous locations in the Flagstaff area. Mountain Treefrogs breed during the summer monsoon season in a variety of temporary aquatic habitats, including earthen stock tanks and roadside ditches. This species may occur in the ponderosa pine forest in or near WACA, especially where there are a number of stock tanks just north and west of the monument. These stock tanks did not fill adequately during our inventory, due to the drought conditions that prevailed in 2001-2003.

Western Chorus Frog (*Pseudacris triseriata*)

This small treefrog breeds in a variety of temporary and permanent aquatic habitats in and around Flagstaff, Arizona, usually where the shoreline is dense grass or there is emergent vegetation. We have seen Western Chorus Frogs at Lower Lake Mary near the confluence with Walnut Canyon (about 6 km [4 mi] southwest of WACA), and the species likely breeds in a number of earthen stock tanks located just west of WACA, and may occur within the monument as well.

Eastern Collared Lizard (*Crotaphytus collaris*)

This large, conspicuous lizard may occur at WACA, but if so, remained undetected during our surveys. The Eastern Collared Lizard is common both north and east of WACA, and could possibly occur in the open, rocky habitats along or in Walnut Canyon near the eastern boundary of the monument.

Lesser Earless Lizard (*Holbrookia maculata*)

This widespread species occurs in a variety of open habitats in northern Arizona, and has been seen in the vicinity of Winona, about 8 km (5 mi) northeast of WACA (Nowak and Persons, unpublished data). The Lesser Earless Lizard may occur in the open woodlands, or more likely, in the wide, open sandy canyon bottom habitats in the eastern part of WACA.

Great Plains Skink (*Eumeces obsoletus*)

In the Southwest, this large skink is usually associated with foothill and mountain habitats, including canyons (Stebbins 2003), and reaches the local northern limit of its distributional range in Arizona in the ponderosa pine forests along the Mogollon Rim just south of Flagstaff. One of us (EMN) has found this species in rocky, ponderosa pine forest habitat near Willard Spring, about 22 km (14 mi) southwest of WACA. While the species may not occur at WACA simply because it has not colonized the area, suitable habitat appears to be present, and we suspect this species may eventually be found in the monument, most likely within or near Walnut Canyon itself.

Madrean Alligator Lizard (*Elgaria kingii*)

Like the Great Plains Skink, this species reaches its northern distributional limit along the Mogollon Rim just south of Flagstaff. We have observed Madrean Alligator Lizards near Willard Spring, about 22 km (14 mi) southwest of WACA (Persons and Nowak, personal observation). Because apparently suitable rocky, forested habitat (e.g., Stebbins 2003) exists at WACA, this species may occur within the monument.

Western Blind Snake (*Leptotyphlops humilis*)

This tiny, burrowing species is widespread in deserts and foothills in southern Arizona and the Verde Valley, but has not been recorded above 1,524 m (5000 ft) elevation (Stebbins 2003). A specimen at the University of Colorado Museum (UCM 20002) was reportedly collected 2.4 km (1.5 mi) northwest of Walnut Canyon, Coconino County, Arizona in 1953. The collector (F.A. Shannon) is a well-known herpetologist, but the locality data may be in error because WACA seems much too high and cold for this species.

Glossy Snake (*Arizona elegans*)

This species is widespread at lower elevations in the region, especially north and east of Flagstaff, and is often common in grassland and open woodlands where there is loose soil suitable for burrowing. Although slightly outside the known local range of the species, Glossy Snakes may occur in the open, sandy habitats in the bottom of Walnut Canyon near the east boundary of the monument.

Night Snake (*Hypsiglena torquata*)

This small, strictly nocturnal species is widespread in a variety of habitats in the region (Stebbins 2003), and almost certainly occurs at WACA.

Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has a spotty distribution across the southern Colorado Plateau, usually occupying grassland habitats in northern Arizona. However, it occurs in woodlands, canyons, and forests in New Mexico and Colorado (Degenhardt et al. 1996, Hammerson 1999), and in Utah it broadly overlaps the range of the Sonoran Mountain Kingsnake in the central mountains (Cox and Tanner 1995, Stebbins 2003). While all "tri-colored" kingsnakes positively identified at WACA have been Sonoran Mountain Kingsnakes, there is a slight chance that Milk Snakes also occur, and are probably more likely in the sandy habitats at the eastern end of the monument.

Striped Whipsnake (*Masticophis taeniatus*)

This fast, diurnal snake is widespread in the region, and we have seen it in pinyon-juniper woodland northeast of WACA, as well as in ponderosa pine forest west of WACA. The Striped Whipsnake almost certainly occurs within the monument.

Western Patch-nosed Snake (*Salvadora hexalepis*)

Most records of this species from northern Arizona are from Great Basin Desertscrub habitats below about 1,524 m (5000 ft) elevation (unpublished data). However, a recent specimen from pinyon-juniper habitat at 1,890 m (6,200 ft) elevation indicates a wider ecological and elevational range for the species in the WACA area. This specimen (UAZ 53765) was found about 8 km (5 mi) northeast of WACA from an open, park-like area within the woodland, in the sandy floodplain of San Francisco Wash, which is a downstream continuation of Walnut Canyon. This suggests that Western Patch-nosed Snakes probably occur in similar habitat in the eastern part of the monument.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

The Black-necked Garter Snake is more aquatic than the more widespread Western Terrestrial Garter Snake, and has a spottier distribution in the region (Stebbins 2003). Persons and Rosen (2001) reported a specimen collected just north of Flagstaff in the early 1900's, probably before the Rio de Flag had been modified into its present flood-control design. Although we observed only Western Terrestrial Garter Snakes at WACA, the Black-necked Garter Snake may occur there as well.

Western Lyre Snake (*Trimorphodon biscutatus*)

This nocturnal, rear-fanged species occurs primarily in the desert regions of southern Arizona below the Mogollon Rim, with an isolated population in the Oak Creek Canyon area (Stebbins 2003). Because this secretive species prefers rocky habitats, and because a number of other southern Arizona species reach their northern distributional limits near WACA (e.g., Great Plains Skink, Madrean Alligator Lizard, Black-tailed Rattlesnake), the Western Lyre Snake may range this far north as well.

Black-tailed Rattlesnake (*Crotalus molossus*)

This species is widespread in a variety of rocky habitats in southern and central Arizona, and reaches the local northern limit of its distributional range just south of Flagstaff (Lowe et al. 1986, Stebbins 2003). Tom Ferrell (former NPS Resource Management Specialist at WACA) told us he once saw a Black-tailed Rattlesnake on the entrance road at WACA, probably in the early 1990's. Because he was familiar with the species from southern Arizona, we are inclined to believe his sighting, but a record such as this would need to be verified with a photograph or specimen.

Table Q-1. Amphibian and reptile species known or expected to occur at Walnut Canyon National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	SX	Present in Park	Rare
Plains Spadefoot	2		
Mexican Spadefoot	SX	Present in Park	Uncommon
Red-spotted Toad	2		
Canyon Treefrog	SX	Present in Park	Uncommon
Mountain Treefrog	1		
Western Chorus Frog	1		
Eastern Collared Lizard	1		
Lesser Earless Lizard	2		
Greater Short-horned Lizard	SP	Present in Park	Common
Eastern Fence Lizard	SP	Present in Park	Abundant
Ornate Tree Lizard	SP	Present in Park	Abundant
Many-lined Skink	SP	Present in Park	Rare
Great Plains Skink	2		
Little Striped Whiptail	SX	Present in Park	Common
Plateau Striped Whiptail	SX	Present in Park	Common
Madrean Alligator Lizard	2		
Western Blind Snake	1		
Glossy Snake	1		
Ring-necked Snake	SP	Present in Park	Rare
Night Snake	3		
Sonoran Mountain Kingsnake	SP	Present in Park	Common
Milk Snake	1		
Striped Whipsnake	3		
Gopher Snake	SP	Present in Park	Common
Western Patch-nosed Snake	3		
Black-necked Garter Snake	1		
Western Terrestrial Garter Snake	SP	Present in Park	Common
Western Lyre Snake	1		
Black-tailed Rattlesnake	3		
Western Rattlesnake	SP	Present in Park	Uncommon
TOTAL RANK 1	8		
TOTAL RANK 2	5		
TOTAL RANK 3	4		
TOTAL FOUND (SX, OX, SP, OP)	14		
WEIGHTED TOTAL	21.2		
ESTIMATED INVENTORY COMPLETENESS	66%		

Table Q-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Walnut Canyon National Monument, 2001-2003. GS = general survey, NGS = nocturnal general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, ND = night drive, and RE = random encounter.

Species	GS	NGS	1-ha TACS	10-ha TACS	ND	RE	Total
Tiger Salamander					1		1
Mexican Spadefoot		1			3		4
Canyon Treefrog	13	3				3	**19**
Eastern Fence Lizard	225		57	34	1	14	**331**
Ornate Tree Lizard	151		15	16		4	186
Little Striped Whiptail	14		2				16
Plateau Striped Whiptail	13		5			1	**19**
Sonoran Mountain Kingsnake	2						2
Gopher Snake	2						2
Western Terrestrial Garter Snake	8		1		1		10
Western Rattlesnake	1				1		2
TOTAL	429	4	80	**50**	**7**	**22**	**592**

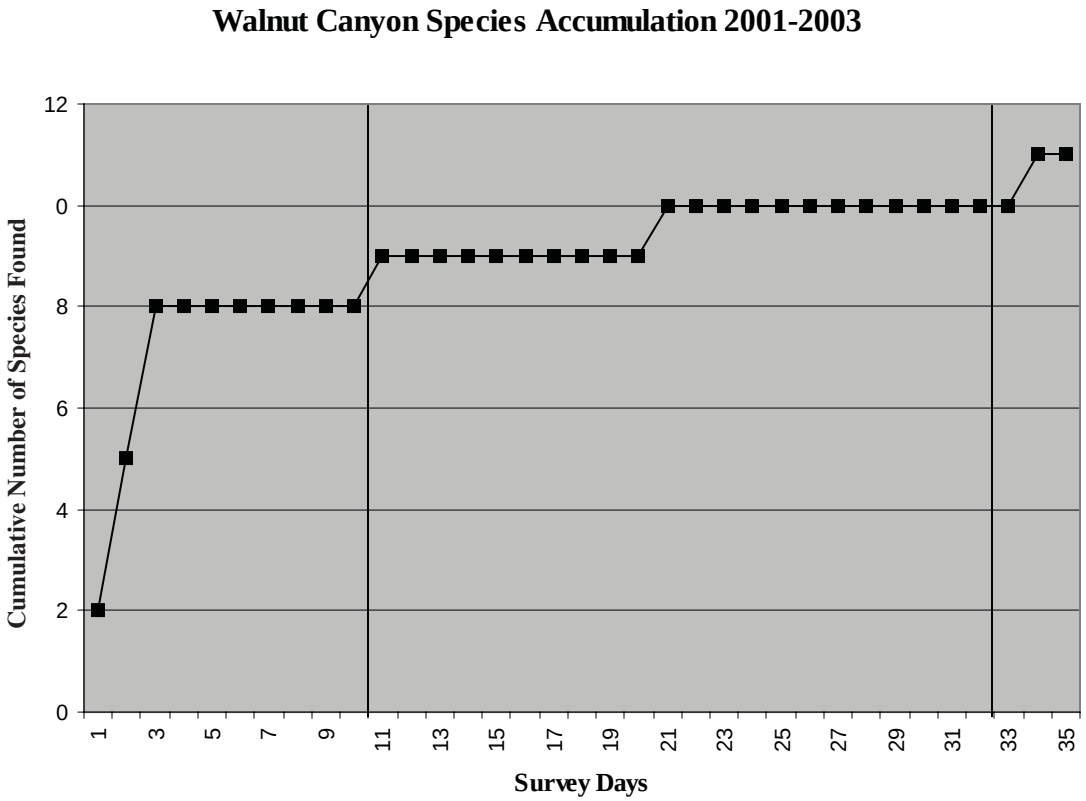

Figure Q-1. Species accumulation curve for amphibians and reptiles at Walnut Canyon National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix R. Wupatki National Monument

WUPA is located about 53 km (33 mi) north of Flagstaff, in Coconino County, Arizona. Elevation ranges between 1,304 and 1,744 m (4,278-5,722 ft). The monument encompasses 14,399 ha (35,566 acres), and was established to protect several prehistoric pueblo ruins. Wupatki is divided by the Doney Cliffs, a northeast trending geologic fault that separates the grassland and juniper savanna habitats to the west from the Great Basin desertscrub habitats in Wupatki Basin to the east. The normally dry Little Colorado River forms the northeastern boundary of the monument. Additional information on natural resources at WUPA is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 208 person-hours surveying for herpetofauna at WUPA in 2001-2003. Methods used, and number of person-hours spent on each method, included general surveys (145.6), random 1-ha TACS plot surveys (20.0), random 10-ha TACS plot surveys (11.3), and night driving (30.8). We recorded 1,067 individual amphibians and reptiles of 24 species during our surveys, and three additional species were documented based on our review of the literature and museum specimen records. A summary of the total number of each species observed by each method is presented in Table R-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at WUPA

Based on our surveys at WUPA and inclusion of previously documented species we estimate an inventory completeness of 95% (Table R-1). A species accumulation curve based on our surveys (Figure R-1) suggests we are close to reaching inventory completeness. As with PEFO, the only other SCPN park with >90% inventory completeness, this high level of inventory completeness at WUPA is primarily due to the availability of extensive paved roads that traverse all major habitats within the monument. In addition, the data available from previous studies and museum specimens has been important at WUPA.

Literature and Museum Specimen Data Searches

We searched for museum specimen records from Coconino County, Arizona from the American Museum of Natural History (AMNH), Arizona State University (ASU), Brigham Young University (BYU), California Academy of Sciences (CAS), The Carnegie Museum (CM),University of Colorado Museum (CU), University of Kansas Museum of Natural History (KU), Los Angeles County Museum (LACM), Museum of Comparative Zoology (MCZ), Museum of Northern Arizona (MNA), Museum of Southwestern Biology, University of New Mexico (MSB), Museum of Vertebrate Zoology (MVZ), Northern Arizona University (NAU), United States National Museum (USNM), University of Arizona (UAZ), University of Michigan Museum of Zoology (UMMZ), University of Texas at El Paso (UTEP), and the Flagstaff Area National Monuments vertebrate collection (WUPA).

We located museum specimen records for 24 species previously collected at WUPA (Appendix T). Three of these (Glossy Snake, Milk Snake, and Western Ground Snake) were not detected during the present inventory. A specimen of Western Terrestrial Garter Snake (MNA Z7.238) collected at WUPA in 1960 is correctly identified, but the locality data may be in error. We also located a specimen record (UMMZ 222953) for Southwestern Toad (Bufo microscaphus), a species not known from the WUPA region (Stebbins 2003), collected along the Little Colorado River at WUPA. We did not examine this specimen, but suspect it may be the similar Woodhouse's Toad, a species we failed to voucher but which occurs in that habitat at WUPA.

There are no comprehensive overviews of the amphibians and reptiles of WUPA. Bateman (1976) presented a combined species list for both SUCR and WUPA, which reduced its usefulness for either monument. Bateman (1980) reported on herpetofaunal surveys at WUPA, primarily focusing on pitfall trapping of lizards in the three major habitat types (cold desert shrub, grassland, and juniper/grassland) in the monument. These surveys documented many of the common species, and broad habitat partitioning results were in general agreement with the present inventory. Walthuis (1972) reported an observation of a Common Kingsnake preying upon a Western Rattlesnake near the Wupatki Ruins. Graham (2001) surveyed a number of ephemeral pools at WUPA, and reported adult amphibians and tadpoles seen at these sites. Persons (2001a) conducted extensive night driving surveys over two years, and recorded most amphibians and snakes known from WUPA. Persons (2001a) presented detailed dot distribution maps for each species along FR 545 and the Wukoki Ruins road, providing insight into the ecological distribution of species within the monument. Persons (1999) reported the first specimen of Western Ground Snake from WUPA, collected in the 1950's, and Persons and Nowak (2004a) reported the Western Banded Geckos collected during the present inventory as a range extension into the Little Colorado River basin. Most recently, Persons (2005) conducted a detailed habitat and distributional study of the Little Striped Whiptail in grasslands at WUPA.

Sensitive Species and Threats to the Herpetofauna

The Little Striped Whiptail has declined in many areas (Stebbins 2003), and WUPA encompasses a significant portion of the regional range of the species (Persons 2005). Maintaining ungrazed, juniper-free grassland habitat appears to be important for Little Striped Whiptail at WUPA (Persons 2005). Almost nothing is known about the status of Milk Snake or Western Ground Snake at WUPA, but these species are rare in the region, and WUPA is known to herpetological collectors as a location at which to find them. Park staff is aware of the potential threat to herpetofauna through illegal collecting, especially by nighttime road driving during the summer months. Road mortality of amphibians and snakes, although currently moderate, could potentially impact populations if visitation and traffic were to greatly increase in the future (Persons 2001a).

Considerations for Future Inventory and Long-term Monitoring

If future inventory efforts are conducted at WUPA, we recommend they focus on searching for Sagebrush Lizard and Western Terrestrial Garter Snake, and collecting a voucher specimen of Woodhouse's Toad. Additional effort could go towards determining the status and distribution of uncommon or rare species such as Tiger Salamander, Western Banded Gecko, Milk Snake, and Western Ground Snake. Overall, night driving is probably the most effective method to survey for most species, but carefully timed cover-flipping surveys would probably work best for some species (e.g., Western Banded Gecko, Western Ground Snake).

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at WUPA to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At WUPA, the primary monitoring method for amphibians will probably be night driving, which is an effective method to sample all amphibian species across most habitats in the monument. Amphibian monitoring may also include periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as Arrowhead Tank, the area of Deadman Wash where FR 545 crosses it, and pools along the Little Colorado River. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys (such as along visitor trails) during the morning or dusk hours. At WUPA, Eastern Fence Lizard, Side-blotched Lizard, and Plateau Striped Whiptail may be good candidates for monitoring, because these species are common throughout the monument and at most SCPN parks, making network-wide comparisons possible. Other lizard species could be included in particular habitat types, such as Lesser Earless Lizard and Little Striped Whiptail in grassland, Western Whiptail and Desert Spiny Lizard in Great Basin Desertscrub, and Ornate Tree Lizard in basalt rockpile habitats within the grassland and juniper woodland.

Species Accounts of Amphibians and Reptiles at WUPA

Because we do not have data on population sizes or density of species at WUPA, and because many species are secretive or are only active during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at WUPA, and also with the same species elsewhere throughout its range in the region. An asterisk (*) denotes a species represented by a voucher specimen. Status of all documented and hypothetical species at WUPA, as well as NPSpecies checklist field assignments, are presented in Table R-1.

Species Documented from Wupatki National Monument

*Tiger Salamander (*Ambystoma tigrinum*)

We observed a single Tiger Salamander at WUPA, crossing FR 545 near the Heiser Spring area in September 2002. The only other mention of this species at WUPA was from a natural history observation card (on file at Flagstaff Area National Monuments headquarters), which reported a Tiger Salamander seen in 1976 after draining a pond at Heiser Spring. Persons (2001a) did not record this species in two years of intensive night driving surveys at WUPA. It is unknown how widespread Tiger Salamanders are in the monument.

*Plains Spadefoot (*Spea bombifrons*)

The Plains Spadefoot is uncommon at WUPA, but is distributed throughout the monument (Persons 2001a). Although

both spadefoots occur together at WUPA, the Plains Spadefoot is much less abundant than the similar Mexican Spadefoot,

*Mexican Spadefoot (*Spea multiplicata*)

The Mexican Spadefoot is abundant throughout WUPA, especially in the Great Basin desertscrub and grassland habitats (Persons 2001a). This species is much more common than the similar Plains Spadefoot.

*Great Plains Toad (*Bufo cognatus*)

This large toad is common in both Great Basin desertscrub and grassland habitats at WUPA, but is apparently absent from juniper savanna (Persons 2001a). Between 1999-2003, which were mostly drought years in the region, we observed no juvenile Great Plains Toads, and heard no breeding choruses (Persons 2001a, present study), suggesting that this species does not reproduce annually in the monument.

*Red-spotted Toad (*Bufo punctatus*)

The Red-spotted Toad is distributed broadly throughout WUPA (Persons 2001a), but primarily occurs in rocky areas such as near Deadman Wash in Wupatki Basin, the Doney Cliffs and Doney Mountain, and in the area west of the Citadel where there is a large amount of exposed limestone bedrock that contain potholes. This species is regularly heard calling from the sewage lagoon south of the visitor center and residence area, as noted by Bateman (1980).

Woodhouse's Toad (*Bufo woodhousii*)

Persons (2001a) found Woodhouse's Toads only in Wupatki Basin, and in only one year (1999) of his two-year study. During the present inventory, we observed two Woodhouse's Toads along the Little Colorado River during spring runoff, but could capture neither individual. Prior to this inventory, Persons (personal observation) found Woodhouse's Toad metamorphs along the Little Colorado River as well, and this habitat is probably the stronghold for the species at WUPA. This is the only documented species at WUPA that is not represented by a verified voucher specimen. However, a specimen record (UMMZ 222953) for Southwestern Toad (Bufo microscaphus), a species not known from the WUPA region, collected along the Little Colorado River at WUPA may actually be the similar Woodhouse's Toad.

*Eastern Collared Lizard (*Crotaphytus collaris*)

This colorful lizard is common in rocky habitats throughout the monument, including sandstone areas in Wupatki Basin; limestone in Wupatki Basin, Antelope Wash, and in the Lomaki area; and volcanic basalt rockpiles on Woodhouse Mesa and in the western grasslands and juniper savanna.

*Long-nosed Leopard Lizard (*Gambelia wislizenii*)

This relative of the Eastern Collared Lizard is also found throughout the monument, but is much more common in the open, shrub habitats in Wupatki Basin. Long-nosed Leopard Lizards were frequently seen perched on small rocks along the River Road leading from near Wukoki Ruin to the Little Colorado River.

*Lesser Earless Lizard (*Holbrookia maculata*)

The Lesser Earless Lizard was abundant in open areas in the western part of WUPA, especially in the juniper-dominated habitats where grass cover was reduced. It was also common in the shrub habitats near the south boundary of the monument, but was absent from the lowermost Great Basin desertscrub habitats in Wupatki Basin. Persons (2005) found this species to be even more abundant on grazed grasslands on Antelope Prairie just north of the WUPA boundary, attributable to the much more open structure of the grassland on the grazed sites as compared to those within the monument.

*Greater Short-horned Lizard (*Phrynosoma hernandesi*)

Persons (2001a) found 17 Greater Short-horned Lizards on the paved roads within WUPA, but none in the lower areas of Wupatki Basin. Likewise, the five individuals we found during the present inventory were all in grassland and juniper habitats, as are all previous collections of this species that contain adequate locality data. Stebbins (2003) does not list desert among the wide array of habitats occupied across the range of the species.

*Desert Spiny Lizard (*Sceloporus magister*)

This large spiny lizard is near the local terminus of its distributional range in the Little Colorado River Valley in the WUPA area. At WUPA, it is restricted to Great Basin desertscrub habitats within and along the margins of Wupatki Basin. Although it occurs near Doney Mountain and in Antelope Wash, it has never been found in the grasslands above the Doney Cliffs. It is common in sandstone and limestone areas, such as along washes or outcrops in Wupatki Basin. Desert Spiny Lizards can often be found on the rock walls near the WUPA visitor center.

*Eastern Fence Lizard (*Sceloporus undulatus*)

This was one of the most frequently observed species in 2001-2003, and was found throughout the monument. Eastern Fence Lizards were usually found on rocks or trees, and were most abundant on the large volcanic basalt rockpiles found throughout the western part of WUPA.

*Ornate Tree Lizard (*Urosaurus ornatus*)

Prior to our surveys, there were no reliable records of this species from WUPA. Bateman (1980) reported observ-

ing two individuals, but because neither were captured, and more importantly because they were observed in Great Basin desertscrub habitat, these likely represent misidentifications of the Side-blotched Lizard. We discovered Ornate Tree Lizards to be locally common on large, volcanic basalt rockpiles in the grassland and juniper savanna habitats in the western part of the monument. We found them in these habitats from near the western boundary east as far as Hull's Canyon in the south, and near some ruins about 1.6 km (1 mi) east of the Lomaki area in the north. In the Lomaki and Citadel area of WUPA, the Ornate Tree Lizard and the Side-blotched Lizard do not directly overlap in distribution, with one species being found on one rockpile, while the other species may be found on a nearby rockpile. Because these species differ in their moisture preferences, with the Ornate Tree Lizard usually occurring in more mesic habitats (Stebbins 2003), this would make an ideal species pair for long-term monitoring at WUPA, where changes in the microdistribution of species could be analyzed in relation to climatic trends.

*Side-blotched Lizard (*Uta stansburiana*)

The Side-blotched Lizard was found throughout much of WUPA, but was generally absent from the far western portion of the monument, where Ornate Tree Lizards were instead found in many of the rocky habitats. Overall, this was the most frequently observed species in 2001-2003, and was abundant in any rocky habitat throughout the Great Basin desertscrub of Wupatki Basin. In some areas in the grasslands at WUPA, this species and the Ornate Tree Lizard do not directly overlap, but instead are found on adjacent rockpiles, providing an ideal situation for long-term monitoring (see Ornate Tree Lizard account).

*Little Striped Whiptail (*Cnemidophorus inornatus*)

This whiptail lizard has a disjunct, relictual distribution on the southern Colorado Plateau, and is generally found in grasslands in the region (Persons 2005, Wright and Lowe 1993). At WUPA, this species occurs throughout the grasslands and juniper habitats west of the Doney Cliffs, including in an isolated area of grassland in the bottom of Antelope Wash, but is only common in open grasslands with few or no junipers (Persons 2005). The Little Striped Whiptail is sympatric with the unisexual Plateau Striped Whiptail throughout its range at WUPA, and also with the Western Whiptail in its limited distribution within Antelope Wash. The grasslands of the eastern San Francisco Volcanic Field, which are more or less centered on the western half of WUPA, contain (in aerial extent) the largest known population of Little Striped Whiptail in Arizona (Persons 2005). Therefore, WUPA may play an important role in regional conservation of this species by providing for the persistence of ungrazed, juniper-free grassland habitats (Persons 2005).

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual whiptail species is widespread over much of the Colorado Plateau (Stebbins 2003), and occurs throughout WUPA, except in the lowest elevation Great Basin desertscrub habitats within Wupatki Basin, where only the Western Whiptail is found. The Plateau Striped Whiptail is most abundant in the same grassland habitats utilized by the Little Striped Whiptail at WUPA, and Persons (2005) found no ecological differences in areas where they occurred together.

*Western Whiptail (*Cnemidophorus tigris*)

This widespread whiptail lizard is found in desert habitats throughout the West (Stebbins 2003). At WUPA, this species is abundant in and restricted to Great Basin desertscrub habitats within Wupatki Basin, including within Antelope Wash. The species may occur in grassier areas in the Crack-In-Rock area, as Persons (personal observation) has noted them in the shadscale-grassland ecotonal habitats north of there.

*Western Banded Gecko (*Coleonyx variegatus*)

One of our most exciting finds at any SCPN park was the discovery of Western Banded Gecko at WUPA (Persons and Nowak 2004a). Previously, this species was only known from Sonoran and Mojave Desert regions, and distributed in Arizona south of the Mogollon Rim and extending eastward along the Colorado River into Grand Canyon National Park. Brennan et al. (2002) recently reported a specimen from Lake Powell (Antelope Point) at GLCA, but WUPA represents the first record for the Little Colorado River basin. Together with the GLCA record, it establishes occurrence of this gecko in Great Basin desertscrub habitats. We found three specimens at WUPA in 2002, two in Deadman Wash (one collected) and one in Kana-a Wash (collected), all under slabs of sandstone. Not included in the results of this inventory, we found another individual in Kana-a Wash in early 2004. It is likely that Western Banded Geckos have extended their distribution up the Little Colorado River Valley from Grand Canyon, as is the case with other more conspicuous species (Desert Spiny Lizard, Western Patchnose Snake) that reach the local terminus of their distributions near WUPA.

*Glossy Snake (*Arizona elegans*)

We did not observe this species in 2001-2003, but Persons (2001a) found Glossy Snakes on the road in grassland and Great Basin desertscrub habitats in and near WUPA. This species is probably common throughout most of WUPA, although it is not known from the lowest elevation areas of Wupatki Basin.

*Night Snake (*Hypsiglena torquata*)

This small, strictly nocturnal species is widespread in the region (Stebbins 2003), and has been found in all major habitat types at WUPA (Persons 2001a, present study). Although not rare, Night Snakes are much less common at WUPA than they were in a similar inventory conducted at PEFO (Drost et al. 1999, 2001).

*Common Kingsnake (*Lampropeltis getula*)

Although we found only a single road-killed Common Kingsnake in 2001-2003, Persons (2001a) observed the species uncommonly throughout the grassland and Great Basin Desertscrub habitats along FR 545 at WUPA.

*Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has a spotty distribution throughout grasslands in northern Arizona, and is known in the WUPA area from two museum specimens collected in 1937 and 1951 along US Highway 89 north of Flagstaff. The 1951 specimen (BYU 10534; Tanner 1951) was collected "37 miles N of Flagstaff along hwy 89, approx. 2 miles N of W entrance to Wupatki Nat'l Mon." Because the current WUPA entrance road was not constructed until 1954, this record refers to the old entrance road, which ran from near Sinagua Trading Post east along the southern boundary of the monument (Gwenn Galenstein, Flagstaff Area National Monuments, personal communication). Therefore, 2 miles north of this road would put this specimen about 0.8 km (0.5 mi) south of the current entrance road, within the boundary of the monument. This species is apparently rare and extremely secretive, and probably still occurs in grassland at WUPA.

*Striped Whipsnake (*Masticophis taeniatus*)

This fast, diurnal snake is widespread in a variety of habitats throughout the region (Stebbins 2003), and is common throughout WUPA.

*Gopher Snake (Pituophis catenifer)

This widespread, generalist species occurs in all habitats throughout WUPA. We found eight Gopher Snakes in 2001-2003, and Persons (2001a) recorded 48 individuals in 1999-2000, the most of any snake species.

*Western Patch-nosed Snake (*Salvadora hexalepis*)

We observed two Western Patch-nosed Snakes in 2001-2003, and Persons (2001a) also observed two individuals. Although one individual we found was on a small grassy mesa just south of Wukoki Ruin, all observations or previously collected specimens have been recorded from within the Wupatki Basin. There is an unverified observation of Western Patch-nosed Snake from the western part of WUPA (natural history observation card on file at Flagstaff Area National Monument headquarters), and a recent record from the pinyon-juniper zone on Leupp Road east of Flagstaff (see Walnut Canyon National Monument account) suggests the species may be more widespread in the area. This snake has likely extended its range southward up the Little Colorado River valley, and appears to reach the local terminus of its distribution in the WUPA area.

*Western Ground Snake (*Sonora semiannulata*)

Persons (1999) reported the first record of this species from WUPA, which was also the first record in Arizona north of the Mogollon Rim outside of the Grand Canyon, and for the Little Colorado River Basin. This report was based on two specimens (UAZ 26371-2) collected in 1951, and the locality was stated as "Wupatki Nat. Mon." Both of these specimens had a banded pattern, which is typical of individuals from the Grand Canyon (Miller et al. 1982) and Yavapai County, Arizona (George Bradley, University of Arizona, personal communication). This small, secretive species usually occupies sites with some subsurface moisture (Stebbins 2003), and spring or seep areas may be the most likely spots within WUPA to harbor populations of Western Ground Snake.

*Western Rattlesnake (*Crotalus viridis*)

The Western Rattlesnake is widespread in the region (Stebbins 2003), and common in all habitats throughout WUPA (Persons 2001a, present study). Specimens from WUPA are referable to the "Hopi" subspecies (C. v. nuntius), which is widespread in northeastern Arizona. Douglas et al. (2002) included specimens (blood samples) from in and near WUPA, all of which he assigned to the Prairie Rattlesnake (C. v. viridis), arguing that the Hopi Rattlesnake is merely a somewhat stunted variety of the Prairie Rattlesnake.

Species That Possibly Occur at Wupatki National Monument

Sagebrush Lizard (*Sceloporus graciosus*)

The Sagebrush Lizard is abundant in some areas of northern Arizona, such as at Petrified Forest National Park (Drost et al. 2001) and on the north rim at Grand Canyon national Park (Miller et al. 1982). However, the species has a spotty distribution in the WUPA area. Persons (personal observation) has seen Sagebrush Lizards near Roden Spring, about 11 km (7 mi) south of WUPA. Three specimens (UTEP 12590-2) were collected in 1975 at a locality "19 mi. (by USHY 89) S & 1 mi. W Cameron Post Office," which we estimate to be 4.8 km (3.0 mi) north of the current WUPA entrance road on US Highway 89. Although we have not surveyed this site, it is within a large area of very dry, heavily grazed grassland, unlike the sandy shrub habitats where the species occurs at Roden Spring and at Petrified Forest. If Sagebrush Lizards

do occur at WUPA, they are rare, and likely occur as small, isolated populations.

Long-nosed Snake (*Rhinocheilus lecontei*)

This species has not been found in the WUPA region, or anywhere in the Little Colorado River basin of northeastern Arizona (Stebbins 2003). However, it occurs within the Grand Canyon, and extends its distribution along the Colorado River corridor into eastern Utah (Grogan and Tanner 1974), suggesting it may occur along the Little Colorado River corridor upstream towards WUPA, as is the case with other desert species such as the Desert Spiny Lizard, Western Banded Gecko, Western Whiptail, and Western Patch-nosed Snake.

Southwestern Black-headed Snake (*Tantilla hobartsmithi*)

This small, secretive species has not been found in northeastern Arizona outside of the Grand Canyon, but it is distributed northward into eastern Utah and extreme western Colorado (Stebbins 2003), and could occur in the WUPA region. Elsewhere this species is usually found under surface objects, and could possibly occur in areas of Wupatki Basin where there are abundant flat sandstone flakes.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

If garter snakes occur at WUPA (see Western Terrestrial Garter Snake account, below), then this species is also possible. Persons and Rosen (2001) reported specimens from the Little Colorado River in the Winslow and Holbrook areas, suggesting the species could follow the river downstream to WUPA. Although the Little Colorado River only flows a few times a year, isolated pools remain for longer periods, however it still seems unlikely that the relatively aquatic Black-necked Garter Snake (Stebbins 2003) would occur at WUPA.

Western Terrestrial Garter Snake (*Thamnophis elegans*)

A specimen of Western Terrestrial Garter Snake in the Museum of Northern Arizona (MNA Z7.238) bears a collecting locality of “Wupatki.” We verified the identification of this specimen, which was collected in 1960 by Ed Lincoln, a graduate student who was studying mammal remains from Wupatki Ruins. No other garter snakes have ever been reported from WUPA, and most habitats within the monument are much too dry for any garter snake species. While it is possible that garter snakes may, at least sometimes, occur along the Little Colorado River at WUPA, the stated locality of “Wupatki” on this specimen suggests that it was, if valid, collected near the Wupatki Ruins. This is supported also by the fact that Lincoln was primarily working in the area of Wupatki Ruins. We may never know if this specimen represents a cataloging error, an errant or dispersing individual, or whether an isolated population of Western Terrestrial Garter Snakes formally occurred near spring areas below Woodhouse Mesa.

Table R-1. Amphibian and reptile species known or expected to occur at Wupatki National Monument. Ranking of probability of species occurrence (“Rank”) is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the “hardest” evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are “breeder” and “native,” respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	SX	Present in Park	Rare
Plains Spadefoot	SX	Present in Park	Common
Mexican Spadefoot	SX	Present in Park	Abundant
Great Plains Toad	SP	Present in Park	Common
Red-spotted Toad	SP	Present in Park	Common
Woodhouse’s Toad	OX	Present in Park	Uncommon
Eastern Collared Lizard	SP	Present in Park	Common
Long-nosed Leopard Lizard	SX	Present in Park	Common
Lesser Earless Lizard	SX	Present in Park	Abundant
Greater Short-horned Lizard	SP	Present in Park	Common
Sagebrush Lizard	2	Unconfirmed	
Desert Spiny Lizard	SX	Present in Park	Common
Eastern Fence Lizard	SX	Present in Park	Abundant
Ornate Tree Lizard	SX	Present in Park	Common

Table R-1. Amphibian and reptile species known or expected to occur at Wupatki National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.—Continued

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Side-blotched Lizard	SX	Present in Park	Abundant
Little Striped Whiptail	SX	Present in Park	Common
Western Whiptail	SX	Present in Park	Abundant
Plateau Striped Whiptail	SX	Present in Park	Abundant
Western Banded Gecko	SX	Present in Park	Uncommon
Glossy Snake	SP	Present in Park	Common
Night Snake	SX	Present in Park	Uncommon
Common Kingsnake	SX	Present in Park	Uncommon
Milk Snake	SP	Present in Park	Rare
Striped Whipsnake	SP	Present in Park	Common
Gopher Snake	SP	Present in Park	Common
Long-nosed Snake	1	Unconfirmed	
Western Patch-nosed Snake	SP	Present in Park	Uncommon
Western Ground Snake	SP	Present in Park	Rare
Southwestern Black-headed Snake	1	Unconfirmed	
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	2	Unconfirmed	
Western Rattlesnake	SX	Present in Park	Common
TOTAL RANK 1	3		
TOTAL RANK 2	2		
TOTAL RANK 3	0		
TOTAL FOUND (SX, OX, SP, OP)	27		
WEIGHTED TOTAL	28.5		
ESTIMATED INVENTORY COMPLETENESS	95%		

Table R-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Wupatki National Monument, 2001-2003. GS = general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, N-R TACS = non-random 1-ha TACS plot, ND = night drive, and RE = random encounter.

Species	GS	1-ha TACS	10-ha TACS	ND	RE	Total
Tiger Salamander				1		1
Plains Spadefoot				4		4
Mexican Spadefoot				22		22
Great Plains Toad				1		1
Red-spotted Toad				5		5
Woodhouse's Toad	2					2
Eastern Collared Lizard	16	1	1		7	25
Long-nosed Leopard Lizard	14	2	3	1	6	26
Lesser Earless Lizard	31	6	1		1	39
Greater Short-horned Lizard	3			1	1	5
Desert Spiny Lizard	40				3	43
Eastern Fence Lizard	142	5	1	1	1	150

Table R-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Wupatki National Monument, 2001-2003. GS = general survey, 1-ha TACS = random 1-ha time-area constrained search (TACS) plot, 10-ha TACS = random 10-ha TACS survey, N-R TACS = non-random 1-ha TACS plot, ND = night drive, and RE = random encounter.—Continued

Species	GS	1-ha TACS	10-ha TACS	ND	RE	Total
Ornate Tree Lizard	25	1				26
Side-blotched Lizard	391	4	28		5	428
Little Striped Whiptail	29				1	30
Western Whiptail	57	3	6		4	70
Plateau Striped Whiptail	154	6	2			162
Western Banded Gecko	3					3
Night Snake	1			2		3
Common Kingsnake					1	1
Striped Whipsnake	6			1	2	9
Gopher Snake	2			3	3	8
Western Patch-nosed Snake	1			1		2
Western Rattlesnake	1		1	1	1	4
TOTAL	918	28	43	44	36	1,067

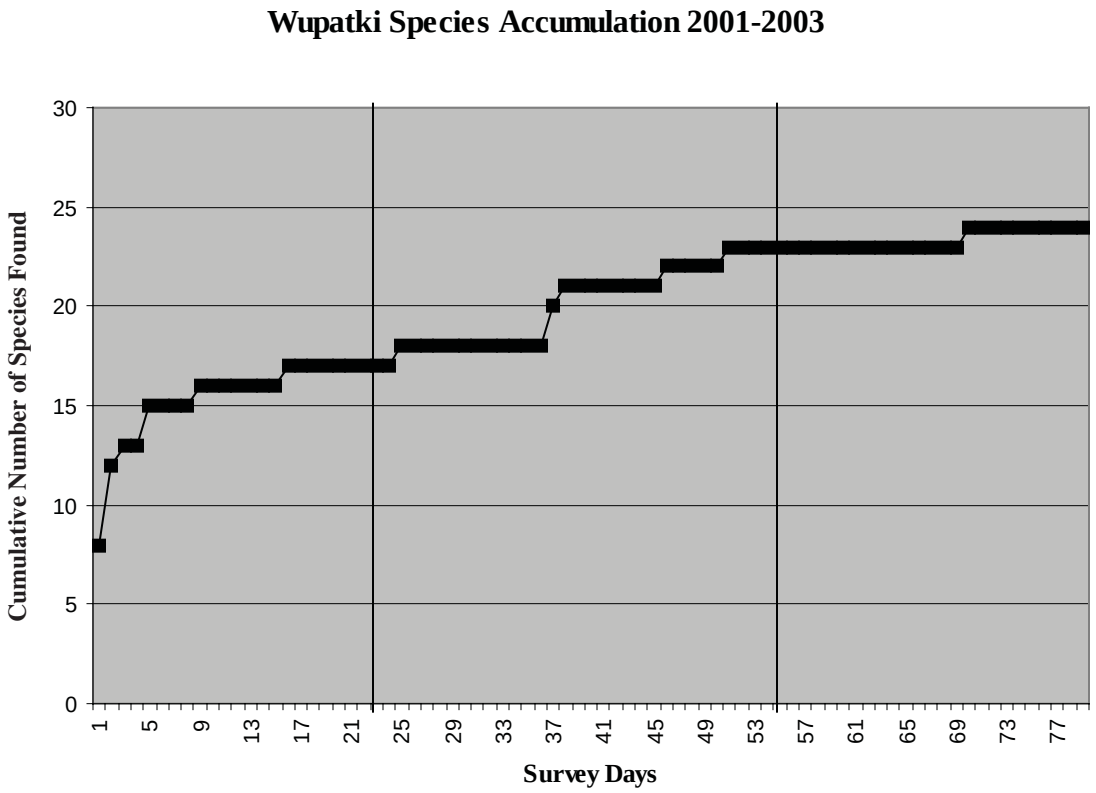

Figure R-1. Species accumulation curve for amphibians and reptiles at Wupatki National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix S. Yucca House National Monument (YUHO)

YUHO is located in the Montezuma Valley south of Cortez, Montezuma County, Colorado. Elevation ranges between 1,767 and 1,805 m (5,798-5,922 ft). The monument encompasses 14 ha (35 acres), and was established to preserve a large, unexcavated ancient pueblo ruin. Habitats at YUHO are dominated by desert shrubs such as four-wing saltbush (*Atriplex canescens*), greasewood (*Sarcobatus vermiculatus*), and wolfberry (*Lycium pallidum*). A perennial spring is located just west of the monument. Roughly 810 ha (2000 acres) of private land surrounding the monument may someday be transferred to the NPS (George San Miguel, personal communication), and this area was included in our inventory. The Ismay Family Property consisted of sagebrush (*Artimisia tridentada*) scrub, pinyon-juniper woodland, and agricultural fields, including the Ute Mountain irrigation ditch and a number of farm ponds. Additional information on natural resources at YUHO is presented in the park narratives section (Appendix D) of Thomas et al. (2004).

Overview of Results

We spent approximately 143 person-hours surveying for herpetofauna at YUHO in 2001-2003. Methods used, and number of person-hours spent on each method, included general surveys (109.3), nocturnal general surveys (19.5), non-random 1-ha TACS plot surveys (11.0), and night driving (3.1). We recorded 318 individual amphibians and reptiles of 13 species during our surveys, and we considered one additional species to be documented based observations by NPS staff. A summary of the total number of each species observed by each method is presented in Table S-2. See Table 5 for voucher specimens collected during this study.

Estimate of Inventory Completeness at YUHO

Based on our surveys at YUHO and inclusion of previously documented species we estimate an inventory completeness of 77% (Table S-1). Although a species accumulation curve based on our surveys (Figure S-1) suggests we are close to reaching inventory completeness, we believe this asymptote reflects only that we are close to detecting most of the common species using our current methods. Detecting the remaining species at YUHO will require much greater field effort and more targeted searches during favorable conditions.

Literature and Museum Specimen Data Searches

We searched specimen records at the California Academy of Sciences (CAS), Museum of Vertebrate Zoology (MVZ), the Museum of Southwestern Biology (MSB), and the USGS Biological Survey Collection for amphibians and reptiles from YUHO. In addition, we were able to search the Colorado Division of Wildlife's amphibian and reptile specimen database for records from YUHO. This database includes all records represented by species account dot maps in Hammerson (1999). We used dot distribution maps in Hammerson (1999) to help us evaluate potential occurrence of some species, based on the proximity of locality dots to YUHO.

We located museum records for specimens of three species previously collected at YUHO (Appendix T), all of which we also observed in 2001-2003. There is no previous literature on the amphibians and reptiles of YUHO. Dr. Albert Spencer (Fort Lewis College) has conducted vertebrate surveys at YUHO for a number of years (field notes are on file in the Resource Management office at MEVE), but has so far observed only the same herpetofauna species we have.

Sensitive Species and Threats to the Herpetofauna

Management of natural and artificial water sources at YUHO, such as filling or drying of ponds and irrigation ditches, will undoubtedly affect amphibians that use these sites for breeding. Northern Leopard Frogs occurred in the YUHO area in the 1960's, but this species has been virtually eliminated from Montezuma County (Marilyn Colyer, personal communication). The unexcavated ruins within the monument itself are apparently used as an overwintering site for numerous snake species, including Western Rattlesnakes. This site may be important for snakes from a much larger area, as suitable, rocky sites such as this appear to be uncommon in the largely agricultural landscape surrounding YUHO. Excavation of these ruins might have a detrimental effect on local snake populations through loss as an overwintering site.

Considerations for Future Inventory and Long-term Monitoring

Because estimated inventory completeness at YUHO is only 77%, additional inventory of amphibians and reptiles may be warranted. If conducted, future inventory effort could focus on documenting species most likely to occur at YUHO, including Mexican Spadefoot, Many-lined Skink, and Night Snake. Without the benefit of extensive roads available for night driving surveys, locating many snake species may require substantial field effort and different methods, such as funnel or pitfall traps. These trapping methods may also be effective in documenting Many-lined Skink.

Alert staff members who spend a lot of time in the parks often see animals. Thus, we encourage all interested NPS staff at YUHO and Mesa Verde to assist in documenting new species. This can be as simple as saving animals found dead (such as on roads), taking several close-up, high-quality images of animals (digital, print, or slide, with location and date to identify the shot), or holding live animals until a herpetologist can process them. Road killed animals should be salvaged and placed in the freezer until they can be properly preserved. These specimens should be double or triple bagged in plastic zip-loc or similar bags, with an effort made to squeeze excess air out of the bags. Complete collection data (date, collector, precise location, preferably with UTM coordinates) should be included in the bags with the specimens.

The SCPN has recently developed a list of core "vital signs" for long-term monitoring across the network, and amphibians were included as monitoring targets for a number of aquatic habitats across the network. At YUHO, amphibian monitoring may be limited to periodic (e.g., annual or biannual) visual encounter surveys (e.g., Crump and Scott 1994) of known breeding sites, such as the various ponds located on Ismay property near the monument. However, the NPS may wish to expand herpetofauna monitoring to include reptiles, and diurnal lizards are the reptile group best suited to monitoring across the SCPN. Methods could include either time-constrained searches or transect surveys during the morning or dusk hours. At YUHO, Sagebrush Lizard, Eastern Fence Lizard, and Plateau Striped Whiptail may be good candidates for monitoring, because these species are common throughout the monument and surrounding Ismay land and at most SCPN parks, making network-wide comparisons possible.

Species Accounts of Amphibians and Reptiles at YUHO

Because we do not have data on population sizes or density of species at YUHO, and because many species are secretive or are active only during short periods each year, the use of the terms abundant, common, uncommon, and rare (the available abundance categories in NPSpecies) are necessarily somewhat subjective. They describe the relative abundance of a particular species, compared with other, similar species at YUHO, and also with the same species elsewhere throughout its range in the region. Status of all documented and hypothetical species at YUHO, as well as NPSpecies checklist field assignments, are presented in Table S-1. An asterisk (*) denotes a species represented by a voucher specimen.

Species Documented from Yucca House National Monument

Tiger Salamander (*Ambystoma tigrinum*)

We observed larval Tiger Salamanders at ponds on the Ismay property, both north of YUHO and east of US Highway 666. However, we only observed this species in 2001, despite repeated visits to these ponds throughout the survey period. Tiger Salamanders are apparently uncommon near YUHO, but probably occur throughout the Montezuma Valley.

*Woodhouse's Toad (*Bufo woodhousii*)

Woodhouse's Toads were frequently observed in the ponds on Ismay property near YUHO, including the spring-fed pond just west of the monument. This widespread species is probably common throughout the YUHO area.

Western Chorus Frog (*Pseudacris triseriata*)

We heard this tiny frog calling from the pond on Ismay property east of US Highway 666, but only in 2001. Unless it is calling, this species can be extremely difficult to locate, even where it is common. The Western Chorus Frog probably occurs throughout the Ismay property near YUHO.

*Eastern Collared Lizard (*Crotaphytus collaris*)

We observed this species only on Ismay property east of US Highway 666, where it is uncommon. Although suitable open, shrubby, rocky habitat exists within YUHO proper, extensive agricultural land use surrounding the monument may isolate this small habitat patch and prevent the species from occurring there.

Lesser Earless Lizard (*Holbrookia maculata*)

We did not observe this species in 2001-2003, but it has been documented from the Montezuma Valley area (Hammerson 1999). George San Miguel and Marilyn Colyer (Mesa Verde National Park Resource Management, personal communication) have observed Lesser Earless Lizards on the Ismay property on the east side of US Highway 666. This is probably the only area around YUHO and the Ismay lands where this species occurs, as is the case with other xeric-adapted species (Eastern Collared Lizard and Side-blotched Lizard) in the monument.

Greater Short-horned Lizard (*Phrynosoma hernandesi*)

We observed two Greater Short-horned Lizards on Ismay property near YUHO, one near the Ute Mountain Ditch and another east of US Highway 666. Although apparently uncommon, this species probably occurs throughout the YUHO area.

*Sagebrush Lizard (S*celoporus graciosus*)

This was one of the most frequently observed lizards in the YUHO area, and was especially abundant in the sagebrush habitats west of the monument, such as in the area along the Ute Mountain Ditch. This species probably occurs throughout the Montezuma Valley.

*Eastern Fence Lizard (*Sceloporus undulatus*)

The Eastern Fence Lizard was common throughout the YUHO area, but less so than the smaller Sagebrush Lizard. This species was frequently found on rocks and trees in the YUHO area, whereas the similar Sagebrush Lizard was usually found on the ground near shrubs.

*Side-blotched Lizard (*Uta stansburiana*)

We only observed a single Side-blotched Lizard, which we collected in Ismay Draw on the Ismay property east of US Highway 666. Although abundant in many habitats in the region, this species is apparently rare near YUHO.

*Plateau Striped Whiptail (*Cnemidophorus velox*)

This unisexual whiptail was the most frequently observed species in the YUHO area, and was common within the monument itself. This species is probably abundant throughout the Montezuma Valley.

*Striped Whipsnake (*Masticophis taeniatus*)

We recorded 21 Striped Whipsnakes at YUHO, but 11 of these were positively identified shed skins found on the unexcavated rubble mounds of the main ruin within the monument. This species overwinters within the ruins, and is probably common throughout the YUHO area.

*Gopher Snake (*Pituophis catenifer*)

This widespread, generalist species is probably common throughout the Montezuma Valley, and was found both on Ismay lands near YUHO as well as on the unexcavated ruins within the monument.

*Western Terrestrial Garter Snake (*Thamnophis elegans*)

We found this widespread garter snake throughout the YUHO area, and it was abundant in the vicinity of the spring-fed pond just west of the monument. We found shed skins of this species on the unexcavated ruins within YUHO, suggesting that it uses these rubble mounds as an overwintering site.

*Western Rattlesnake (*Crotalus viridis*)

This widespread species is common throughout the YUHO area, including within the monument proper. The unexcavated ruins at YUHO have long been known as an overwintering site for rattlesnakes (Marilyn Colyer, MEVE, personal communication), and we confirmed this, although most of the shed skins we found there were from other species.

Species That Possibly Occur at Yucca House National Monument

Mexican Spadefoot (*Spea multiplicata*)

This species has been documented from southwestern Colorado along McElmo Creek and the Mancos River in the YUHO area (Hammerson 1999), and may occur in the Montezuma Valley as well. Marilyn Colyer (Mesa Verde National Park, personal communication) observed a possible New Mexico Spadefoot in 1999 near the Ute Mountain Ditch on Ismay property just west of the monument.

Red-spotted Toad (*Bufo punctatus*)

The Red-spotted Toad occurs throughout the YUHO region of southwestern Colorado (Hammerson 1999). However, because this species is usually found in rocky habitats (Hammerson 1999), it is probably absent from YUHO. If present in the YUHO area, it would most likely occur in the more broken terrain found on Ismay property east of US Highway 666.

Northern Leopard Frog (*Rana pipiens*)

This species, which has declined in many parts of its range (Stebbins 2003), was found in ponds and along the Ute Mountain Ditch in the YUHO area until the late 1960's, but has not been observed since (Marilyn Colyer, Msea Verde National Park, personal communication). We do not know if other populations are extant in the Montezuma Valley.

Ornate Tree Lizard (*Urosaurus ornatus*)

The Ornate Tree Lizard occurs in southwestern Colorado in the YUHO region, but typically inhabits rocky habitats such as canyons, talus slopes, or areas with large boulders (Hammerson 1999). This species may occur in small numbers on the Ismay lands east of US Highway 666.

Many-lined Skink (*Eumeces multivirgatus*)

The only record of this species from the YUHO area is a specimen collected from Mesa Verde National Park (Douglas 1966, Hammerson 1999). Marilyn Colyer (personal communication) observed a possible Many-lined Skink in 1985 near the spring-fed pond just west of YUHO. This species probably

occurs throughout the YUHO area, especially in the mesic habitats near springs, ponds, and irrigation ditches.

Racer (*Coluber constrictor*)

The only record of this species in southwestern Colorado is from the Animas River just north of the New Mexico border, east of the YUHO region (Hammerson 1999). Because Racers occupy habitats available at YUHO, such as agricultural land and semidesert shrublands (Hammerson 1999), it may occur in the Montezuma Valley.

Ring-necked Snake (*Diadophis punctatus*)

The Ring-necked Snake has not been documented from western Colorado or the Four Corners area (Stebbins 2003). However, the species has a spotty distribution throughout the Southwest (Stebbins 2003), and isolated populations could occur almost anywhere. Ring-necked Snakes are usually found in moist habitats in the West (Stebbins 2003), and if present at YUHO would most likely be in the areas around springs or ponds.

Night Snake (*Hypsiglena torquata*)

This strictly nocturnal species is widespread over most of the Colorado Plateau (Stebbins 2003), and has been collected at Mesa Verde National Park (Douglas 1966, Hammerson 1999). Night Snakes almost certainly occur at YUHO. At Natural Bridges National Monument in southeastern Utah, Night Snakes used the same overwintering sites as Western Rattlesnakes (Persons, personal observation), and they may overwinter with rattlesnakes and other species in the unexcavated ruins at YUHO as well.

Milk Snake (*Lampropeltis triangulum*)

The Milk Snake has been found at a number of localities in southwestern Colorado, including at Mesa Verde National Park and near Cortez (Douglas 1966, Hammerson 1999). The species occupies a wide variety of habitats in Colorado (Hammerson 1999), and may occur at YUHO.

Coachwhip (*Masticophis flagellum*)

Albert Spencer (Fort Lewis College, personal communication) provided us with correspondence relating to a Coachwhip in the Fort Lewis College biology teaching collection, which was reportedly collected in the unexcavated ruins at YUHO in 1965 by Fort Lewis professors James Erickson and Don Johnson. Although Spencer believes this record to be valid, there are numerous problems associated with the known history of the specimen, including that it was never cataloged or affixed with a specimen tag. In addition, the desert-adapted Coachwhip has not been documented from the region (Stebbins 2003). Therefore, we do not believe sufficient evidence exists to verify that this specimen came from YUHO.

Smooth Green Snake (*Opheodrys vernalis*)

The Smooth Green Snake is widely distributed in montane habitats in southwestern Colorado (Hammerson 1999), and has been found as close to YUHO as Mesa Verde National Park (Douglas 1966). Although usually occurring in lush meadow and riparian habitats in Colorado (Hammerson 1999), this species could conceivably occur in the more mesic areas in the Montezuma Valley, such as the grassy areas near the spring-fed pond just west of YUHO.

Black-necked Garter Snake (*Thamnophis cyrtopsis*)

This species is not widely distributed in Colorado, but does occur in the San Juan River basin south of the YUHO area (Hammerson 1999, Stebbins 2003). Although only the Western Terrestrial Garter Snake has been found at YUHO, there is a slight chance that the Black-necked Garter Snake could occur in the region as well.

Table S-1. Amphibian and reptile species known or expected to occur at Yucca House National Monument. Ranking of probability of species occurrence ("Rank") is as follows: 1 = low probability, 2 = medium probability, and 3 = high probability. SX = specimen collected, this study. SP = specimen collected, previous study. OX = species observed, this study. OP = species observed previously (only included if observation(s) reliable). Although a species may be represented by multiple categories, only the "hardest" evidence is given, i.e., a specimen trumps an observation, and data from this study trumps previous data. Weighted total is equivalent to the total number of species expected to occur, and estimated inventory completeness is simply the number documented (SX, SP, OX, or OP) divided by the weighted total. For all species, NPSpecies checklist fields for residency and nativity are "breeder" and "native," respectively.

Species	Rank	NPSpecies Park Status	NPSpecies Abundance
Tiger Salamander	OX	Present in Park	Uncommon
Mexican Spadefoot	3	Probably Present	
Red-spotted Toad	1	Unconfirmed	
Woodhouse's Toad	SX	Present in Park	Common
Western Chorus Frog	OX	Present in Park	Common
Northern Leopard Frog	1	Historic	
Eastern Collared Lizard	SX	Present in Park	Uncommon
Lesser Earless Lizard	OP	Present in Park	Uncommon
Greater Short-horned Lizard	OX	Present in Park	Uncommon
Sagebrush Lizard	SX	Present in Park	Abundant
Eastern Fence Lizard	SX	Present in Park	Common
Ornate Tree Lizard	1	Unconfirmed	
Side-blotched Lizard	SX	Present in Park	Uncommon
Many-lined Skink	3	Probably Present	
Plateau Striped Whiptail	SX	Present in Park	Abundant
Racer	1	Unconfirmed	
Ring-necked Snake	1	Unconfirmed	
Night Snake	3	Probably Present	
Milk Snake	2	Unconfirmed	
Coachwhip	N/A	False Report	
Striped Whipsnake	SP	Present in Park	Common
Smooth Green Snake	1	Unconfirmed	
Gopher Snake	SX	Present in Park	Common
Black-necked Garter Snake	1	Unconfirmed	
Western Terrestrial Garter Snake	SX	Present in Park	Abundant
Western Rattlesnake	SP	Present in Park	Common
TOTAL RANK 1	7		
TOTAL RANK 2	1		
TOTAL RANK 3	3		
TOTAL FOUND (SX, OX, SP, OP)	14		
WEIGHTED TOTAL	18.2		
ESTIMATED INVENTORY COMPLETENESS	77%		

Table S-2. Number of individuals (excluding tadpoles) of each species observed by each survey method during a herpetofauna inventory of Yucca House National Monument, 2001-2003. GS = general survey, NGS = nocturnal general survey, N-R TACS = non-random 1-ha time-area constrained search (TACS) plot, and RE = random encounter.

Species	GS	NGS	N-R TACS	RE	Total
Tiger Salamander		15			15
Woodhouse's Toad	8	23		3	34
Western Chorus Frog		18			18
Eastern Collared Lizard	6		1		7
Greater Short-horned Lizard	2				2
Sagebrush Lizard	40		10	4	54
Eastern Fence Lizard	17		12		29
Side-blotched Lizard			1		1
Plateau Striped Whiptail	52		14	2	68
Striped Whipsnake	9		11	1	21
Gopher Snake	8				8
Western Terrestrial Garter Snake	49	2	1	1	53
Western Rattlesnake	7			1	8
TOTAL	198	58	50	12	318

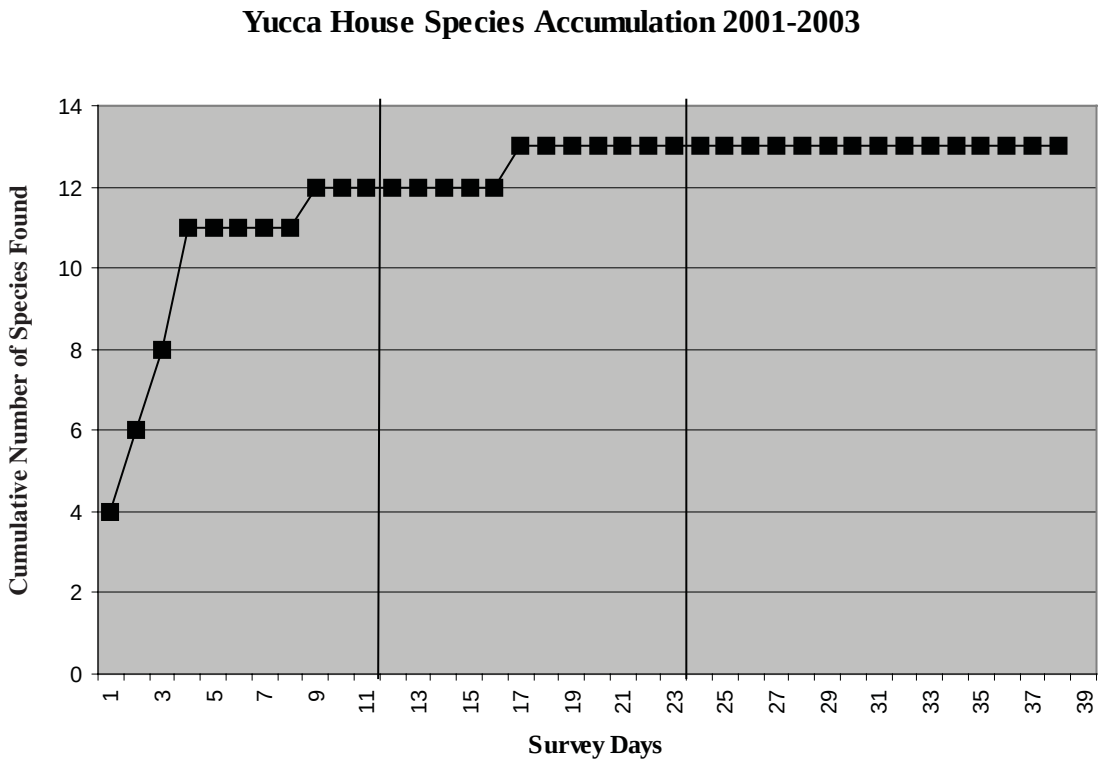

Figure S-1. Species accumulation curve for amphibians and reptiles at Yucca House National Monument, 2001-2003. Yearly survey days are separated by vertical lines through the data.

Appendix T. Specimen Records from Southern Colorado Plateau Network Parks

Table T-1. Amphibian and reptile specimen records from Southern Colorado Plateau Network parks. Park and museum acronyms are defined in the text. Records with no park field are from near, but outside, a park. Most locality data were copied verbatim (including misspellings and curious punctuation) from museum specimen databases.

Park	Species	Museum Number	Date Collected	Collector	Locality
AZRU	*Chrysemys picta*	MSB 7514	6/2/48	LM Pierson	Aztec, Aztec Ruins Nat'l Mon
BAND	*Bufo woodhousii*	MSB 30662	7/17/73	JS Jacob	White Rock Canyon, W bank of Rio Grande, between capu…
BAND	*Cnemidophorus exsanguis*	MSB 30668	6/19/73	JS Jacob	Frijoles Canyon, grassy area between hdg. and Tyuonyi Ruins...
BAND	*Cnemidophorus exsanguis*	MSB 30669	6/24/73	JS Jacob	Frijoles Canyon, area between rental cabins at Hdg
BAND	*Cnemidophorus exsanguis*	MSB 30670	6/24/73	JS Jacob	Frijoles Canyon, area between rental cabins at Hdg
BAND	*Cnemidophorus exsanguis*	MSB 31778	5/20/75	RB Halley	In bottom of Alamo Canyon
BAND	*Cnemidophorus exsanguis*	MSB 31780	6/3/75	RB Halley	Hondo Canyon
BAND	*Cnemidophorus tesselatus*	MSB 31779	6/3/75	RB Halley	on mesa edge above White Rock Canyon, 1/2 mi. S Alamo…
BAND	*Cnemidophorus velox*	MSB 30672	6/17/73	JS Jacob	Lummis Canyon, Sairmis SW of Visitors Center
BAND	*Cnemidophorus velox*	MSB 30673	6/17/73	JS Jacob	Frijoles Canyon, area immediately NE of Monument Head…
BAND	*Cnemidophorus velox*	MSB 30674	6/17/73	JS Jacob	Frijoles Canyon, Headquarters maintanance area
BAND	*Cnemidophorus velox*	MSB 30675	6/17/73	JS Jacob	Frijoles Canyon, 1.3 trail mis. S of Hdg at Sewer spray…
BAND	*Cnemidophorus velox*	MSB 30676	6/17/73	JS Jacob	Frijoles Canyon, 1.3 trail mis. S of Hdg at Sewer spray…
BAND	*Cnemidophorus velox*	MSB 30677	6/17/73	JS Jacob	Frijoles Canyon, Big Kiva
BAND	*Cnemidophorus velox*	MSB 30678	6/17/73	JS Jacob	Frijoles Canyon, area between rental cabins at Hdg
BAND	*Crotaphytus collaris*	MSB 31781	5/21/75	RB Halley	White Rock Canyon
BAND	*Diadophis punctatus*	MSB 30533	5/22/75	RB Halley	White Rock Canyon
BAND	*Eumeces multivirgatus*	MSB 30661	6/19/73	JS Jacob	Upper Lummis Canyon, above trail crossing S canyon wall…
BAND	*Eumeces multivirgatus*	MVZ 22396	4/19/36	Adrey E. Borell	Bandelier National Monument, Frijoles Canyon
BAND	*Hyla arenicolor*	MSB 30594	9/7/73	JS Jacob	Lummis Canyon, 2 air mis. W visitors center
BAND	*Hyla arenicolor*	MSB 30595	9/7/73	JS Jacob	Lummis Canyon, 2 air mis. W visitors center
BAND	*Hyla arenicolor*	MSB 30596	9/7/73	JS Jacob	Lummis Canyon, 2 air mis. W visitors center
BAND	*Hyla arenicolor*	MSB 30597	9/7/73	JS Jacob	Lummis Canyon, 2 air mis. W visitors center
BAND	*Hyla arenicolor*	MSB 30598	9/7/73	JS Jacob	Lummis Canyon, 2 air mis. W visitors center
BAND	*Hyla arenicolor*	MSB 31783	5/20/75	RB Halley	near stream in Alamo Canyon
BAND	*Masticophis taeniatus*	MSB 30534	6/3/75	RB Halley	White Rock Canyon
BAND	*Phrynosoma hernandesi*	MSB 30660	6/8/73	JS Jacob	Juniper Campground, Frijoles Mesa
BAND	*Plethedon neomexicanus*	MSB 41653	9/6/75	RB Halley	0.25 mi W Apache

Table T-1. Amphibian and reptile specimen records from Southern Colorado Plateau Network parks. Park and museum acronyms are defined in the text. Records with no park field are from near, but outside, a park. Most locality data were copied verbatim (including misspellings and curious punctuation) from museum specimen databases.—Continued

Park	Species	Museum Number	Date Collected	Collector	Locality
BAND	*Sceloporus undulatus*	MSB 30679	6/5/73	JS Jacob	Lummis Canyon, 1.5 air mis. SW of Visitors Center
BAND	*Sceloporus undulatus*	MSB 30680	6/7/73	JS Jacob	Escobas Mesa, 1 trail mi., from upper crossing gate
BAND	*Sceloporus undulatus*	MSB 30681	6/7/73	JS Jacob	Frijoles Canyon, 1.3 trail mi., from upper crossing gate
BAND	*Sceloporus undulatus*	MSB 30682	6/7/73	JS Jacob	Frijoles Canyon, 1 air mi., SE upper crossing at Beaver…
BAND	*Sceloporus undulatus*	MSB 30683	6/7/73	JS Jacob	Escobas Mesa, 3/4 trail mi., from upper crossing gate
BAND	*Sceloporus undulatus*	MSB 30684	6/7/73	JS Jacob	Frijoles Canyon, 1 air mi. SE upper crossing at Beaver Dam…
BAND	*Sceloporus undulatus*	MSB 30685	6/16/73	JS Jacob	Upper Frijoles Canyon, 8/10 trail mi., from Apache Creek.
BAND	*Sceloporus undulatus*	MSB 30686	6/17/73	JS Jacob	Frijoles Canyon area between rental cabins at Hdq.
BAND	*Sceloporus undulatus*	MSB 30687	6/17/73	JS Jacob	Alamo Canyon, 2.5 air mis. SE of Monu. Hdq., E rim of…
BAND	*Sceloporus undulatus*	MSB 30688	6/17/73	JS Jacob	Frijoles Canyon area between rental cabins at Hdq.
BAND	*Sceloporus undulatus*	MSB 30689	6/17/73	JS Jacob	Frijoles Canyon area between rental cabins at Hdq.
BAND	*Sceloporus undulatus*	MSB 30690	6/19/73	JS Jacob	Upper Lummis Canyon, above trail crossing
BAND	*Sceloporus undulatus*	MSB 30691	6/18/73	JS Jacob	Frijoles Canyon, Tyuonyi Ruins
BAND	*Sceloporus undulatus*	MSB 30692	6/18/73	JS Jacob	Frijoles Canyon, Dumpster area near amphitheater
BAND	*Sceloporus undulatus*	MSB 30693	6/18/73	JS Jacob	Frijoles Canyon, Tyuonyi Ruins
BAND	*Sceloporus undulatus*	MSB 30694	6/24/73	JS Jacob	Capulin Canyon, 150 m above base camp on N canyon wall…
BAND	*Sceloporus undulatus*	MSB 30695	8/2/73	JS Jacob	Canada de Cochiti Grant, Lower Sanchez Canyon
BAND	*Sceloporus undulatus*	MVZ 22371	4/19/36	Adrey E. Borell	Bandelier National Monument, Frijoles Canyon
BAND	*Sceloporus undulatus*	MVZ 66375	8/12/54	James D. Anderson	Bandelier National Monument, Frijoles Canyon
BAND	*Thamnophis elegans*	MSB 30656	6/7/73	JS Jacob	Frijoles Canyon, along trail between new beaver dams and…
BAND	*Thamnophis elegans*	MSB 30657	6/7/73	JS Jacob	Frojoles Canyon, 1 air mi. SE Upper Crossing at Beaver Dam…
BAND	*Thamnophis elegans*	MSB 30658	6/7/73	JS Jacob	Frojoles Canyon, 1 air mi. SE Upper Crossing at Beaver Dam…
BAND	*Thamnophis elegans*	MSB 30659	6/7/73	JS Jacob	Frojoles Canyon, 1 air mi. SE Upper Crossing at Beaver Dam…
BAND	*Urosaurus ornatus*	MSB 30664	6/7/73	JS Jacob	Frijoles Canyon, 1 air mi. SE Upper Crossing at Beaver Po…
BAND	*Urosaurus ornatus*	MSB 30665	6/7/73	JS Jacob	Frijoles Canyon, 1 air mi. SE Upper Crossing at Beaver Po…
BAND	*Urosaurus ornatus*	MSB 30666	6/19/73	JS Jacob	Upper Lummis Canyon above trail crossing
ELMA	*Crotalus viridis*	MSB 42750	9/15/84	CW Painter, Bog…	35.4 km S I-40 on NM 117
ELMA	*Holbrookia maculata*	UMMZ 86613			Point of Malpais
ELMA	*Masticophis taeniatus*	MSB 53424		JN Stuart	El Malpais, NM Hwy 217 in the Narrows
ELMO	*Ambystoma tigrinum*	KU 15556			El Morro Nat. Mon.
ELMO	*Ambystoma tigrinum*	KU 15557			El Morro Nat. Mon.
ELMO	*Crotalus viridis*	CWGF			El Morro Nat. Mon.

Table T-1. Amphibian and reptile specimen records from Southern Colorado Plateau Network parks. Park and museum acronyms are defined in the text. Records with no park field are from near, but outside, a park. Most locality data were copied verbatim (including misspellings and curious punctuation) from museum specimen databases.—Continued

Park	Species	Museum Number	Date Collected	Collector	Locality
ELMO	*Phrynosoma hernandesi*	KU 11298			El Morro Nat. Mon.
ELMO	*Phrynosoma hernandesi*	KU 11299			El Morro Nat. Mon.
ELMO	*Pituophis catenifer*	CWGF			El Morro Nat. Mon.
ELMO	*Sceloporus undulatus*	KU 15121			El Morro Nat. Mon.
ELMO	*Sceloporus undulatus*	KU 15122			El Morro Nat. Mon.
ELMO	*Sceloporus undulatus*	KU 15123			El Morro Nat. Mon.
ELMO	*Sceloporus undulatus*	KU 15124			El Morro Nat. Mon.
ELMO	*Sceloporus undulatus*	KU 15125			El Morro Nat. Mon.
ELMO	*Sceloporus undulatus*	KU 15126			El Morro Nat. Mon.
ELMO	*Sceloporus undulatus*	UMMZ 122794			El Morro Nat. Mon.
ELMO	*Spea bombifrons*	KU 17222			El Morro Nat. Mon.
ELMO	*Spea bombifrons*	KU 17223			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14538			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14539			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14540			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14541			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14542			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14543			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14544			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14545			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 14546			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17271			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17272			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17273			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17274			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17275			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17276			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17277			El Morro Nat. Mon.
ELMO	*Spea multiplicata*	KU 17278			El Morro Nat. Mon.
ELMO	*Thamnophis elegans*	KU 8557			El Morro Nat. Mon.
ELMO	*Urosaurus ornatus*	CU 5605			El Morro Nat. Mon.
GLCA	*Ambystoma tigrinum*	UU 1762	7/30/38	H.N. Russell	San Juan River, 30 Mi. above Colorado River

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Arizona elegans*	BYU 18899	10-May-62	Tanner	Utah-Arizona state line, 9 miles W of Page (Hwy 89).
GLCA	*Arizona elegans*	BYU 20734	4-Sep-62	Heinrichs	'Near Glen Canyon Dam on Hwy 89.'
GLCA	*Arizona elegans*	BYU 20737	4-Sep-62	Heinrichs	'Near Glen Canyon Dam on Hwy 89.'
GLCA	*Arizona elegans*	BYU 21429	3-Sep-62	Heinrichs	Near mi. post 56, Hwy 89
GLCA	*Bufo microscaphus*	BYU 2230	4-Jun-40	Beck	Coyote Gulch, 8 mi E of Willow Spring Tank.
GLCA	*Bufo punctatus*	BYU 14711	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14712	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14714	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14715	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14716	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14717	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14718	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14719	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14720	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14721	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14722	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14723	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14955	16-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14956	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 14957	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	BYU 21418	4-May-63		Warm Springs, Crossing of the Fathers Rd.'
GLCA	*Bufo punctatus*	BYU 21927	16-May-59	Salisbury	Padre''s Creek, Crossing of the Fathers
GLCA	*Bufo punctatus*	BYU 2231	4-Jun-40	Beck	Coyote Gulch, 8 mi E of Willow Spring Tank.
GLCA	*Bufo punctatus*	BYU 3653	4-Jun-40	Beck	Coyote Gulch, 8 mi E of Willow Spring Tank.
GLCA	*Bufo punctatus*	BYU 4713	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo punctatus*	LACM 136597	17-Apr-1947	Mulaik collection	Lee's Ferry, Colorado River
GLCA	*Bufo punctatus*	LACM 136598	17-Apr-1947	Mulaik collection	Lee's Ferry, Colorado River
GLCA	*Bufo punctatus*	UU 1567	7/30/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Bufo punctatus*	UU 1568	7/30/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Bufo punctatus*	UU 1569	7/30/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Bufo punctatus*	UU 1570	7/30/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Bufo punctatus*	UU 1571	7/30/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Bufo woodhousii*	BS/FC 2561	7/16/82	B.R. Riddle	E bank Lake Powell 1 mi N of San Juan River 41S 9E S 26

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Bufo woodhousii*	BS/FC 2562	7/16/82	B.R. Riddle	E bank Lake Powell 1 mi N of San Juan River 41S 9E S 26
GLCA	*Bufo woodhousii*	BYU 14725	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14726	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14727	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14728	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14729	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14730	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14731	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14732	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14733	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14734	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14735	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14736	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14737	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14738	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14739	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14740	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14741	15-May-59		‘Crossing of the Fathers’
GLCA	*Bufo woodhousii*	BYU 14742	15-May-59		‘Crossing of the Fathers’
GLCA	*Bufo woodhousii*	BYU 14743	15-May-59		‘Crossing of the Fathers’
GLCA	*Bufo woodhousii*	BYU 14744	15-May-59		‘Crossing of the Fathers’
GLCA	*Bufo woodhousii*	BYU 14745	15-May-59		‘Crossing of the Fathers’
GLCA	*Bufo woodhousii*	BYU 14746	15-May-59		‘Crossing of the Fathers’
GLCA	*Bufo woodhousii*	BYU 14747	15-May-59		‘Crossing of the Fathers’
GLCA	*Bufo woodhousii*	BYU 14935	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14936	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14937	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14938	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14939	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14940	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14941	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Bufo woodhousii*	BYU 14942	15-May-59	Tanner	‘Crossing of the Fathers.’

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Bufo woodhousii*	BYU 14943	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 14944	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 14945	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 14946	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 14947	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 14948	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 14949	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 14950	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Bufo woodhousii*	BYU 4291	4-Sep-41	Beck	Escalante River, junc. of Coyote Gulch.
GLCA	*Bufo woodhousii*	BYU 4292	4-Sep-41	Beck	Escalante River, junc. of Coyote Gulch.
GLCA	*Bufo woodhousii*	BYU 4293	4-Sep-41	Beck	Escalante River, junc. of Coyote Gulch.
GLCA	*Bufo woodhousii*	BYU 4294	4-Sep-41	Beck	Escalante River, junc. of Coyote Gulch.
GLCA	*Bufo woodhousii*	BYU 4295	4-Sep-41	Beck	Escalante River, junc. of Coyote Gulch.
GLCA	*Bufo woodhousii*	BYU 4296	4-Sep-41	Beck	Escalante River, junc. of Coyote Gulch.
GLCA	*Bufo woodhousii*	BYU 4297	4-Sep-41	Beck	Escalante River, junc. of Coyote Gulch.
GLCA	*Bufo woodhousii*	LACM 105734	17-Jun-1969	WC Welbourn	Page, W. side town
GLCA	*Bufo woodhousii*	UU 1595	7/23/37	A.M. Woodbury	Colorado River below Rock Creek
GLCA	*Bufo woodhousii*	UU 1896	7/14/37	A.M. Woodbury	San Juan River (between Copper and Piute canyons)
GLCA	*Bufo woodhousii*	UU 3340	7/16/58	N.K. Dean	Colorado River Basin, 107 mi. N Lee's Ferry
GLCA	*Bufo woodhousii*	UU 8189	4/3/57	A.W. Grundmann	Hite, on island
GLCA	*Bufo woodhousii*	UU 8190	4/3/57	A.W. Grundmann	Hite, on island
GLCA	*Bufo woodhousii*	UU 8191	4/3/57	A.W. Grundmann	Hite, on island
GLCA	*Bufo woodhousii*	UU 8192	4/3/57	A.W. Grundmann	Hite, on island
GLCA	*Bufo woodhousii*	UU 8193	4/3/57	A.W. Grundmann	Hite, on island
GLCA	*Chrysemys picta*	UAZ 39731	8/31/58	F. Wright	Face Canyon
GLCA	*Cnemidophorus species*	UU 1250	7/24/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Cnemidophorus species*	UU 1251	7/24/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Cnemidophorus species*	UU 3333	7/9/58	N.K. Dean	Warm Spring Creek, Glen Canyon
GLCA	*Cnemidophorus species*	UU 3334	7/9/58	N.K. Dean	Warm Spring Creek, Glen Canyon
GLCA	*Cnemidophorus species*	UU 3335	7/9/58	N.K. Dean	Warm Spring Creek, Glen Canyon
GLCA	*Cnemidophorus tigris*	BYU 11257	15-May-53	Beck	'Hole-in-the-Rock'
GLCA	*Cnemidophorus tigris*	BYU 11954		Beck & Chandler	Escalante River, near junc. w/ Colorado River

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Cnemidophorus tigris*	BYU 11955		Beck & Chandler	Escalante River, near junc. w/ Colorado River
GLCA	*Cnemidophorus tigris*	BYU 11956		Beck & Chandler	Escalante River, near junc. w/ Colorado River
GLCA	*Cnemidophorus tigris*	BYU 14903	17-May-59	Covey	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14904	16-May-59	Rowland	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14905	16-May-59	Heninger	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14906	16-May-59	Salisbury	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14907	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14908	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14909	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14910	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 14911	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 18959	11-May-62	Tanner	'Crossing of the Fathers.'
GLCA	*Cnemidophorus tigris*	BYU 21258	20-Jun-23	Heinrichs	'Page'
GLCA	*Cnemidophorus tigris*	BYU 21421	4-May-63		2 miles N of Warm Springs, Crossing of the Fathers Rd.
GLCA	*Cnemidophorus tigris*	BYU 21422	4-May-63		2 miles N of Warm Springs, Crossing of the Fathers Rd.
GLCA	*Cnemidophorus tigris*	BYU 21423	5-May-63		'5 miles W of Page.'
GLCA	*Cnemidophorus tigris*	BYU 21424	5-May-63		'5 miles W of Page.'
GLCA	*Cnemidophorus tigris*	BYU 2746	4-Jun-39	Tanner	'Wahweap Creek (CCC road).'
GLCA	*Cnemidophorus tigris*	BYU 31910	19-May-68	McMoris	Bullfrog Basin, SE Utah
GLCA	*Cnemidophorus tigris*	LACM 100542	20-May-1955	LM Stevens	W. side of Colorado River, mouth of N. wash
GLCA	*Cnemidophorus tigris*	LACM 100543	20-May-1955	LM Stevens	W. side of Colorado River, mouth of N. wash
GLCA	*Cnemidophorus tigris*	LACM 100544	20-May-1955	LM Stevens	W. side of Colorado River, mouth of N. wash
GLCA	*Cnemidophorus tigris*	LACM 134286	07-Aug-1980	JW Wright	1 mi N. Wahweap jct on Hwy 89
GLCA	*Cnemidophorus tigris*	UMMZ 121757	8/7/59	FR Gehlbach	Hite
GLCA	*Cnemidophorus tigris*	UMMZ 121758	8/7/59	FR Gehlbach	Hite
GLCA	*Cnemidophorus tigris*	UU1453	7/31/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Cnemidophorus tigris*	UU1499	7/30/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Crotalus viridis*	BYU 11260	15-May-53	Beck	'Hole in the Rock.'
GLCA	*Crotalus viridis*	BYU 14923	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Crotalus viridis*	BYU 20744	5-Sep-62	Heinrichs	West of Page, Hwy 89
GLCA	*Crotalus viridis*	BYU 20745	4-Sep-62	Heinrichs	West of Page, Hwy 89
GLCA	*Crotalus viridis*	BYU 2140	4-Jun-39	Tanner	Wahweap, c.c.c. Road.

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Crotalus viridis*	BYU 2760	4-Jun-39	Tanner	Wahweap, c.c.c. Road.
GLCA	*Crotalus viridis*	BYU 41398			‘Lake Powell 40 miles N Bullfrog.’
GLCA	*Crotalus viridis*	BYU 41399			‘Lake Powell 40 miles N Bullfrog.’
GLCA	*Crotalus viridis*	BYU 42090	9-Jun-72		2 mi S. Glen Canyon City, along Hwy 89 under Jimsen Weed next to temporary pond’
GLCA	*Crotalus viridis*	UMMZ 205059			Hite Marina
GLCA	*Crotaphytus bicinctores*	BYU 11407	14-May-53	Bessey	‘Hole in the Rock.’
GLCA	*Crotaphytus bicinctores*	BYU 12526			‘4 miles N of Hite.’
GLCA	*Crotaphytus bicinctores*	BYU 12700	20-May-55	Stevens	1/2 to 1/4 mile W of mouth of N Wash, W side of Colorado River.
GLCA	*Crotaphytus bicinctores*	BYU 12701	20-May-55	Stevens	Mouth of N Wash, W side of Colorado River.
GLCA	*Crotaphytus bicinctores*	BYU 14894	16-May-59	Covey	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14895	16-May-59	Spencer	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14896	16-May-59	Heninger	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14897	5-May-59	Salisbury	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14898	5-May-59	Salisbury	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14899	16-May-59	Mashburn	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14900	16-May-59	Mashburn	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14901	16-May-59	Mashburn	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 14902	16-May-59	Mashburn	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 18921	11-May-62	Tanner	‘Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 21259	4-May-63	Heinrichs	‘5-10 miles S of Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 21260	4-May-63	Heinrichs	‘5-10 miles S of Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 21262	4-May-63	Heinrichs	‘5-10 miles S of Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 21263	4-May-63	Heinrichs	‘5-10 miles S of Crossing of the Fathers.’
GLCA	*Crotaphytus bicinctores*	BYU 21276	4-May-63	Heinrichs	5-10 miles S of Crossing of the Fathers, along road
GLCA	*Crotaphytus bicinctores*	BYU 42078	24-May-75	Smith	Lee’’s Ferry, W of river.
GLCA	*Crotaphytus collaris*	BYU 499	21-Jun-27	Call	‘Lee’’s Ferry’
GLCA	*Crotaphytus collaris*	UU 1449	8/8/38	A.M. Woodbury	4 mi. below Last Chance Canyon, Colorado River
GLCA	*Gambelia wislizenii*	BYU 11325	23-May-53	Standing	Lone Rock, approx. 75 miles E of Kanab
GLCA	*Gambelia wislizenii*	BYU 12008	23-May-53	Standing	Lone Rock, approx. 75 miles E of Kanab
GLCA	*Gambelia wislizenii*	BYU 12558	20-May-55	Tanner	‘Mouth of N wash & Colorado River.’
GLCA	*Gambelia wislizenii*	BYU 14912	16-May-59	Covey	‘Crossing of the Fathers.’
GLCA	*Gambelia wislizenii*	BYU 14981	22-May-53	Tanner	Lone Rock, 75 miles E of Kanab

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Gambelia wislizenii*	BYU 21419	5-May-63	Heinrichs	'5 miles W of Page.'
GLCA	*Gambelia wislizenii*	BYU 32228	10-May-68	Ingram	'Bull Frog Basin.'
GLCA	*Gambelia wislizenii*	BYU 32229	10-May-68	Ingram	'Bull Frog Basin.'
GLCA	*Gambelia wislizenii*	BYU 32230	10-May-68	Ingram	'Bull Frog Basin.'
GLCA	*Gambelia wislizenii*	BYU 38832	10-Jul-85	Mindell	The mouth of the White River where it enters Lake Powell
GLCA	*Gambelia wislizenii*	BYU 556	8-Jul-27	Cottam	'Marble Canyon'
GLCA	*Gambelia wislizenii*	LACM 94806	16-Jun-1970	W.C. Welbourn	Warm Crk. Bay NNE Wahweap Rec. Area (by air)
GLCA	*Gambelia wislizenii*	UU 1452	8/8/38	W.B. Mittleman	4 mi. below Last Chance Canyon, Colorado River
GLCA	*Gambelia wislizenii*	UU 3328	7/7/58	N.K. Dean	Ticaboo Canyon, Colorado River, 154 mi. N Lee's Ferry
GLCA	*Gambelia wislizenii*	UU 3569	5/14/60	G.G. Musser	W Branch Colorado River at Hite
GLCA	*Hyla arenicolor*	BYU 14748	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14749	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14750	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14751	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14752	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14753	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14754	16-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14928	16-May-59	Bullock	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14929	23-May-59	Brewster	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 14971	15-May-59	Rowland	'Crossing of the Fathers.'
GLCA	*Hyla arenicolor*	BYU 15537	27-Sep-49	Parker	'Coyote Gulch'
GLCA	*Hyla arenicolor*	BYU 1688		Beck & Chandler	Escalante River, near junc. w/ Colorado River
GLCA	*Hyla arenicolor*	BYU 18963	11-May-62	Richardson	Padre Creek, Crossing of the Fathers
GLCA	*Hyla arenicolor*	BYU 2233	4-Jun-40	Beck	Coyote Gulch, 8 mi E of Willow Spring Tank
GLCA	*Hyla arenicolor*	BYU 23469	27-Sep-49	Parker	'Coyote Gulch'
GLCA	*Hyla arenicolor*	BYU 23470	27-Sep-49	Parker	'Coyote Gulch'
GLCA	*Hyla arenicolor*	BYU 2384		Beck & Chandler	Escalante River, near junc. w/ Colorado River.
GLCA	*Hyla arenicolor*	BYU 2385		Beck & Chandler	Escalante River, near junc. w/ Colorado River
GLCA	*Hyla arenicolor*	BYU 4285	4-Sep-41	Beck	Escalante River, junc. Coyote Gulch.
GLCA	*Hyla arenicolor*	BYU 4286	4-Sep-41	Beck	Escalante River, junc. Coyote Gulch.
GLCA	*Hyla arenicolor*	BYU 4287	4-Sep-41	Beck	Escalante River, junc. Coyote Gulch.
GLCA	*Hyla arenicolor*	BYU 4289	4-Sep-41	Beck	Escalante River, junc. Coyote Gulch.

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Hyla arenicolor*	BYU 4290	4-Sep-41	Beck	Escalante River, junc. Coyote Gulch.
GLCA	*Hyla arenicolor*	UTEP 13393	8/1/68	RS Funk	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UTEP 13394	8/1/68	RS Funk	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1284	7/25/37	L.C. Cole	Rock Creek, Colorado River
GLCA	*Hyla arenicolor*	UU 1285	7/25/37	L.C. Cole	Rock Creek, Colorado River
GLCA	*Hyla arenicolor*	UU 1548	8/1/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1549	8/1/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1550	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1551	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1552	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1553	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1554	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1555	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1556	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1572	8/1/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Hyla arenicolor*	UU 1573	8/1/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Hypsiglena torquata*	BYU 21274	20-May-62	Tanner	‘Page’
GLCA	*Hypsiglena torquata*	MVZ 241605	5/9/03	Louis Porras	Hwy 276, 4.2 mi N Bullfrog
GLCA	*Lampropeltis getula*	UU 1885	8/6/38	H.N. Russell, Jr.	Bar 20 - Colorado River, 50 mi. above Lee’s Ferry
GLCA	*Lampropeltis getula*	UU 3322	7/12/58	N.K. Dean	Colorado River 121 mi. N Lee’s Ferry
GLCA	*Masticophis taeniatus*	UAZ 39720	6/14/61	F. Wright	Forbidden Canyon, Glen Canyon
GLCA	*Phrynosoma platyrhinos*	BYU 14888	15-May-59	Heninger	‘Crossing of the Fathers’
GLCA	*Phrynosoma platyrhinos*	BYU 14889	15-May-59	Heninger	‘Crossing of the Fathers’
GLCA	*Phrynosoma platyrhinos*	BYU 14890	9-May-59	Heninger	‘Crossing of the Fathers’
GLCA	*Phrynosoma platyrhinos*	BYU 14891	16-May-59	Nelson	‘Crossing of the Fathers’
GLCA	*Phrynosoma platyrhinos*	BYU 14892	15-May-59	Salisbury	‘Crossing of the Fathers’
GLCA	*Phrynosoma platyrhinos*	BYU 14893	16-May-59	Spencer	‘Crossing of the Fathers’
GLCA	*Phrynosoma platyrhinos*	BYU 16663	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Phrynosoma platyrhinos*	BYU 16664	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Phrynosoma platyrhinos*	BYU 16665	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Phrynosoma platyrhinos*	BYU 18922	11-May-62	Tanner	‘Crossing of the Fathers.’
GLCA	*Phrynosoma platyrhinos*	UU 1287	7/27/37	L.C. Cole	Rock Creek, Colorado River
GLCA	*Phrynosoma platyrhinos*	UU 3343		A. Grundmann	Glen Canyon

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Phrynosoma platyrhinos*	UU 3351		A. Grundmann	Glen Canyon
GLCA	*Pituophis catenifer*	BS/FC 5081	9/18/85	R.D. Curnow & C.A. Ramotnik	E bank Lake Powell, mi. 69
GLCA	*Pituophis catenifer*	BYU 14642	17-May-58	Tanner	Approx. 1/2 mile NW Utah-Arizona line, NW Glen Canyon Dam.
GLCA	*Pituophis catenifer*	BYU 21428	4-Sep-62	Heinrichs	Near mile post 48-Hwy 89, W of Page Arizona.
GLCA	*Pituophis catenifer*	BYU 21430	29-Aug-62	Heinrichs	1 mile N of Wahweap turnoff, Hwy 89
GLCA	*Pituophis catenifer*	BYU 21437	5-Sep-62	Heinrichs	1 1/2 mile W of Wahweap turnoff, Hwy 89
GLCA	*Pituophis catenifer*	LACM 102408		WC Welbourn	Warm Creek Bay, 6 mi. NNE Wahweap Rec. Area
GLCA	*Pituophis catenifer*	LACM 102430	16-Jun-1969	WC Welbourn	1 mi. NW Ariz-Utah border on US Hwy 89
GLCA	*Pituophis catenifer*	UU 3324	7/12/58	H. Hall	Colorado River 118 mi. N Lee's Ferry
GLCA	*Rana pipiens*	BYU 14701	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14702	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14703	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14704	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14705	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14706	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14707	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14708	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14709	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14710	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14959	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14960	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14961	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14962	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14963	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14964	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14965	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 14966	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Rana pipiens*	BYU 18962	11-May-62	Nesbit	Padre Creek, Crossing of the Fathers
GLCA	*Rana pipiens*	BYU 23597	16-May-59	Salisbury	Padres Creek, Crossing of the Fathers
GLCA	*Rana pipiens*	BYU 23598	16-May-59	Salisbury	Padres Creek, Crossing of the Fathers
GLCA	*Rana pipiens*	BYU 23599	17-May-59	Washburn	Padres Creek, Crossing of the Fathers
GLCA	*Rana pipiens*	BYU 23600	17-May-59	Washburn	Padres Creek, Crossing of the Fathers

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Rana pipiens*	BYU 23601	17-May-59	Washburn	Padres Creek, Crossing of the Fathers
GLCA	*Rana pipiens*	BYU 23602	17-May-59	Washburn	Padres Creek, Crossing of the Fathers
GLCA	*Rana pipiens*	BYU 2861		Beck	Colorado River, at mouth of Escalante River.
GLCA	*Rana pipiens*	UU 3339	7/16/58	N.K. Dean	Colorado River basin, 109 mi. N Lee's Ferry
GLCA	*Rhinocheilus lecontei*	BYU 20750	3-Sep-62	Heinrichs	Wahweap turnoff, Hwy 89
GLCA	*Rhinocheilus lecontei*	BYU 21257	17-May-63	Tanner	Mi post 555 W of Glen Canyon, on Hwy 89
GLCA	*Rhinocheilus lecontei*	BYU 32621	30-May-64	Maxwell	0.5 mi across bay (east) from Wahweap Marina, Lake Powell
GLCA	*Rhinocheilus lecontei*	BYU 74197	4-May-62		Wahweap turnoff, Hwy 89
GLCA	*Salvadora hexalepis*	BYU 11304	23-May-53	Gifford	1 mi S of Lone Rock, 78 Mi E of Kanab
GLCA	*Salvadora hexalepis*	BYU 14876	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Salvadora hexalepis*	BYU 14877	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Salvadora hexalepis*	BYU 22478	7-Sep-64	Alcom	'Wahweap Cr. near Lone Rock.'
GLCA	*Salvadora hexalepis*	UU 1255	7/20/37	H. Glenny	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	BYU 11259	16-May-52	Shirts	'Hole in the Rock'
GLCA	*Sauromalus obesus*	BYU 12710	5/20/55	Tanner	Mouth of N Wash, 5 miles above Hite
GLCA	*Sauromalus obesus*	BYU 14879	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14880	16-May-59	Rowley	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14881	16-May-59	Finley	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14882	16-May-59	Spencer	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14883	17-May-59	Covey	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14884	16-May-59	Rowland	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14885	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14886	17-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 14887	17-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 16615	17-May-58	Hunter	Glen Canyon Dam, 1 mile upstream
GLCA	*Sauromalus obesus*	BYU 21507		Heinrichs	'Page'
GLCA	*Sauromalus obesus*	BYU 21508		Heinrichs	'Page'
GLCA	*Sauromalus obesus*	BYU 21509		Heinrichs	'Page'
GLCA	*Sauromalus obesus*	BYU 21510		Heinrichs	'Page'
GLCA	*Sauromalus obesus*	BYU 21732		Avery	'Crossing of the Fathers.'
GLCA	*Sauromalus obesus*	BYU 2858	25-Apr-39	Davis	'Warm Creek'
GLCA	*Sauromalus obesus*	BYU 29994		Heinrichs	'Page'
GLCA	*Sauromalus obesus*	BYU 40622	27-Apr-72	Atwood	'SE of Page'

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Sauromalus obesus*	BYU 40623	27-Apr-72	Atwood	'SE of Page'
GLCA	*Sauromalus obesus*	BYU 40624	27-Apr-72	Atwood	'SE of Page'
GLCA	*Sauromalus obesus*	CAS 99988	5/16/59	W.W. Tanner and G. Rowland	Crossing of the Fathers
GLCA	*Sauromalus obesus*	UU 1245	7/22/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1246	7/24/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1247	7/24/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1252	7/27/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1253	7/27/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1254	7/27/37	H. Glenny	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1290	7/22/37	Wm. Kiss	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1292	7/27/37	A.M. Woodbury	Rock Creek, Colorado River
GLCA	*Sauromalus obesus*	UU 1527	8/4/38	A.M. Woodbury	70 mi. above Lee's Ferry, Colorado River
GLCA	*Sauromalus obesus*	UU 1528	8/4/38	A.M. Woodbury	70 mi. above Lee's Ferry, Colorado River
GLCA	*Sauromalus obesus*	UU 1675	8/7/38	A.M. Woodbury	Near Last Chance Creek, Colorado River
GLCA	*Sceloporus graciosus*	BYU 16627	16-May-59	Covey	'Crossing of the Fathers.'
GLCA	*Sceloporus graciosus*	BYU 16628	16-May-59	Covey	'Crossing of the Fathers.'
GLCA	*Sceloporus graciosus*	BYU 16629	16-May-59	Covey	'Crossing of the Fathers.'
GLCA	*Sceloporus graciosus*	BYU 16630	16-May-59	Covey	'Crossing of the Fathers.'
GLCA	*Sceloporus graciosus*	BYU 16631	16-May-59	Covey	'Crossing of the Fathers.'
GLCA	*Sceloporus graciosus*	UU 4580	5/13/60	G.G. Musser	8 mi. from Colorado River confluence, east fork Lake Canyon
GLCA	*Sceloporus magister*	BS/FC 2569	7/16/82	B.R. Riddle	E bank Lake Powell 1 mi N of San Juan R. 41S 9E S 27
GLCA	*Sceloporus magister*	BS/FC 2570	7/16/82	B.R. Riddle	E bank Lake Powell 1 mi N of San Juan R. 41S 9E S 27
GLCA	*Sceloporus magister*	BS/FC 2571	7/16/82	B.R. Riddle	E bank Lake Powell 1 mi N of San Juan R. 41S 9E S 27
GLCA	*Sceloporus magister*	BS/FC 2572	7/18/82	B.R. Riddle	E bank of Lake Powell, 1 1/2 mi S of Escalante River 40 1/2 S 9E S26
GLCA	*Sceloporus magister*	BYU 11263	15-May-53	Beck	'Hole in the Rock'
GLCA	*Sceloporus magister*	BYU 11264	15-May-53	Beck	'Hole in the Rock'
GLCA	*Sceloporus magister*	BYU 11390		Beck & Chandler	'Escalante River (lower portion).'
GLCA	*Sceloporus magister*	BYU 11399	23-May-53	Hansen	Lone Rock, approx 75 miles E of Kanab.
GLCA	*Sceloporus magister*	BYU 11400	13-May-53	Bessey	'Hole in the Rock'
GLCA	*Sceloporus magister*	BYU '12007	23-May-53	Standing	'10 miles W of Lone Rock.'
GLCA	*Sceloporus magister*	BYU 12885	16-May-53	Beck	'Hole in the Rock'
GLCA	*Sceloporus magister*	BYU 12886	16-May-53	Beck	'Hole in the Rock'

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Sceloporus magister*	BYU 12947	21-Aug-46	Beck	Coyote Gulch, Escalante Basin.
GLCA	*Sceloporus magister*	BYU 13067	23-May-53	Tanner	Lone Rock, approx 75 miles E of Kanab.
GLCA	*Sceloporus magister*	BYU 13143	23-May-53	Hansen	Lone Rock, approx 75 miles E of Kanab.
GLCA	*Sceloporus magister*	BYU 13144	23-May-53	Hansen	Lone Rock, approx 75 miles E of Kanab.
GLCA	*Sceloporus magister*	BYU 14914	16-May-59	Lunceford	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14915	16-May-59	Rowland	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14916	16-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14917	16-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14918	16-May-59	Nelson	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14919	16-May-59	Mashburn	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14920	16-May-59	Mashburn	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14921	16-May-59	Mashburn	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14922	16-May-59	Heninger	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 14933	15-May-59	Tanner	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 18900	12-May-62	Tanner	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 18964	15-May-59	Nesbit	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 18998	11-May-62	Richardson	‘Crossing of the Fathers.’
GLCA	*Sceloporus magister*	BYU 21256	20-May-63	Heinrichs	‘Page’
GLCA	*Sceloporus magister*	BYU 2126	4-Jun-39	Tanner	‘Wahweap Creek (CCC road).’
GLCA	*Sceloporus magister*	BYU 2127	4-Jun-39	Tanner	‘Wahweap Creek (CCC road).’
GLCA	*Sceloporus magister*	BYU 2134	4-Jun-39	Tanner	‘Wahweap Creek (CCC road).’
GLCA	*Sceloporus magister*	BYU 2135	4-Jun-39	Tanner	‘Wahweap Creek (CCC road).’
GLCA	*Sceloporus magister*	BYU 21415	4-May-63		Warm Springs, Crossing of the Fathers Road.
GLCA	*Sceloporus magister*	BYU 21417	4-May-63		Warm Springs, Crossing of the Fathers.
GLCA	*Sceloporus magister*	BYU 21420	5-May-63		‘5 miles W Page.’
GLCA	*Sceloporus magister*	BYU 21431	24-Aug-62	Heinrichs	‘1 mile N of Wahweap turnoff Hwy 89.’
GLCA	*Sceloporus magister*	BYU 21432	24-Aug-62	Heinrichs	‘1 mile N of Wahweap turnoff Hwy 89.’
GLCA	*Sceloporus magister*	BYU 2744	4-Jun-39	Tanner	‘Wahweap Creek (CCC road).’
GLCA	*Sceloporus magister*	BYU 36065	6-Jun-69	Harding	‘Bullfrog Basin’
GLCA	*Sceloporus magister*	BYU 9769		Beck & Chandler	‘Escalante River (lower portion).’
GLCA	*Sceloporus magister*	LACM 136547	17-Apr-1947	S.-D. Mulaik	Lee’s Ferry, Colorado
GLCA	*Sceloporus magister*	LACM 96140	16-Jun-1970	W.C. Welbourn	Warm Crk Bay, 6 mi. (by air) NNE Wahweap Rec. Area

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Sceloporus magister*	LACM 96141	06-Jul-1947	R. Hardy	Colorado River opposite Hite
GLCA	*Sceloporus magister*	UMMZ 121731	8/7/59	FR Gehlbach	Hite
GLCA	*Sceloporus magister*	UU 1501	7/31/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Sceloporus magister*	UU 1508	7/31/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Sceloporus magister*	UU 1519	7/31/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Sceloporus magister*	UU 1520	8/7/38	M.B. Mittleman	Colorado River, 46 mi. above Lee's Ferry
GLCA	*Sceloporus magister*	UU 3326	7/1/58	N.K. Dean	Colorado River, 162 mi. N Lee's Ferry
GLCA	*Sceloporus magister*	UU 3327	7/1/58	N.K. Dean	Colorado River, 162 mi. N Lee's Ferry
GLCA	*Sceloporus magister*	UU 3344		A. Grundmann	Glen Canyon
GLCA	*Sceloporus undulatus*	BYU 11251	15-May-53	Beck	'Hole in the Rock.'
GLCA	*Sceloporus undulatus*	BYU 16666	15-May-59	Tanner	'Crossing of the Fathers'
GLCA	*Sceloporus undulatus*	BYU 16705	14-May-53	Bessey	'Hole in the Rock'
GLCA	*Sceloporus undulatus*	BYU 16706	14-May-53	Bessey	'Hole in the Rock'
GLCA	*Sceloporus undulatus*	BYU 2094	4-Jun-39	Tanner	'Wahweap Creek (CCC road).'
GLCA	*Sceloporus undulatus*	BYU 2745	4-Jun-39	Tanner	'Wahweap Creek (CCC road).'
GLCA	*Sceloporus undulatus*	BYU 8489	15-Aug-47	Beck	'Hole in the Rock'
GLCA	*Sceloporus undulatus*	UU 1543	7/31/38	M.B. Mittleman	San Juan River, 27 Mi. above Colorado River
GLCA	*Sceloprus undulatus*	BS/FC 2573	7/16/82	B.R. Riddle	E bank of Lake Powell, 1 mi N of San Juan R 41S 9E S26
GLCA	*Spea intermontana*	BYU 14724	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Spea intermontana*	BYU 14958	16-May-59	Mashburn	'Crossing of the Fathers.'
GLCA	*Spea intermontana*	BYU 16716	10-Jun-59	Sorenson	'Crossing of the Fathers.'
GLCA	*Spea species*	UU 1642	7/30/38	M.B. Mittleman	San Juan River, 35 Mi. above Colorado River
GLCA	*Thamnophis elegans*	UAZ 40505	6/1/61	F. Wright	Glenn Canyon, Smith Fork
GLCA	*Urosaurus ornatus*	BS/FC 223	8/27/66	P.A. Biggins	Lake Powell
GLCA	*Urosaurus ornatus*	BS/FC 2605	7/16/82	B.R. Riddle	1 mi N of San Juan R, E bank of Lake Powell 41S 9E S26
GLCA	*Urosaurus ornatus*	BYU 11268	15-May-53	Beck	'Hole in the Rock'
GLCA	*Urosaurus ornatus*	BYU 11511	27-Sep-49	Parker	'Coyote Gulch (tributary of Escalante River).'
GLCA	*Urosaurus ornatus*	BYU 11512	27-Sep-49	Parker	'Coyote Gulch (tributary of Escalante River).'
GLCA	*Urosaurus ornatus*	BYU 14926	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Urosaurus ornatus*	BYU 14927	16-May-59	Nelson	'Crossing of the Fathers.'
GLCA	*Urosaurus ornatus*	BYU 16667	15-May-59	Tanner	'Crossing of the Fathers'
GLCA	*Urosaurus ornatus*	BYU 23604	16-May-59	Salisbury	Padre''s Creek, Crossing-of-the-Fathers

Table T-1. Amphibian and reptile specimen records from Southern Colorado Plateau Network parks. Park and museum acronyms are defined in the text. Records with no park field are from near, but outside, a park. Most locality data were copied verbatim (including misspellings and curious punctuation) from museum specimen databases.—Continued

Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Urosaurus ornatus*	BYU 40616	5-May-71	Patton	'Lee''s Ferry'
GLCA	*Urosaurus ornatus*	BYU 4298	4-Sep-41	Beck	'Coyote Gulch (tributary of Escalante River).'
GLCA	*Urosaurus ornatus*	LACM 97906	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 97908	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 97909	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 97910	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 97911	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 97912	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 97913	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 97914	17-Jun-1969	W. C. Welbourne	Glen Canyon Dam
GLCA	*Urosaurus ornatus*	LACM 98025	06-Jul-1947	R. Hardy	Colorado River, opposite Hite
GLCA	*Urosaurus ornatus*	LACM 98026	06-Jul-1947	R. Hardy	Colorado River, opposite Hite
GLCA	*Urosaurus ornatus*	LACM 98027	06-Jul-1947	R. Hardy	Colorado River, opposite Hite
GLCA	*Urosaurus ornatus*	UU 1619	8/7/38	M.B. Mittleman	Last Chance Canyon, Colorado River
GLCA	*Urosaurus ornatus*	UU 1628	8/7/38	M.B. Mittleman	Last Chance Canyon, Colorado River
GLCA	*Urosaurus ornatus*	UU 1635	8/7/38	M.B. Mittleman	Last Chance Canyon, Colorado River
GLCA	*Urosaurus ornatus*	UU 1660	8/7/38	M.B. Mittleman	Last Chance Canyon, Colorado River
GLCA	*Urosaurus ornatus*	UU 1669	8/7/38	M.B. Mittleman	Last Chance Canyon, Colorado River
GLCA	*Uta stansburiana*	BS/FC 229	8/27/66	P.A. Biggins	Lake Powell
GLCA	*Uta stansburiana*	BS/FC 2589	7/16/82	B.R. Riddle	E bank Lake Powell 1 mi N of San Juan R. 41S 9E S 26
GLCA	*Uta stansburiana*	BS/FC 2590	7/16/82	B.R. Riddle	E bank Lake Powell 1 mi N of San Juan R. 41S 9E S 26
GLCA	*Uta stansburiana*	BS/FC 2591	7/17/82	B.R. Riddle	E bank Lake Powell, 3 mi N Escalante R. 40S 9 E
GLCA	*Uta stansburiana*	BS/FC 2592	7/17/82	B.R. Riddle	E bank Lake Powell, 3 mi N Escalante R. 40S 9 E
GLCA	*Uta stansburiana*	BS/FC 2593	7/17/82	B.R. Riddle	E bank Lake Powell, 3 mi N Escalante R. 40S 9 E
GLCA	*Uta stansburiana*	BS/FC 2594	7/17/82	B.R. Riddle	E bank Lake Powell, 3 mi N Escalante R. 40S 9 E
GLCA	*Uta stansburiana*	BS/FC 2595	7/17/82	B.R. Riddle	E bank Lake Powell, Halls Crossing Marina
GLCA	*Uta stansburiana*	BS/FC 2596	7/18/82	B.R. Riddle	E bank Lake Powell, 1.5 mi N Escalante R. 40 1/2 S 9 E
GLCA	*Uta stansburiana*	BS/FC 2597	7/18/82	B.R. Riddle	E bank Lake Powell, 1.5 mi N Escalante R. 40 1/2 S 9 E
GLCA	*Uta stansburiana*	BS/FC 2598	7/18/82	B.R. Riddle	E bank Lake Powell, 1.5 mi N Escalante R. 40 1/2 S 9 E
GLCA	*Uta stansburiana*	BS/FC 2599	7/18/82	B.R. Riddle	E bank Lake Powell, 1.5 mi N Escalante R. 40 1/2 S 9 E
GLCA	*Uta stansburiana*	BS/FC 2600	7/18/82	B.R. Riddle	E bank Lake Powell, 1.5 mi N Escalante R. 40 1/2 S 9 E
GLCA	*Uta stansburiana*	BS/FC 2601	7/19/82	B.R. Riddle	E bank Lake Powell, 1 mi S, 6 mi E Gunsight Butte

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Uta stansburiana*	BS/FC 2602	7/19/82	B.R. Riddle	E bank Lake Powell, 1 mi S, 6 mi E Gunsight Butte
GLCA	*Uta stansburiana*	BS/FC 2603	7/19/82	B.R. Riddle	E bank Lake Powell, 1 mi S, 6 mi E Gunsight Butte
GLCA	*Uta stansburiana*	BS/FC 2604	7/19/82	B.R. Riddle	E bank Lake Powell, 1 mi S, 6 mi E Gunsight Butte
GLCA	*Uta stansburiana*	BYU 11265	15-May-53	Beck	'Hole in the Rock'
GLCA	*Uta stansburiana*	BYU 11266	15-May-53	Beck	'Hole in the Rock'
GLCA	*Uta stansburiana*	BYU 14924	16-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 14925	16-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 14930	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 14931	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 14932	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 14934	15-May-59	Tanner	'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 14980	22-May-53	Tanner	Lone Rock, 75 mi E of Kanab
GLCA	*Uta stansburiana*	BYU 16608	17-May-58	Hunter	1 mile upstream from Glen Canyon Dam, Glen Canyon
GLCA	*Uta stansburiana*	BYU 16609	17-May-58	Hunter	1 mile upstream from Glen Canyon Dam, Glen Canyon
GLCA	*Uta stansburiana*	BYU 1673		Beck & Chandler	Hole-in-the-Rock, Colorado River.
GLCA	*Uta stansburiana*	BYU 1674		Beck & Chandler	Hole-in-the-Rock, Colorado River.
GLCA	*Uta stansburiana*	BYU 16796		Tanner	'Glen Canyon Dam.'
GLCA	*Uta stansburiana*	BYU 1700	7-Jul-27	Kartchner	'Lee''s Ferry'
GLCA	*Uta stansburiana*	BYU 1702	7-Jul-27	Kartchner	'Lee''s Ferry'
GLCA	*Uta stansburiana*	BYU 18960			'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 18961			'Crossing of the Fathers.'
GLCA	*Uta stansburiana*	BYU 2128	4-Jun-39	Tanner	'Wahweap Creek (CCC road).'
GLCA	*Uta stansburiana*	BYU 2129	4-Jun-39	Tanner	'Wahweap Creek (CCC road).'
GLCA	*Uta stansburiana*	BYU 2130	4-Jun-39	Tanner	'Wahweap Creek (CCC road).'
GLCA	*Uta stansburiana*	BYU 21410	4-May-63		Warm Springs, Crossing of the Fathers'' Rd
GLCA	*Uta stansburiana*	BYU 21411	4-May-63		Warm Springs, Crossing of the Fathers'' Rd
GLCA	*Uta stansburiana*	BYU 21412	4-May-63		Warm Springs, Crossing of the Fathers'' Rd
GLCA	*Uta stansburiana*	BYU 21433	24-Aug-62	Heinrichs	1 mi N of Wahweap turnoff, Hwy 89
GLCA	*Uta stansburiana*	BYU 21434	24-Aug-62	Heinrichs	1 mi N of Wahweap turnoff, Hwy 89
GLCA	*Uta stansburiana*	BYU 21435	24-Aug-62	Heinrichs	1 mi N of Wahweap turnoff, Hwy 89
GLCA	*Uta stansburiana*	BYU 2748	4-Jun-39	Tanner	'Wahweap Creek (CCC road).'
GLCA	*Uta stansburiana*	BYU 617	7-Jul-27	Kartchner	'Lee''s Ferry'

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Park	Species	Museum Number	Date Collected	Collector	Locality
GLCA	*Uta stansburiana*	LACM 122072	16-Jun-1969	WC Welbourn	Warm Crk Bay, 14 miles NE Glen Cyn City (by road)
GLCA	*Uta stansburiana*	LACM 122073	16-Jun-1969	WC Welbourn	Warm Crk Bay, 14 miles NE Glen Cyn City (by road)
GLCA	*Uta stansburiana*	UU 1291	7/26/37	Wm. Kiss	Rock Creek, Colorado River
GLCA	*Uta stansburiana*	UU 1469	8/1/38	M.B. Mittleman	San Juan River, 20 Mi. above Colorado River
GLCA	*Uta stansburiana*	UU 1495	8/5/38	M.B. Mittleman	Colorado River, 63 mi. above Lee's Ferry
GLCA	*Uta stansburiana*	UU 2176	7/30/38	A.M. Woodbury	San Juan River, 35 Mi. above Colorado River
GLCA	*Uta stansburiana*	UU 3123	7/30/38	A.M. Woodbury	San Juan River, 35 Mi. above Colorado River
GLCA	*Uta stansburiana*	UU 3331	7/3/58	N.K. Dean	Hite, Colorado River, 162 mi. N Lee's Ferry
GLCA	*Uta stansburiana*	UU 3332	7/3/58	N.K. Dean	Hite, Colorado River, 162 mi. N Lee's Ferry
GLCA	*Uta stansburiana*	UU 3349		A. Grundmann	Glen Canyon
GLCA	*Uta stansburiana*	UU 3350		A. Grundmann	Glen Canyon
PETR	*Cnemidophorus neomexicanus*	MSB 16607	5/20/67	AE Dunham	Volcanoes, 8 mi W of Albuquerque
PETR	*Cnemidophorus neomexicanus*	MSB 61397	5/11/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61398	5/11/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61399	5/11/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61400	5/7/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61401	5/7/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61402	5/7/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61403	5/11/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61404	5/11/97	BC Pickering	At volcanoes
PETR	*Cnemidophorus neomexicanus*	MSB 61405	5/11/97	BC Pickering	At volcanoes
PETR	*Crotalus viridis*	MSB 14581	4/23/66	DE Wilson	Albuquerque Volcanoes
PETR	*Crotalus viridis*	MSB 14874	5/2/66	RG Clarkson	Near Volcanos, just W Albuquerque, N of US 66
PETR	*Crotalus viridis*	MSB 14875	5/2/66	RG Clarkson	Near Volcanos, just W Albuquerque, N of US 66
PETR	*Crotalus viridis*	MSB 15293	4/23/66	RS Jaramillo	Volcanoes W of Albuquerque
PETR	*Crotalus viridis*	MSB 16465	3/24/67	CB Jones	Volcanoes W of Albuquerque
PETR	*Crotalus viridis*	MSB 19442	5/15/69	CA Knight	1 mi E of Volcano Peaks on W. Mesa
PETR	*Crotalus viridis*	MSB 31178	4/21/71	B Galentine	7.5 mi W and 4 mi N of Albuquerque, Vulcan Crater, T11N R3E, sec. 9
PETR	*Crotalus viridis*	MSB 31311	4/3/72	D Johnson, B Galenstine	Albuquerque, Volcano Cliffs Park, West Mesa
PETR	*Crotalus viridis*	MSB 31312	4/3/72	D Johnson, B Galenstine	Albuquerque, Volcano Cliffs Park, West Mesa
PETR	*Crotalus viridis*	MSB 8356	4/21/50	WJ Koster, H Campbell	Just S Volcanoes, W Mesa
PETR	*Crotalus viridis*	MSB 8400	5/31/39	SW Bowman	Volcanoes, W of Rio Grande

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Park	Species	Museum Number	Date Collected	Collector	Locality
PETR	*Crotalus viridis*	MSB 8461	3/17/69	R Beach	Volcanoes, W of Rio Grande
PETR	*Crotaphytus collaris*	MSB 16777	5/15/67	M Kobylack	Albuquerque Volcanoes, 8 mi W Albuquerque
PETR	*Gambelia wislizenii*	MSB 16778	5/16/67	M Kobylack	Albuquerque Volcanoes, 8 mi W Albuquerque
PETR	*Holbrookia maculata*	MSB 16602	5/20/67	AE Dunham	Volcanoes, 8 mi W of Albuquerque
PETR	*Holbrookia maculata*	MSB 16603	5/20/67	AE Dunham	Volcanoes, 8 mi W of Albuquerque
PETR	*Holbrookia maculata*	MSB 58739	4/16/75	D Harvey	Vulcan Crater, 7.5 mi. W, and 4 mi. N of Albuquerque, T11N R3E Sec. 9
PETR	*Hypsiglena torquata*	MSB 19379	5/11/69	CA Knight	West Mesa, 2 miles W. of Univ. of Alb.
PETR	*Masticophis flagellum*	MSB 14639	4/16/66	DP Reagan	.5 mi W Albuquerque Volcanoes
PETR	*Masticophis flagellum*	MSB 15544	6/20/65	MB Snipes	.5 mi W southern most volcano, W of Albuqerque
PETR	*Phrynosoma hernandesi*	MSB 19337	4/20/69	MR Gruner	Volcanos, just West of Albuquerque
PETR	*Phrynosoma modestum*	MSB 15114	3/19/66	CO Morgan	Volcano, Mesa W of Albuquerque
PETR	*Phrynosoma modestum*	MSB 15540	4/21/66	MB Snipes	Southern most volcano W of Albuquerque
PETR	*Phrynosoma modestum*	MSB 30310	5/12/74	K Kietzke	Main volcano cone, volcanoes W of foun
PETR	*Phrynosoma modestum*	MSB 31277	4/20/71	B Galenstine	Vulcan Crater, 7.5 mi. W and 4 mi. N of Albuquerque, T11N R3E Sec. 9
PETR	*Pituophis catenifer*	MSB 25533	4/13/69	JJ Lavandoski	Under debris in dump about 1 mi S of S Volcan
PETR	*Pituophis catenifer*	MSB 61395	5/11/97	BC Pickering	3 mi N I-40 on the base of the volcano, DOR
PETR	*Pituophis catenifer*	MSB 8386	11/6/56	H Campbell	5 mi W Albuquerque, 1 mi S Volcanoes
PETR	*Sceloporus undulatus*	MSB 15542	4/21/66	MB Snipes	Southern most volcano W of Albuquerque
PETR	*Sceloporus undulatus*	MSB 15543	6/20/65	MB Snipes	.5 mi W southern most volcano, W of Albuqerque
PETR	*Sceloporus undulatus*	MSB 21210	5/16/69	CA Knight	2 mi W of University of Albuquerque, in volcano cliffs
PETR	*Sceloporus undulatus*	MSB 21211	5/16/69	CA Knight	2 mi W of University of Albuquerque, in volcano cliffs
PETR	*Uta stansburiana*	MSB 15115	3/19/66	CO Morgan	Volcano, Mesa W of Albuquerque
PETR	*Uta stansburiana*	MSB 15116	3/19/66	CO Morgan	Volcano, Mesa W of Albuquerque
PETR	*Uta stansburiana*	MSB 15117	3/19/66	CO Morgan	Volcano, Mesa W of Albuquerque
PETR	*Uta stansburiana*	MSB 15541	4/21/66	MB Snipes	Southern most volcano W of Albuquerque
PETR	*Uta stansburiana*	MSB 16604	5/20/67	AE Dunham	Volcanoes, 8 mi W of Albuquerque
PETR	*Uta stansburiana*	MSB 16605	5/20/67	AE Dunham	Volcanoes, 8 mi W of Albuquerque
PETR	*Uta stansburiana*	MSB 16606	5/20/67	AE Dunham	Volcanoes, 8 mi W of Albuquerque
PETR	*Uta stansburiana*	MSB 16774	5/14/67	M Kobylack	Albuquerque Volcanoes, 8 mi W Albuquerque
PETR	*Uta stansburiana*	MSB 16775	5/14/67	M Kobylack	Albuquerque Volcanoes, 8 mi W Albuquerque
PETR	*Uta stansburiana*	MSB 16776	5/14/67	M Kobylack	Albuquerque Volcanoes, 8 mi W Albuquerque
RABR	*Bufo punctatus*	MVZ 16365	23-Jun-33	Seth B. Benson	Rainbow Bridge, 4000 ft

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Park	Species	Museum Number	Date Collected	Collector	Locality
RABR	*Bufo punctatus*	MVZ 16366	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 16367	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 16368	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 16369	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 16370	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 16371	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 16372	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 16373	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Bufo punctatus*	MVZ 17706	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17707	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17708	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17709	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17710	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17711	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17712	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17713	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17714	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17715	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17716	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17717	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17718	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17719	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17720	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17721	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17722	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17723	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo punctatus*	MVZ 17724	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Bufo woodhousii*	MVZ 16357	6/23/33	Seth B. Benson	Rainbow Bridge, 4000 ft
RABR	*Cnemidophorus tigris*	MVZ 16409	6/22/33	Louise Kellogg	Rainbow Bridge, 4000 ft
RABR	*Cnemidophorus tigris*	MVZ 17881	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Cnemidophorus tigris*	MVZ 17882	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft

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Park	Species	Museum Number	Date Collected	Collector	Locality
RABR	*Crotaphytus bicinctores*	MVZ 16376	6/22/33	Seth B. Benson	Rainbow Bridge
RABR	*Crotaphytus bicinctores*	MVZ 16377	6/22/33	Seth B. Benson	Rainbow Bridge
RABR	*Crotaphytus bicinctores*	MVZ 16378	6/22/33	Seth B. Benson	Rainbow Bridge
RABR	*Crotaphytus bicinctores*	MVZ 16379	6/22/33	Louise Kellogg	Rainbow Bridge, 4000 ft
RABR	*Crotaphytus bicinctores*	MVZ 16380	6/23/33	Louise Kellogg	Rainbow Bridge, 4000 ft
RABR	*Crotaphytus bicinctores*	MVZ 17739	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Crotaphytus bicinctores*	MVZ 17740	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Hypsiglena torquata*	UAZ 39598		Tim Walker	Ranibow Bridge Nat Mon
RABR	*Rana pipiens*	MVZ 17735	7/7/33	Theodore H. Eaton, Jr.	Rainbow Bridge Canyon, below Bridge; elevation 3500 ft.
RABR	*Sceloporus magister*	UAZ 21859		P.Gegenheimer, S. Hale	Ranibow Bridge Nat Mon
RABR	*Sceloporus magister*	UAZ 21867		P.Gegenheimer, S. Hale	Ranibow Bridge Nat Mon
RABR	*Sceloporus undulatus*	MVZ 16396	6/22/33	Louise Kellogg	Rainbow Bridge, 4000 ft
RABR	*Uta stansburiana*	MVZ 16389	6/22/33	Louise Kellogg	Rainbow Bridge, 4000 ft
RABR	*Uta stansburiana*	MVZ 16390	6/22/33	Louise Kellogg	Rainbow Bridge, 4000 ft
RABR	*Uta stansburiana*	MVZ 17781	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Uta stansburiana*	MVZ 17782	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Uta stansburiana*	MVZ 17783	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Uta stansburiana*	MVZ 17784	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Uta stansburiana*	MVZ 17785	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
RABR	*Uta stansburiana*	MVZ 17786	7/6/33	Theodore H. Eaton, Jr.	Rainbow Bridge Trail, 4000 ft
SAPU	*Ambystoma tigrinum*	MSB 25527	10/10/72	C Cummings, Murphy	Gran Quivira National Monument, garage floor
SAPU	*Sceloporus undulatus*	MSB 81	6/6/53	H Campbell, K Campbell	Quorai Ruins, near Punta
SAPU	*Sceloporus undulatus*	MSB 82	6/6/53	H Campbell, K Campbell	Quorai Ruins, near Punta
SAPU	*Thamnophis cyrtopsis*	MSB 23059	8/16/69	AL Mirabal	200 yds W behind Abo State Monument
SUCR	*Phrynosoma hernandesi*	AMNH 62855	8/19/40	Harry C James	Sunset Crater
SUCR	*Sceloporus undulatus*	MNA Z7.27	6/28/32	CM Armack	1/2 mile E Sunset Crater on Kana-a Valley rd., 7000 ft.
SUCR	*Urosaurus ornatus*	BYU 32409	6/5/69	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32410	6/5/69	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32411	6/5/69	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32412	6/5/69	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32413	6/5/69	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32414	6/5/69	McMorris	Sunset Crater lava flow

Table T-1. Amphibian and reptile specimen records from Southern Colorado Plateau Network parks. Park and museum acronyms are defined in the text. Records with no park field are from near, but outside, a park. Most locality data were copied verbatim (including misspellings and curious punctuation) from museum specimen databases.—Continued

Park	Species	Museum Number	Date Collected	Collector	Locality
SUCR	*Urosaurus ornatus*	BYU 32415	6/5/69	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32416	6/5/69	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32669	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32670	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32671	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32672	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32673	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32674	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32675	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32676	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32677	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	BYU 32678	6/3/70	McMorris	Sunset Crater lava flow
SUCR	*Urosaurus ornatus*	FMNH 51813	8/7/47	Alexander Pope	Sunset Crater, mouth of Ice Cave
SUCR	*Urosaurus ornatus*	FMNH 51814	8/7/47	Alexander Pope	Sunset Crater, mouth of Ice Cave
SUCR	*Urosaurus ornatus*	LACM 18937	8/16/33	Bogert	NW Sunset Crater
SUCR	*Urosaurus ornatus*	LACM 97890	7/31/47	C.E. Peterson	Sunset Crater
SUCR	*Urosaurus ornatus*	MVZ 75892	5/2/63	R.F. Jessen	Sunset Crater; elevation 6700 ft
SUCR	*Urosaurus ornatus*	MVZ 75893	5/2/63	R.F. Jessen	Sunset Crater; elevation 6700 ft
SUCR	*Urosaurus ornatus*	MVZ 75894	5/2/63	R.F. Jessen	Sunset Crater; elevation 6700 ft
WACA	*Crotalus viridis*	MNA Z7.231	9/16/63		at Visitor Center, Walnut Canyon
WACA	*Crotalus viridis*	WACA 3047	8/3/74	J. Ellis	Santa Fe Dam
WACA	*Diadophis punctatus*	WACA 3029	8/25/73	Scott Archer	Picnic area rest rooms, ca. 2042 m
WACA	*Eumeces multivirgatus*	LACM 14913	8/6/31	Bogert	Coconino Co: Wanut Canyon Ntl. Monument
WACA	*Lampropeltis pyromelana*	WACA 3046	8/21/73	R. Jones	Walnut CAnyon PIcnic Area
WACA	*Phrynosoma hernandesi*	WACA 3042	6/19/73	M. Salomonson	Visitor Center
WACA	*Phrynosoma hernandesi*	WACA 3043	7/18/72	M. Salomonson	Picnic Area
WACA	*Phrynosoma hernandesi*	WACA 3044	7/19/73	M. Salomonson	Picnic Area
WACA	*Pituophis catenifer*	WACA 3030	5/27/73	Jim Ellis	Walnut Canyon entrance station
WACA	*Sceloporus undulatus*	LACM 17512	9/3/31	Bogert	Walnut Canyon National Monument
WACA	*Sceloporus undulatus*	LACM 17513	9/3/31	Bogert	Walnut Canyon National Monument
WACA	*Sceloporus undulatus*	LACM 17514	9/3/31	Bogert	Walnut Canyon National Monument
WACA	*Sceloporus undulatus*	MCZ R-34293	/ /	LM Klauber	Walnut Canyon, Coconino, Arizona

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Park	Species	Museum Number	Date Collected	Collector	Locality
WACA	*Sceloporus undulatus*	WACA 3032	7/12/72	M. Salomonson	Residence area
WACA	*Sceloporus undulatus*	WACA 3033	8/5/72	M. Salomonson	Island Trail
WACA	*Sceloporus undulatus*	WACA 3034	8/15/72	M. Salomonson	Island Trail
WACA	*Sceloporus undulatus*	WACA 3035	8/5/72	M. Salomonson	Island Trail
WACA	*Thamnophis elegans*	WACA 3048	7/22/72	M. Salomonson	Residence Area
WACA	*Thamnophis elegans*	WACA 3049	9/20/73	M.G. Salomonson	Walnut Canyon entrance road
WACA	*Thamnophis elegans*	WACA 3050	5/26/73	M. Salomonson	Canyon bottom below Island
WACA	*Urosaurus ornatus*	CM 30769	8/9/52	G Woodside	Walnut Canyon National Monument
WACA	*Urosaurus ornatus*	UMMZ 64941	9/18/26	CL Hubbs, Schultz	Walnut Cany Nat Monument
WACA	*Urosaurus ornatus*	WACA 3031	7/16/74	W. Atchison	Visitor Center
WACA	*Urosaurus ornatus*	WACA 3036	8/14/72	M. Salomonson	Visitor Center
WACA	*Urosaurus ornatus*	WACA 3037	7/16/74	M. Salomonson	Rim Trail
WACA	*Urosaurus ornatus*	WACA 3038	7/3/74	M. Salomonson	Visitor Center
WACA	*Urosaurus ornatus*	WACA 3039	7/21/72	M. Salomonson	Island Trail
WACA	*Urosaurus ornatus*	WACA 3040	9/3/72	M. Salomonson	Visitor Center
WACA	*Urosaurus ornatus*	WACA 3041	8/5/72	M. Salomonson	Island Trail
WUPA	*Arizona elegans*	ASU 3878	7/27/58	J.W. Heinrich	32 mi. N Flagstaff
WUPA	*Arizona elegans*	MNA Z7.260	8/8/66	CJ May, O.R. Brown	at entrance of Wupatki Rd. and St. Hwy 89a on 89a
WUPA	*Arizona elegans*	NAU 2305	9/28/74	C.L. Leferve	Wupatki Nat'l Mon, W of Cedar Cyn.
WUPA	*Arizona elegans*	UAZ 51062	7/18/97	T.B. Persons	2.0 mi S of N entrance to Wupatki Nat Mon (FSR 545), Hwy 89, ca. 5700 ft el.
WUPA	*Arizona elegans*	WUPA 16684	8/29/99	Trevor B. Persons	FR 545, milepost 19.0
WUPA	*Arizona elegans*	WUPA 16687	6/8/99	Trevor B. Persons	FR 545, milepost 2.2
WUPA	*Arizona elegans*	WUPA 16711	4/25/87	SK Cinnamon	1.5 mi. S Wupatki VC, 545
WUPA	*Arizona elegans*	WUPA 1767	/ /	Richard V. Harris	4 mi. SE Wupatki Ruin
WUPA	*Bufo cognatus*	CJM 175	/ /	CJ May	4 mi. E Wupatki Nat'l Mon. boundary (US Hwy 89) on Forest Rt. 545
WUPA	*Bufo cognatus*	MNA Z6.381	7/7/66	CJ May	4 mi. N of bdy. of Wupatki Nat'l Mon, on Sunset Crater loop rd.
WUPA	*Bufo cognatus*	WUPA 16693	8/18/99	Trevor B. Persons	FR 545, milepost 1.6
WUPA	*Bufo microscaphus*	UMMZ 222953	5/21/76	Dick Huho	On south bank of Little Colorado River near Antelope Wash Road, Wupatki Nat Monument
WUPA	*Bufo punctatus*	MNA Z6.334	7/7/66	CJ May	4 mi. N of bdy. of Wupatki Nat'l Mon, on Sunset Crater loop rd.
WUPA	*Bufo punctatus*	WUPA 16689	8/7/99	Trevor B. Persons	FR 545, milepost 12.9
WUPA	*Bufo punctatus*	WUPA 16703	/ /	SK Cinnamon	Heiser Sewage Lagoons
WUPA	*Bufo punctatus*	WUPA 16704	/ /	SK Cinnamon	Heiser Sewage Lagoons

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Bufo punctatus*	WUPA 1764	/ /	Richard V. Harris	Wupatki Residence Area
WUPA	*Bufo punctatus*	WUPA 1765	/ /	Richard V. Harris	Wupatki Residence Area
WUPA	*Cnemidophorus inornatus*	LACM 137269	/ /	JW Wright	Wupatki, Hwy 89 (trading post)
WUPA	*Cnemidophorus inornatus*	LACM 137270	/ /	JW Wright	Wupatki, Hwy 89 (trading post)
WUPA	*Cnemidophorus inornatus*	LACM 137271	/ /	JW Wright	Wupatki, Hwy 89 (trading post)
WUPA	*Cnemidophorus inornatus*	LACM 14679	8/9/31	Bogert	Wupatki Ruins
WUPA	*Cnemidophorus inornatus*	MNA Z7.1014	5/3/69	CJ May	1 mi. E on Wupatki Nat'l Mon. rd from US 89
WUPA	*Cnemidophorus inornatus*	MNA Z7.1038	7/30/72	CJ May	0.8 mi. E on Wupatki Nat'l Mon. rd from US 89
WUPA	*Cnemidophorus inornatus*	MNA Z7.2845	7/20/66	CJ May	1 mi. E on Wupatki Nat'l Mon, rd. from US 89
WUPA	*Cnemidophorus tigris*	UAZ 5623	9/22/39	D. Jones	Wupatki Ruin, Wupatki Nat'l Mon
WUPA	*Cnemidophorus tigris*	UAZ 5624	9/22/39	D. Jones	Wupatki Ruin, Wupatki Nat'l Mon
WUPA	*Cnemidophorus tigris*	UMMZ 224043	7/12/78	CM Overcast	Wupatki National Monument, Antelope Wash
WUPA	*Cnemidophorus tigris*	UMMZ 224044	7/17/78	CM Overcast	Wupatki National Monument, Antelope Wash
WUPA	*Cnemidophorus tigris*	UMMZ 224045	7/21/78	CM Overcast	Wupatki National Monument, Antelope Wash
WUPA	*Cnemidophorus tigris*	UTEP 13143	6/7/74	CJ May	1 mi. NE Wupatki Nat'l Monument HQ
WUPA	*Cnemidophorus velox*	BYU 32087	6/10/69	McMorris	Wupatki National Monument
WUPA	*Cnemidophorus velox*	LACM 137272	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137273	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137274	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137275	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137276	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137277	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137278	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137279	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137280	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137281	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137282	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137283	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137284	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	LACM 137285	/ /	JW Wright	Wupatki jct., _mi. N by Hwy 89, near trading post
WUPA	*Cnemidophorus velox*	MNA Z7.127	8/18/33	C.W. Quaintance	Wupatki
WUPA	*Cnemidophorus velox*	MNA Z7.128	8/19/33	C.W. Quaintance	Wupatki, on cinder hill slope

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Cnemidophorus velox*	MNA Z7.2548	5/31/67	RS Funk, CJ May	1 mi. E on Wupatki Nat'l Mon. rd from US 89
WUPA	*Cnemidophorus velox*	UAZ 5362	8/2/51	C.H. Lowe	Wupatki Nat'l Mon, 1.2 mi. W The Citadel
WUPA	*Cnemidophorus velox*	UAZ 5374	8/2/51	C.H. Lowe	Wupatki Nat'l Mon, 1.2 mi. W The Citadel
WUPA	*Cnemidophorus velox*	WUPA 16983	9/2/00	Trevor B. Persons	FR 545, milepost 4.6
WUPA	*Cnemidophorus velox*	WUPA 1770	/ /	Richard V. Harris	Wupatki Residence Area
WUPA	*Crotalus viridis*	NAU 2410	10/10/76	John Fisher	Wupatki Nat'l Mon.
WUPA	*Crotalus viridis*	UMMZ 224263	9/3/77	Jon Peters	Wupatki
WUPA	*Crotalus viridis*	WUPA 1639	9/1/75	Richard V. Harris	1/4 mi. S Doney Picnic Area, 3 mi. WNW Wupatki Ruin
WUPA	*Crotalus viridis*	WUPA 16681	9/5/99	Trevor B. Persons	FR 545, milepost 1.3
WUPA	*Crotalus viridis*	WUPA 16685	11/5/99	Trevor B. Persons	FR 545, milepost 19.3
WUPA	*Crotalus viridis*	WUPA 16694	/ /	BK Palmer	2.2 mi. S of south entrance, W 1/2 NW 1/4 S. 20, T24N R10E, Wupatki National Monument
WUPA	*Crotalus viridis*	WUPA 16695	7/23/83	B Palmer	Hwy 89, 1/2 mi. north Wupatki N. entrance
WUPA	*Crotalus viridis*	WUPA 16696	8/2/84	R Aman	USFS 545, 3/4 mi. S Doney Crater cattleguard
WUPA	*Crotalus viridis*	WUPA 16697	10/14/86	SK Cinnamon	USFS 545, Antelope Wash rd., roadkill mp 11
WUPA	*Crotalus viridis*	WUPA 16972	5/28/00	Trevor B. Persons	FR 545, milepost 18.3
WUPA	*Crotalus viridis*	WUPA 16976	8/1/00	Trevor B. Persons	FR 9122M, e. of mp 22.5 of FR 545
WUPA	*Crotalus viridis*	WUPA 16981	9/2/00	Trevor B. Persons	FR 545, milepost 17.1
WUPA	*Crotalus viridis*	WUPA 16985	9/7/00	Trevor B. Persons	Wukoki Ruins Road, 1.2 mi. from FR 545
WUPA	*Crotalus viridis*		/ /		Wupatki Ruins
WUPA	*Crotaphytus collaris*	BYU 11387	6/10/51	Tanner	Along Hwy 89, 37 miles N of Flagstaff (Wupatki Nat'l Monument)
WUPA	*Crotaphytus collaris*	BYU 11388	6/10/51	Tanner	Along Hwy 89, 37 miles N of Flagstaff (Wupatki Nat'l Monument)
WUPA	*Crotaphytus collaris*	BYU 32109	6/6/69	Ingram	Wapatki National Monument
WUPA	*Crotaphytus collaris*	BYU 32110	6/6/69	Ingram	Wapatki National Monument
WUPA	*Crotaphytus collaris*	BYU 32732	6/3/70	Ingram	Wupatki National Monument
WUPA	*Crotaphytus collaris*	BYU 32742	6/3/70	Ingram	Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29943	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29944	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29945	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29946	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29947	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29948	/ /		W edge Wupatki National Monument

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Crotaphytus collaris*	KU 29949	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29950	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29951	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29952	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29953	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29954	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29955	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	KU 29956	/ /		W edge Wupatki National Monument
WUPA	*Crotaphytus collaris*	MNA Z7.122	8/16/33	C.W. Quaintance	Wupatki, cinder background
WUPA	*Crotaphytus collaris*	MNA Z7.17	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Crotaphytus collaris*	MNA Z7.19	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Crotaphytus collaris*	MNA Z7.20	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Crotaphytus collaris*	MNA Z7.218	7/2/59	R. Heavly	Citadel Ruins
WUPA	*Crotaphytus collaris*	MNA Z7.240	/ /	Ed Lincoln	Wupatki
WUPA	*Crotaphytus collaris*	MNA Z7.2576	7/12/66	CJ May	ca. 5.5 mi. NE Wupatki Nat'l Mon. HQ, Black Falls"
WUPA	*Crotaphytus collaris*	MNA Z7.2577	7/12/66	CJ May	ca. 5.5 mi. NE Wupatki Nat'l Mon. HQ, Black Falls"
WUPA	*Crotaphytus collaris*	MNA Z7.2578	7/12/66	CJ May	ca. 5.5 mi. NE Wupatki Nat'l Mon. HQ, Black Falls"
WUPA	*Crotaphytus collaris*	NAU 2268	9/28/74	C.L. Leferve	Wupatki Nat'l Mon, Lomaki Ruin
WUPA	*Crotaphytus collaris*	NAU 2269	9/28/74	C.L. Leferve	Wupatki Nat'l Mon, Lomaki Ruin
WUPA	*Crotaphytus collaris*	UAZ 1512	8/16/39	Dick Starson	Wupatki Nat'l Mon
WUPA	*Crotaphytus collaris*	UAZ 32906	7/2/70	J.K. Cross	2 mi (Wupatki Nat Mon Rd) E Hwy 89
WUPA	*Crotaphytus collaris*	UAZ 632	8/2/51	C.H. Lowe	Wupatki Nat'l Mon, 3.3 mi (rd) W monument HQ
WUPA	*Crotaphytus collaris*	UAZ 633	8/2/51	C.H. Lowe	Wupatki Nat'l Mon, 3.3 mi (rd) W monument HQ
WUPA	*Crotaphytus collaris*	WUPA 16971	5/7/00	Trevor B. Persons	FR 545, milepost 9.8
WUPA	*Gambelia wislizenii*	AMNH 119940	7/15/66	J Sluder	Wupatki Nat'l Monument, 1.1 mi. NW of Wupatki Ruins
WUPA	*Gambelia wislizenii*	MNA Z7.123	8/17/33	L. Hargrave	Wupatki
WUPA	*Gambelia wislizenii*	MNA Z7.23	5/27/33	L.L. Hargrave	Wupatki Pueblo
WUPA	*Gambelia wislizenii*	UAZ 34854	5/29/72	J.K. Cross	S road entrance to Wupatki Nat'l Mon
WUPA	*Gambelia wislizenii*	UMMZ 223165	7/10/78	CM Overcast	Wupatki National Monument, Antelope Wash
WUPA	*Gambelia wislizenii*	UMMZ 223166	9/9/78	CM Overcast	Wupatki National Monument, Antelope Wash
WUPA	*Gambelia wislizenii*	WUPA 16707	6/15/88	SK Cinnamon	mp 15, USFS 545, Wupatki Nat'l Mon
WUPA	*Holbrookia maculata*	BYU 11372	6/10/51	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Holbrookia maculata*	BYU 11373	6/10/51	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM
WUPA	*Holbrookia maculata*	BYU 11374	6/10/51	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM
WUPA	*Holbrookia maculata*	BYU 11375	6/10/51	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM
WUPA	*Holbrookia maculata*	BYU 11377	6/10/51	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM
WUPA	*Holbrookia maculata*	BYU 11736	6/10/51	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM
WUPA	*Holbrookia maculata*	BYU 13518	4/20/56	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM
WUPA	*Holbrookia maculata*	BYU 13522	4/20/56	Tanner	37 miles N of Flagstaff, along Hwy 89, near W edge of Wupatki NM
WUPA	*Holbrookia maculata*	CAS 155965	6/5/69	JR McMorris	Wupatki National Monument, Lomaki Ruins
WUPA	*Holbrookia maculata*	LACM 53604	8/9/31	Bogert	Wupatki Ruins
WUPA	*Holbrookia maculata*	MNA Z7.219	7/2/59	R. Heavly	Citadel Ruins
WUPA	*Holbrookia maculata*	MNA Z7.220	7/2/59	R. Heavly	Citadel Ruins
WUPA	*Holbrookia maculata*	MNA Z7.86	7/29/32	C.M. Armack	Citadel Pueblo, Wupatki
WUPA	*Holbrookia maculata*	UAZ 1580	5/10/40	P. Jones	NW corner of Wupatki Nat. Mon. Near Hwy 89
WUPA	*Holbrookia maculata*	UMMZ 223240	7/21/78	CM Overcast	Wupatki National Monument, Grassland near Lomaki Ruin
WUPA	*Holbrookia maculata*	UMMZ 223241	8/19/78	CM Overcast	Wupatki National Monument, 1.5 mi E of Lomaki Ruin
WUPA	*Holbrookia maculata*	UMMZ 223242	9/2/78	CM Overcast	Wupatki National Monument, 1.5 mi E of Lomaki Ruin
WUPA	*Holbrookia maculata*	USNM 312953	9/14/23		Black Falls, 5 mi. SW of indian ruins
WUPA	*Holbrookia maculata*	WUPA 1650	9/25/75	Richard V. Harris	3 mi. SE Wupatki Ruin
WUPA	*Hypsiglena torquata*	UTEP 13221	5/24/76	CJ May	USHY 89, 11.3 rd. mi. S Gray Mountain Post Office
WUPA	*Hypsiglena torquata*	UTEP 13222	5/24/76	CJ May	USHY 89, 11.3 rd. mi. S Gray Mountain Post Office
WUPA	*Hypsiglena torquata*	WUPA 16683	6/1/99	Trevor B. Persons	FR 545, milepost 17.3
WUPA	*Hypsiglena torquata*	WUPA 16978	8/19/00	Trevor B. Persons	FR 545, milepost 2.8
WUPA	*Lampropeltis getula*	WUPA 16686	11/5/99	Trevor B. Persons	FR 545, milepost 1.5
WUPA	*Lampropeltis getula*	WUPA 16713	8/2/83	B Palmer	USFS 545, Wukoki turnoff, Wupatki Nat'l Mon
WUPA	*Lampropeltis getula*	WUPA 16982	9/2/00	Trevor B. Persons	FR 545, milepost 12.3
WUPA	*Lampropeltis getula*	WUPA 1766	/ /	Richard V. Harris	4 miles SE Wupatki Ruin
WUPA	*Lampropeltis triangulum*	BYU 10534	6/10/51	Wilmer Tanner	37 miles N of Flagstaff along hwy 89, approx. 2 miles N of W entrance to Wupatki Nat'l Mon.
WUPA	*Lampropeltis triangulum*	MVZ 16416	6/8/33	Seth B. Benson	33 mi N Flagstaff on Flagstaff-Cameron Rd.
WUPA	*Masticophis bilineatus*	UAZ 39725	6/22/54	W.H. Woodin	Flagstaff, 32 mi N Flagstaff on Wupatki Natl Mon Rd near Rt 89
WUPA	*Masticophis taeniatus*	LACM 20591	/ /	Bogert	Wupatki Ruins
WUPA	*Masticophis taeniatus*	MNA Z7.144	7/6/48	M.A. Wetherill	Wupatki, Black Hawk Valley

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Masticophis taeniatus*	MNA Z7.5	4/17/33	L.L. Hargrave	Heiser Spring, Wupatki, 5000 ft.
WUPA	*Masticophis taeniatus*	MNA Z7.6	5/29/33	L.L. Hargrave	Wupatki Pueblo 5100 ft.
WUPA	*Masticophis taeniatus*	UMMZ 224129	5/26/76	Bateman	Wupatki Sunset Crater loop rd 2 mi. out of Wupatki National Monument
WUPA	*Masticophis taeniatus*	UTEP 4123	5/11/74	JC Bokich	DOR USHY 89, ca. 10 mi. N Sunset Carater Nat'l Monument
WUPA	*Masticophis taeniatus*	WUPA 16682	5/10/99	Trevor B. Persons	FR 545, milepost 3.4
WUPA	*Masticophis taeniatus*	WUPA 16710	10/8/86	SK Cinnamon	mp 12, USFS 545, Wupatki Nat'l Mon
WUPA	*Masticophis taeniatus*	WUPA 1768	5/10/77	Richard V. Harris	Wupatki Visitor Center parking lot
WUPA	*Masticophis taeniatus*		/ /		Wupatki Ruins
WUPA	*Phrynosoma hernandesi*	MNA Z7.225	7/27/59	R. Heavly	Wupatki
WUPA	*Phrynosoma hernandesi*	MNA Z7.239	/ /	Ed Lincoln	Wupatki
WUPA	*Phrynosoma hernandesi*	NAU 1004	9/27/69	R Smith	W. border Wupatki National Monument
WUPA	*Phrynosoma hernandesi*	UAZ 1984	7/29/39	D. Jones	Wupatki Nat'l Mon
WUPA	*Phrynosoma hernandesi*	UMMZ 223402	7/28/77		1/4 mi. E of Lemicki run (sic), Wupatki National MOnument
WUPA	*Phrynosoma hernandesi*	WUPA 1653	9/28/75	Richard V. Harris	1.8 km W Wupatki Ruin
WUPA	*Phrynosoma hernandesi*	WUPA 16705	4/24/88	SK Cinnamon	mp 25, USFS 545, s. of Wupatki
WUPA	*Phrynosoma hernandesi*	WUPA 16706	4/23/88	SK Cinnamon	Hull's Canyon, Wupatki Nat'l Mon.
WUPA	*Phrynosoma hernandesi*	WUPA 16975	7/29/00	Trevor B. Persons	FR 545, milepost 20.5
WUPA	*Pituophis catenifer*	ASU 4327	4/20/62	M.A. Nickerson	Wuparki (sic) ruins
WUPA	*Pituophis catenifer*	MNA Z7.11	9/24/33	A.L. Williamson	Wupatki Pueblo
WUPA	*Pituophis catenifer*	MNA Z7.110	7/31/39	A.R. Phillips	Highway N of Wupatki
WUPA	*Pituophis catenifer*	MNA Z7.236	/ /	Ed Lincoln	Wupatki
WUPA	*Pituophis catenifer*	UMMZ 224138	/ /		Wupatki National Monument R9E T26N Sec 17 Elev 5430 ft
WUPA	*Pituophis catenifer*	WUPA 16678	5/23/99	Trevor B. Persons	FR 545, milepost 9.3
WUPA	*Pituophis catenifer*	WUPA 16679	8/8/99	Trevor B. Persons	FR 545, milepost 18.4
WUPA	*Pituophis catenifer*	WUPA 16680	9/1/99	Trevor B. Persons	FR 545, milepost 1.7
WUPA	*Pituophis catenifer*	WUPA 16698	5/4/89	SK Cinnamon	White Mesa Rd., Wupatki Nat'l Mon.
WUPA	*Pituophis catenifer*	WUPA 16699	5/26/78	Randy S. Hurley	Nolakihu-Citadel Ruin, Wupatki Nat'l Mon
WUPA	*Pituophis catenifer*	WUPA 16700	10/26/84	SK Cinnamon	1 mi. W Doney Crater, USFS 545
WUPA	*Pituophis catenifer*	WUPA 16701	10/26/84	S Cinnamon	0.8 mi. S Citadel, USFS 545
WUPA	*Pituophis catenifer*	WUPA 16702	10/8/86	SK Cinnamon	mp 14 USFS 545, Wupatki Nat'l Mon.
WUPA	*Pituophis catenifer*	WUPA 16708	4/12/86	SK Cinnamon	mp 11, USFS 545, Wupatki Nat'l Mon.
WUPA	*Pituophis catenifer*	WUPA 16974	7/16/00	Trevor B. Persons	FR 545, milepost 19.9

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Pituophis catenifer*	WUPA 16980	8/22/00	Trevor B. Persons	FR 545, milepost 7.2
WUPA	*Pituophis catenifer*	WUPA 16984	9/2/00	Trevor B. Persons	FR 545, milepost 4.0
WUPA	*Salvadora hexalepis*	MNA Z7.2526	7/4/71	CJ May	Wupatki Ruins
WUPA	*Salvadora hexalepis*	MVZ 193329	8/13/84	Harry W. Greene	0.5 mi NE Loop Rd. on road to Wukoki Ruins
WUPA	*Salvadora hexalepis*	SFH 2064	/ /	Steve Hale	Wupatki Nat'l Mon., 20 mi. E US Hwy 89 on Forest Route 545
WUPA	*Salvadora hexalepis*	WUPA 16712	5/9/83	SK Cinnamon	1 mi. W Wupatki VC, DOR west side
WUPA	*Salvadora hexalepis*	WUPA 16713	8/2/83	B Palmer	3 1/2 mi. ESE Wupatki Ruin
WUPA	*Salvadora hexalepis*	WUPA 16977	8/17/00	Trevor B. Persons	Wukoki Ruins Road, 0.8 miles from FR 545
WUPA	*Salvadora hexalepis*	WUPA 1769	5/7/77	Richard V. Harris	2 mi. W Wupatki Ruin, DOR west side of Doney Crater
WUPA	*Sceloporus magister*	MNA Z7.116	8/17/33	Don Collier	Wupatki
WUPA	*Sceloporus magister*	MNA Z7.119	8/16/33	C.W. Quaintance	Wupatki, east of ruins
WUPA	*Sceloporus magister*	MNA Z7.120	8/17/33	C.W. Quaintance	Wupatki, east of ruins
WUPA	*Sceloporus magister*	MNA Z7.124	8/17/33	A. Ten, B. Williamson	Wupatki, 2 mi. E of main ruins
WUPA	*Sceloporus magister*	MNA Z7.125	8/16/33	C.W. Quaintance	East of Wupatki
WUPA	*Sceloporus magister*	MNA Z7.21	5/30/33	A.L. Williamson	Wupatki Pueblo
WUPA	*Sceloporus magister*	MNA Z7.24	4/25/37	Milton Wetherill	Wupatki Pueblo
WUPA	*Sceloporus magister*	MNA Z7.28	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Sceloporus magister*	UAZ 2707	6/24/41	D. Staranson	Wupatki Ruins, Wupatki Nat. Mon.
WUPA	*Sceloporus magister*	UAZ 2708	8/15/39	L. Holbrook	Wupatki Nat. Mon., 5000 ft.
WUPA	*Sceloporus magister*	UAZ 2717	5/12/40	C.R. Jones	Wupatki Ruin, Wupatki Nat. Mon., ca, 4900 ft.
WUPA	*Sceloporus magister*	UAZ 2729	8/2/51	C.H. Lowe	Wupatki Nat. Mon., at HQ (Wupatki Ruins)
WUPA	*Sceloporus magister*	UMMZ 223802	6/15/77	GC Bateman	Wupatki National Monument, Window Rock
WUPA	*Sceloporus magister*	WUPA 1647	9/20/75	Richard V. Harris	Wupatki Ruin
WUPA	*Sceloporus magister*	WUPA 16690	6/22/99	Trevor B. Persons	FR 545, milepost 10.0
WUPA	*Sceloporus magister*	WUPA 1771	/ /	Richard V. Harris	Wupatki Residence Area
WUPA	*Sceloporus undulatus*	MCZ R-34292	/ /	LM Klauber	Wupatki: Coconino: Arizona
WUPA	*Sceloporus undulatus*	MNA Z7.126	8/19/33	C.W. Quaintance	Wupatki, on cinder slope
WUPA	*Sceloporus undulatus*	MNA Z7.237	/ /	Ed Lincoln	Wupatki
WUPA	*Sceloporus undulatus*	MNA Z7.29	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Sceloporus undulatus*	NAU 999	10/30/69	R Smith	S. edge Wupatki National Monument
WUPA	*Sceloporus undulatus*	UAZ 3069	9/7/39	D. Jones, J.C. Macy	Wupatki Ruin, Wupatki Nat. Mon.
WUPA	*Sceloporus undulatus*	UAZ 3087	8/2/51	C.H. Lowe	Wupatki Nat. Mon., 1.2 mi. W the Citadel

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Sceloporus undulatus*	UAZ 42538	7/28/53	W.H. Woodin	9 mi W Wupatki Nat Mon HQ
WUPA	*Sceloporus undulatus*	UMMZ 223774	9/28/74	CL Lefeure	Wupatki National Monument, Lomaki Ruin
WUPA	*Sceloporus undulatus*	UMMZ 223775	9/27/69	R. Smith	W border Wupatki National Monument
WUPA	*Sceloporus undulatus*	UMMZ 223910	7/23/75	TA Vaughan	Wupatki National Monument 2 mi NW of headquarters
WUPA	*Sceloporus undulatus*	UMMZ 223911	7/31/75	TA Vaughan	Wupatki National Monument, Antelope Wash rd.
WUPA	*Sceloporus undulatus*	UMMZ 223912	7/21/78	CM Overcast	Wupatki National Monument, 0.5 mi. W of Arrowhead Tank
WUPA	*Sceloporus undulatus*	UMMZ 223913	7/10/78	CM Overcast	Wupatki National Monument, Arrowhead Tank
WUPA	*Sceloporus undulatus*	UMMZ 223914	9/9/78	CM Overcast	Wupatki National Monument, Antelope Wash
WUPA	*Sceloporus undulatus*	UMMZ 223915	9/9/78	CM Overcast	Wupatki National Monument, Antelope Wash
WUPA	*Sceloporus undulatus*	UMMZ 223916	10/30/69	R. Smith	S edge Wupatki National Monument
WUPA	*Sceloporus undulatus*	UMMZ 223917	10/30/69	R. Smith	S edge Wupatki National Monument
WUPA	*Sceloporus undulatus*	UMMZ 223918	10/30/69	R. Smith	S edge Wupatki National Monument
WUPA	*Sceloporus undulatus*	UMMZ 223919	10/30/69	R. Smith	S edge Wupatki National Monument
WUPA	*Sceloporus undulatus*	WUPA 1648	9/25/76	Richard V. Harris	3 mi. ESE Wupatki Ruin
WUPA	*Sceloporus undulatus*	WUPA 16709	10/7/86	SK Cinnamon	E of mp 5, USFS 545, Wupatki Nat'l Mon.
WUPA	*Sonora semiannulata*	UAZ 26371	6/9/51	Pierson	Wupatki Nat. Mon.
WUPA	*Sonora semiannulata*	UAZ 26372	6/9/51	Pierson	Wupatki Nat. Mon.
WUPA	*Spea bombifrons*	UTEP 13294	5/23/79	CJ May	Wupatki Nat'l Monument rd., ca. 2.4 rd. mi. E jct. with USHY 89
WUPA	*Spea bombifrons*	UTEP 13295	5/23/79	CJ May	Wupatki Nat'l Monument rd., ca. 2.4 rd. mi. E jct. with USHY 89
WUPA	*Spea bombifrons*	UTEP 13296	5/23/79	CJ May	Wupatki Nat'l Monument rd., ca. 2.4 rd. mi. E jct. with USHY 89
WUPA	*Spea bombifrons*	UTEP 13297	5/23/79	CJ May	Wupatki Nat'l Monument rd., ca. 2.4 rd. mi. E jct. with USHY 89
WUPA	*Spea bombifrons*	UTEP 132978	5/23/79	CJ May	Wupatki Nat'l Monument rd., ca. 2.4 rd. mi. E jct. with USHY 89
WUPA	*Spea bombifrons*	UTEP 132979	5/23/79	CJ May	Wupatki Nat'l Monument rd., ca. 2.4 rd. mi. E jct. with USHY 89
WUPA	*Spea bombifrons*	WUPA 16973	7/8/00	Trevor B. Persons	FR 545, milepost 13.7
WUPA	*Spea intermontana*	NAU 2404	7/18/77	Richard V. Harris	Wupatki Nat'l Mon. Recorded as Scaphiopus intermontanus, now at UMMZ (#?), probably bombifrons
WUPA	*Spea multiplicata*	MNA Z6.459	6/27/66	CJ May	2 mi. NE on Sunset Crater-Wupatki rd. from US 89
WUPA	*Spea multiplicata*	WUPA 16688	7/14/99	Trevor B. Persons	FR 545, milepost 6.7
WUPA	*Spea multiplicata*	WUPA 16691	8/14/99	Trevor B. Persons	FR 545, milepost 10.3
WUPA	*Spea multiplicata*	WUPA 16692	8/14/99	Trevor B. Persons	FR 545, milepost 15.9
WUPA	*Spea multiplicata*	WUPA 16979	8/19/00	Trevor B. Persons	FR 545, milepost 1.5
WUPA	*Thamnophis elegans*	MNA Z7.238	/ /	Ed Lincoln	Wupatki
WUPA	*Urosaurus ornatus*	LACM 18938	8/9/31	Bogert	Wupatki Ruins

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Park	Species	Museum Number	Date Collected	Collector	Locality
WUPA	*Urosaurus ornatus*	LACM 18939	8/9/31	Bogert	Wupatki Ruins
WUPA	*Urosaurus ornatus*	LACM 18940	8/9/31	Bogert	Wupatki Ruins
WUPA	*Uta stansburiana*	MNA Z7.115	8/17/33	A. Ten, B. Williamson	Wupatki
WUPA	*Uta stansburiana*	MNA Z7.117	8/18/33	C.W. Quaintance	Wupatki
WUPA	*Uta stansburiana*	MNA Z7.118	8/17/33	C.W. Quaintance	Wupatki, black cinder background
WUPA	*Uta stansburiana*	MNA Z7.30	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Uta stansburiana*	MNA Z7.31	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Uta stansburiana*	MNA Z7.32	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Uta stansburiana*	MNA Z7.33	/ /	A.L. Williamson	Wupatki Pueblo
WUPA	*Uta stansburiana*	MNA Z7.34	5/19/33	L.L. Hargrave	Wupatki Pueblo
WUPA	*Uta stansburiana*	UMMZ 223594	10/30/69	R Smith	South edge Wupatki National Monument
WUPA	*Uta stansburiana*	UMMZ 223595	10/30/69	R Smith	South edge Wupatki National Monument
WUPA	*Uta stansburiana*	UMMZ 223596	10/30/69	R Smith	South edge Wupatki National Monument
WUPA	*Uta stansburiana*	UMMZ 223597	10/30/69	R Smith	South edge Wupatki National Monument
WUPA	*Uta stansburiana*	UMMZ 223598	10/30/69	R Smith	South edge Wupatki National Monument
WUPA	*Uta stansburiana*	UMMZ 223599	8/3/78	CM Overcast	Wupatki National Monument, grassland near Lomaki Ruin
WUPA	*Uta stansburiana*	UMMZ 223600	8/3/78	CM Overcast	Wupatki National Monument, grassland near Lomaki Ruin
WUPA	*Uta stansburiana*	UMMZ 223601	6/15/77	EL Polvent	Wupatki National Monument, Window Rock
WUPA	*Uta stansburiana*	UTEP 4158	5/11/74	JC Bokich	Wupatki Nat'l Monument, off USHY 89 N of Flagstaff
WUPA	*Uta stansburiana*	UTEP 4159	5/11/74	JC Bokich	Wupatki Nat'l Monument, off USHY 89 N of Flagstaff
WUPA	*Uta stansburiana*	UTEP 4160	5/11/74	JC Bokich	Wupatki Nat'l Monument, off USHY 89 N of Flagstaff
WUPA	*Uta stansburiana*	WUPA 1649	9/25/76	Richard V. Harris	3 mi. ESE Wupatki Ruin
YUHO	*Crotalus viridis*	YUHO 102	4/17/84	Hugh Quinn	
YUHO	*Crotalus viridis*	YUHO 103	4/17/84	Hugh Quinn	
YUHO	*Crotalus viridis*	YUHO 104	4/17/84	Hugh Quinn	
YUHO	*Crotalus viridis*	YUHO 105	4/17/84	Hugh Quinn	
YUHO	*Crotalus viridis*	YUHO 106	4/17/84	Hugh Quinn	
YUHO	*Crotalus viridis*	YUHO 107	4/17/84	Hugh Quinn	
YUHO	*Masticophis taeniatus*	BS/FC 6253	9/26/64	none	Yucca House National Monument
YUHO	*Masticophis taeniatus*	BS/FC 6254	10/1/64	none	Yucca House National Monument
YUHO	*Masticophis taeniatus*	CSU uncataloged	10/1/64	Johnson	Yucca House National Monument
YUHO	*Thamnophis elegans*	UCM 25513	4/14/64	Johnson	Yucca House National Monument

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Park	Species	Museum Number	Date Collected	Collector	Locality
YUHO	*Thamnophis elegans*	UCM 25514	4/14/64	Johnson	Yucca House National Monument
YUHO	*Thamnophis elegans*	UCM 25515	4/14/64	Johnson	Yucca House National Monument
YUHO	*Thamnophis elegans*	UCM 25516	4/14/64	Johnson	Yucca House National Monument
YUHO	*Thamnophis elegans*	UCM 25517	4/14/64	Johnson	Yucca House National Monument
	Ambystoma tigrinum	MSB 60956	8/5/97	CW Painter, RD Jennings	Hubbard Pond, Aztec
	Ambystoma tigrinum	WACA 3045	7/27/74	M. Salomonson	Continental Country Club, 5 miles W. of Walnut Canyon Nat'l Mon.
	Bufo punctatus	CU 5766			11.5 mi. SSE Grants
	Bufo woodhousii	MSB 31782	8/23/75	RB Halley	1/2 mi. S Bandelier Natl. Monu., mouth of Medio Canyon and Cochiti Lake
	Bufo woodhousii	UMMZ 86604			8 mi. SE Paxton
	Cnemidophorus neomexicanus	MSB 11713	6/5/61	JW Wright	1 mi W Scholle
	Cnemidophorus neomexicanus	MSB 41041	8/16/73	WG Degenhardt, JS Jacob	White Rock Canyon at mouth of Sanchez Canyon, 6 mi. NE Cochiti Pueblo
	Cnemidophorus tigris	MSB 61331	6/26/98	CW Painter, DS Sias	Just outside NW corner of Bisti Wilderness Area, ca. 30.5 air mi S Farmington
	Cnemidophorus velox	CU 5458			11.5 mi. SSE Grants
	Cnemidophorus velox	UMMZ 86619			8 mi. SE Paxton
	Crotalus atrox	CU 5591			10.4 mi. S. Grants
	Crotalus atrox	CWGF			11.5 mi. SSE Grants
	Crotalus molossus	CU 5868			8 mi. NE Grants
	Crotalus viridis	CU 5590			10.4 mi. S. Grants
	Crotalus viridis	MCZ 62267			25 mi. S. Grants
	Crotaphytus collaris	CU 5747			10.4 mi. S. Grants
	Crotaphytus collaris	UMMZ 122621			11.5 mi. SSE Grants
	Crotaphytus collaris	UMMZ 122622			11.5 mi. SSE Grants
	Elaphe guttata	MVZ 171740	8/9/78	Stevan J. Arnold	5 mi NW McCartys
	Eumeces multivirgatus	CU 5607			17 mi. SW Grants
	Eumeces multivirgatus	CWGF			2 mi. W. El Morro Nat. Mon.
	Eumeces multivirgatus	MNA Z7.177		Bill Carson	4 1/2 mi. E of Flagstaff
	Eumeces multivirgatus	NAU 2267	10/9/74	Bandoli	1.2 mi. N of Wupatki turnoff on west side of hwy 89
	Eumeces obsoletus	CU 5455			11.5 mi. SSE Grants
	Eumeces obsoletus	UMMZ 86623			8 mi. SE Paxton
	Holbrookia maculata	MCZ 6824			Grants
	Hyla arenicolor	CU 6233			11.5 mi. SSE Grants
	Hyla eximia	UAZ 553447	8/1/87	F.C. Baptista	6.1 mi. S of Flagstaff on Lake Mary Rd at Lake Mary Store

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Park	Species	Museum Number	Date Collected	Collector	Locality
	Lampropeltis pyromelana	MNA Z7.2854	8/12/89	T.J. Merkel	FR 420, 1/2 mi. from US Hwy 89, T23N R8E, Sec 29
	Masticophis flagellum	TNHC 4487			8 mi. E Grants
	Masticophis taeniatus	CU 5602			10.4 mi. S. Grants
	Masticophis taeniatus	MSB 457	7/12/53	H Campbell	Abo Canyon, 9 mi W Mountainair
	Phrynosoma hernandesi	CU 5601			10.4 mi. S. Grants
	Phrynosoma hernandesi	MSB 1237	8/31/48	WJ Koster, K Rafferty	Near El Morro Nat'l Monument
	Phrynosoma hernandesi	MSB 1340	5/10/46	B Madson	Aztec
	Pituophis catenifer	CU 5769			5 mi. SSW U.S. Rt. 66 on N.M. Rt. 117
	Pituophis catenifer	UMMZ 86631			16 mi. S Grants
	Rana blairi	MSB 850	5/10/46	B Madson	Aztec
	Rana blairi	MSB 851	5/10/46	B Madson	Aztec
	Rana catesbiana	MSB 12467	4/16/65	DT Jennings	Manzano Lake, Manzano
	Rana catesbiana	MSB 41214	8/16/73	WG Degenhardt, JS Jacob	W. bank of Rio Grande at mouth of Capulin Canyon
	Rana catesbiana	MSB 41215	8/16/73	WG Degenhardt, JS Jacob	W. bank of Rio Grande at mouth of Capulin Canyon
	Salvadora grahamiae	CU 5655			10.4 mi. S. Grants
	Salvadora grahamiae	MSB 60991	10/9/97	BL Christman, SL Kilpatrick	DOR US Hwy 60, 11 mi E Jct NM Hwy 47
	Salvadora hexalepis	UAZ 53765	9/1/01	J. A. Persons	Leupp Rd., ca. 1.8 mi (rd) NE Townsend-Winona Rd, SE 1/4 Sec 34, T22N R9E, ca. 6200 ft. el.
	Scaphiopus couchii	MSB 50012	9/27/82	JN Stuart	1/4 mi. below Cochiti Dam, side channel of Rio Grande (W side)
	Sceloporus graciosus	UTEP 12590	5/30/75	CJ May	19 mi. (by USHY 89) S & 1 mi. W Cameron Post Office
	Sceloporus graciosus	UTEP 12591	5/30/75	CJ May	19 mi. (by USHY 89) S & 1 mi. W Cameron Post Office
	Sceloporus graciosus	UTEP 12592	5/30/75	CJ May	19 mi. (by USHY 89) S & 1 mi. W Cameron Post Office
	Sceloporus undulatus	CU 5608			10.4 mi. S. Grants
	Sceloporus undulatus	UMMZ 86611			18 mi. SW Grants
	Sceloporus undulatus	UMMZ 86612			17 mi. SW Grants
	Spea intermontana	CU 6308			2 mi. W. El Morro Nat. Mon.
	Spea multiplicata	CU 5775			11.5 mi. SSE Grants
	Tantilla hobartsmithi	BYU 11757	5/15/54	Tanner	1 mile W of Star Spring, Henry Mts.
	Tantilla hobartsmithi	BYU 11758	5/15/54	Tanner	1 mile W of Star Spring, Henry Mts.
	Tantilla hobartsmithi	BYU 31206	5/18/68	Hopkin	Starr Springs, Henry Mts.
	Thamnophis cyrtopsis	CU 5053			11.5 mi. SSE Grants
	Thamnophis elegans	UMMZ 123131			7.8 mi. SE Grants
	Urosaurus ornatus	CU 5127			17 mi. SW Grants

Table T-1. Amphibian and reptile specimen records from Southern Colorado Plateau Network parks. Park and museum acronyms are defined in the text. Records with no park field are from near, but outside, a park. Most locality data were copied verbatim (including misspellings and curious punctuation) from museum specimen databases.—Continued

Park	Species	Museum Number	Date Collected	Collector	Locality
	Urosaurus ornatus	CU 5695			17 mi. SW Grants
	Urosaurus ornatus	MCZ 62308			25 mi. S. Grants
	Xantusia vigilis	BYU 11731	10-Jun-54	Tanner	20 miles NW of Hite (about 5 mi above Hog Spring).
	Xantusia vigilis	BYU 11732	10-Jun-54	Tanner	20 miles NW of Hite (about 5 mi above Hog Spring).
	Xantusia vigilis	BYU 11733	10-Jun-54	Tanner	20 miles NW of Hite (about 5 mi above Hog Spring).
	Xantusia vigilis	BYU 12644	9-Jun-55	Tanner	200 yds S of Trachyte Creek
	Xantusia vigilis	BYU 12645	9-Jun-55	Tanner	200 yds S of Trachyte Creek
	Xantusia vigilis	BYU 12646	9-Jun-55	Tanner	‘200 yds S of Trachyte Creek
	Xantusia vigilis	BYU 12647	9-Jun-55	Tanner	‘200 yds S of Trachyte Creek
	Xantusia vigilis	BYU 13238	18-Jun-56	Tanner	‘200 yds S of Trachyte Creek
	Xantusia vigilis	BYU 31207	19-May-68	Grogan	300 yds S of Trachyte Creek.
	Xantusia vigilis	BYU 31208	19-May-68	Grogan	300 yds S of Trachyte Creek.
	Xantusia vigilis	BYU 46854	10-May-01	Porras	18.1 mi E Hall’s Crossing, then 5.8 mi NNW on Moki Canyon Rd
	Xantusia vigilis	BYU 46854	10-May-01	Lamar	18.1 mi E Hall’s Crossing, then 5.8 mi NNW on Moki Canyon Rd
	Leptotyphlops humilis	UCM 20002		Shannon	1.5 mi NW Walnut Cyn

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