

Mammal Inventories of Selected Parks in the Northern Colorado Plateau Network

Including:

**Capitol Reef and Black Canyon National Parks, Curecanti National Recreation Area,
Golden Spike National Historic Site, and Cedar Breaks, Fossil Butte, Timpanogos Cave,
Hovenweep, and Pipe Springs National Monuments**

**Annual Report for FY2001 to the
National Park Service
Moab, UT**

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EXECUTIVE SUMMARY

In 2001 we initiated inventories of mammals on selected national parks and monuments within the Northern Colorado Plateau Network (NCPN) of the National Park Service. The overarching goal of these efforts was to begin efforts to document 90% of mammals that are suspected of occurring on national parklands. We worked on nine different parks: Capitol Reef and Black Canyon National Parks, Curecanti National Recreation Area, Golden Spike National Historic Site, and Cedar Breaks, Fossil Butte, Hovenweep, Pipe Springs, and Timpanogos Cave National Monuments.

On these nine parks in the NCPN during 2001, we amassed a total of 11,773 trap nights and 108 mist net-nights and gathered data on 2104 individual captures, observations, and reports on mammals of 73 species. We captured 3 species of insectivores, 17 species of bats, 1 lagomorph, 30 species of rodents, and 1 carnivore. We also documented 21 additional species by observation, photograph, scat, tracks, or interviews with park staff. Additional species were documented by data mining efforts using published literature and museum records. By park, the current level of documentation (documented species/likely species) is: BLCA, 68%; CARE, 90%; CEBR, 40%; CURE, 65%; FOBU, 53%; GOSP, 25%; HOVE, 41%; PISP, 47%; TICA, 19%. Levels of documentation vary not only by park but also by mammalian group and we make recommendations for specific work during 2002, along with comments on the current composition of lists of mammals occurring on the parks.

The Colorado Plateau occupies parts of Wyoming, Colorado, Utah, New Mexico, and Arizona and is generally defined as those areas drained by the Colorado River and its tributaries. The plateau comprises a diversity of landforms, such as mesas, valleys, and mountains, and vegetation associations ranging from arid lowlands with cacti, saltbush, and piñon-juniper forests to open grasslands with scattered sage and riparian forests to high elevations with spruce, fir, aspen, and wet meadows.

Historically, several places on the Colorado Plateau have been the subjects of geological and biological explorations. In 1869, J. W. Powell explored and mapped the canyon country of the Colorado River (Powell 1961). In the late 1800s, C.H. Merriam, V. Bailey, M. Cary, and other employees of the Bureau of Biological Survey conducted biological explorations of parts of the area. More recently, university-based researchers such as S.D. Durrant (1952), D.M. Armstrong (1972), J.S. Findley et al. (1975), D.F. Hoffmeister (1986), and J. Fitzgerald et al. (1994) have added to our understanding of the fauna of the Colorado Plateau. Until very recently, access to many areas on the plateau has been difficult and as a consequence, these areas have remained relatively poorly-known.

This relative lack of knowledge about fauna and flora of the plateau applies to most Federal lands, including Fish and Wildlife Service refuges, Bureau of Land Management areas, and National Park Service (NPS) lands. In 2000, the NPS initiated a nationwide program to obtain better information on occurrence of vertebrates and plants on NPS lands. In 2001, the Midcontinent Ecological Science Center, U.S. Geological Survey, joined this effort as a cooperator and we conducted surveys for terrestrial and volant mammals occurring on nine national parks or monuments in the NPS Northern Colorado Plateau Network: Black Canyon

National Park (BLCA), Capitol Reef National Park (CARE), Cedar Breaks National Monument (CEBR), Curecanti National Recreation Area (CURE), Fossil Butte National Monument (FOBU), Golden Spike National Historic Site (GOSP), Hovenweep National Monument (HOVE), Pipe Spring National Monument (PISP), and Timpanogos Cave National Monument (TICA). Our objectives were to provide baseline information on mammal distribution and occurrence with a specific goal, over a two-year period, of documenting 90% of the mammal species occurring on these parks (e.g., NPS Proposal 2000).

METHODS AND MATERIALS

We prepared lists of all mammals that might conceivably occur on each park using Armstrong (1972), Clark (1977), Clark and Stromberg (1987), Durrant (1952), Findley et al. (1975), Fitzgerald et al. (1994), Hall (1981), and Hoffmeister (1986). These park lists were produced both in text (Word) format and in an Excel database. An earlier version of the Excel database was provided to the NCPN office in Moab; an updated copy that reflects activities in 2001 is attached to this report (Appendix A; all appendices in digital format). We have used the “track changes” option in Excel to note these changes. We categorized the species on each list as unconfirmed (= unlikely to occur), possibly present (= species likely to occur, range includes or is near the park), and present (= documented by us or others). To assess progress toward documenting 90% of species occurring on a given park, we divided the number of documented species by the number of likely species (possibly present) and multiplied by 100 to obtain a percentage. Tabulations for each park, by major group of mammals, are attached to this report (Appendix B).

Mammals were surveyed using mist nets for bats, and live traps and pitfall traps for capture of insectivores and rodents; observational methods were the predominant means of documenting the occurrence of larger species of mammals (see Bogan, in NPS Proposal 2000, for additional details). Bats were netted following methods described by Kunz and Kurta (1988). Nets were set and opened about 20 minutes before sunset and monitored until closure. Level of effort was quantified by using the number of net-nights for each site (e.g., 3 nets set for one night = 3 net-nights). Number of nets at a site varied, depending on size and shape of the water source, extent of water sources on a park, and number of investigators at each site.

Rodents were trapped using Sherman live traps that typically were set in paired (Calhoun) transect lines of twenty stations, two traps per station, with 10 to 15 meters between stations (Wilson et al. 1996). In some cases, single lines of traps were set due to linearity of habitat or specific design objectives. Rolled oats were used as bait for live traps. Unbaited pitfall traps consisting of 1-gallon plastic buckets were buried at ground level to aid in the capture of small rodents and insectivores. All trapping methods were discussed with park staff prior to implementation. Level of trapping effort was quantified as total number of trap nights for each site (e.g., 200 traps x 2 days = 400 trap nights).

Capture and handling methods of bats and rodents followed a written protocol approved by the USGS Midcontinent Ecological Science Center, Animal Care and Use Committee. Upon capture, bats and rodents were promptly removed from the net or trap, identified to species, other data collected, and then released unharmed. Data included time/date of capture, species, sex, age, reproductive condition, locality, number and size of nets or trapline location, names of investigators, time of deployment and closure of nets, and temperature were recorded on

standardized data sheets; most of this information was later transferred to an Excel database (Appendix C, consisting of about 2104 entries at present) that contains additional information as requested by NPS. We are continuing to update this appendix. GPS and habitat data were entered into computerized forms provided by NCPN and these also are attached to this report (Appendix D). Scientific names in this report and Appendix C follow Jones et al. (1997) with the exception of Townsend's big-eared bat (*Corynorhinus townsendii*, Tumlison and Douglas 1992) and western chipmunks (*Eutamias* spp., Hoffmeister 1986). Age of bats was determined by examining epiphyseal ossification, as described by Anthony (1988). Age of rodents was determined by reproductive condition, size, and pelage color. Reproductive condition of males was determined if cauda epididymides were visible or the testes were scrotal; females were noted as pregnant, lactating, or postlactating for bats and rodents.

Selected voucher specimens were taken to ensure correct identification of species or to document a new record of occurrence; these specimens are noted in the capture database. Bats and rodents were prepared as study skins and skeletal material is being cleaned for identification. Voucher specimens were deposited in the Biological Survey Collection, Museum of Southwestern Biology (MSB), University of New Mexico. Samples of heart, kidneys, and liver were preserved in liquid nitrogen and deposited in the Division of Genomic Resources at the University of New Mexico.

RESULTS AND DISCUSSION

On NCPN parks during 2001, we amassed a total of 11,773 trap nights and 108 mist net-nights during which we obtained data on 2104 captures, observations, and reports of 73 species of mammals on parklands (Appendix C in part). We captured about 2008 mammals of 52 species

(3 insectivores, 17 bats, 1 lagomorph, 30 rodents, and 1 carnivore; Appendix C). We also documented twenty-one additional species by observation, photograph, scat, tracks, or interviews with park staff (Appendix C). Additional species were documented by data mining efforts using published literature and museum records. By park, the current level of documentation (documented species/likely species) is: BLCA, 68%; CARE, 90%; CEBR, 40%; CURE, 65%; FOBU, 53%; GOSP, 25%; HOVE, 41%; PISP, 47%; TICA, 19%. These are probably conservative estimates of level of documentation, as discussed below.

Individual Park Results

Black Canyon National Park. At BLCA our efforts consisted of 12 mist-net nights and 1240 trap nights, during which we documented nine species of bats by capture or audible call and 322 individual small terrestrial mammals by livetrapping (Appendix C). Although we did not capture the big free-tailed bat (*Nyctinomops macrotis*) and spotted bat (*Euderma maculatum*), we were able to document these two species by their unique audible calls. Our capture of a Yuma myotis (*M. yumanensis*) is the first known occurrence of this species for Montrose County.

The deer mouse (*Peromyscus maniculatus*), a widespread and common species across North America (Hall 1981), was the most frequently captured species (183 individuals), followed by the brush mouse (*P. boylii*, 36 individuals captured), bushy-tailed woodrat (*Neotoma cinerea*, 25), and least chipmunk (*Eutamias minimus*, 24). We believe that our capture of the Hopi chipmunk (*E. rufus*) is the first for BLCA. We also observed or documented by sign Nuttall's cottontail, rock squirrel, porcupine, coyote, bear, mountain lion, bobcat, elk, and mule deer.

Our work in 2001 and that of other earlier workers (e.g., Armstrong 1972) has resulted in good documentation of some groups, such as bats (88% of likely species), rodents (93%), and

artiodactyls (67%) but other groups need additional work. In particular, more effort is needed to document the occurrences of species of insectivores (20%), lagomorphs (33%), and carnivores (42%). These groups should be priorities for work in 2002.

Capitol Reef National Park. Biologists from Midcontinent Ecological Science Center (or its predecessors; see unpublished reports to NPS by Bogan and Ramotnik) did extensive survey work for mammals at Capitol Reef National Park (CARE) in the late 1980s and early 1990s. Nonetheless, the NCPN requested additional work at CARE, primarily in back-country areas not previously surveyed. In 2001, we accumulated a total of 58 mist-net nights and 2297 trap nights. We netted 179 bats of 15 species and captured 155 mammals of 11 species (Appendix C). Our captures of the long-eared myotis (*Myotis evotis*) and the big free-tailed bat (*Nyctinomops macrotis*) represent new species records for CARE.

Although *P. maniculatus* is generally the most common species of rodent on the Colorado Plateau, at CARE the number of captures for this species was surpassed by those of the Piñon Mouse (*P. truei*, 58) and Great Basin Pocket Mouse (*Perognathus parvus*, 37; Appendix C), numbers that reflect the habitats trapped in 2001. Park staff provided some additional documented occurrences including bighorn sheep and ringtail. A skull of an adult male bighorn was found on the park; bighorns at CARE have been transplanted from Canyonlands National Park. The ringtail was captured near park headquarters around some dumpsters.

CARE is the one park in the NCPN that appears to have met the criterion for documentation of 90% of species likely to occur at the park. For insectivores, bats, and artiodactyls 100% of species have been documented and for rodents and carnivores 87% and 92% of the species have been documented, respectively. Only lagomorphs remain

underrepresented (50%). It seems likely that two additional species have been documented as well (white-tailed jackrabbit and red squirrel). Given these levels of documentation, most by voucher specimens taken within the last decade or so, consideration should be given as to the need for additional work at CARE during 2001.

Cedar Breaks National Monument. Cedar Breaks National Monument (CEBR) was the highest (> 10,000 ft) of all parks and monuments we surveyed on the Colorado Plateau and has representatives of several species known only from high-elevation habitats in southwestern Utah. Our efforts at CEBR included 7 mist-net nights and 1885 trap nights. These efforts resulted in captures of 4 bats of 3 species and 241 rodents of 10 species (Appendix C).

At CEBR, we captured one montane shrew, one of the few shrew captures obtained during 2001. We netted two individuals of the little brown bat (*Myotis lucifugus*), a relatively uncommon species in this part of Utah (Oliver 2000). This species can be mistaken for other, similar species such as the long-legged myotis (*M. volans*) which we also captured at CEBR. We also netted the big brown bat (*E. fuscus*) during our work at CEBR.

Common rodents at CEBR included Uinta (*E. umbrinus*, 62) and least (18) chipmunks, canyon (*P. crinitus*, 16) and, especially, deer mice (111 individuals), and montane (*Microtus montanus*, 14) and long-tailed voles (*M. longicaudus*, 9; Appendix C). We also captured several northern pocket gophers, *Thomomys talpoides*. We captured an ermine (*Mustela erminea*) in one of our Sherman live traps. This species has been reported from CEBR by Stock (1970). We also observed but did not capture a golden-mantled squirrel (*Spermophilus lateralis*), located near the canyon rim. Rodents (60% of likely species documented) and artiodactyls (67%) are relatively well-known at CEBR but other groups, especially shrews, bats, and carnivores, are

underrepresented to date. Efforts in 2002 should focus on all groups but on the more poorly known groups in particular. At CEBR, documentation of bats will probably require use of a bat detector.

Curecanti National Recreation Area. At CURE, we compiled a total of 19 mist net nights and 1338 trap nights and captured a total of 349 mammals (Appendix C). Three hundred and twenty of these captures were terrestrial mammals of 14 species and 29 individuals of 4 species were bats (Table 4). Fifty-seven percent of these captures were of the deer mouse (*Peromyscus maniculatus*), a common and widespread species. Other abundant species captured included the least chipmunk (*Eutamias minimus*, 23), western jumping mouse (*Zapus princeps*, 22), and montane vole (*Microtus montanus*, 19). CURE is somewhat more poorly known (56% of species documented) than its neighbor to the West, BLCA (64%), although early work by Durrant and Robinson (1962) provided useful information on the park's mammals.

At CURE, rodents (100% of likely species documented) and shrews (80%) are well documented but other groups, especially carnivores, still need additional work. We have documented 38% of bats likely to occur but our ability to document more may be hindered by the abundance of water (in the reservoir) and a paucity of usable netting sites remote from the reservoir. We will rely more on use of a bat detector at CURE in 2002.

Fossil Butte National Monument. At FOBU we mist-netted a total of 9 nights and amassed a total of 1338 trapnights with Sherman live traps. These efforts resulted in the capture of 16 bats of 3 species and 181 rodents of 11 species. Clark's (1977) earlier work at FOBU has provided some baseline information for this park; he reported capturing or observing about 23 species, many of which we captured or observed in 2001. Clark used snaptraps rather than live traps and

caught only two species, deer mice and least chipmunks. We captured these two species and eight others, including three species of bats. The deer mouse comprised 61% of captures (Appendix C). The second most abundant species encountered was the least chipmunk (*T. minimus*, 47 captures). Clark (1977) observed an additional 21 species, a number exceeded by our own observations (8 species).

Lagomorphs (75% of likely species documented), rodents (86%), and artiodactyls (100%) are relatively well documented at FOBU. However, shrews (0), bats (20%), and carnivores (25%) require additional work at this park and efforts in 2002 should focus more on these groups.

Golden Spike National Monument. We are not aware of previous work on mammals at GOSP. Habitat at the park is somewhat linear and consisted primarily of open sage-grassland with small outcrops of rock, a small canyon, and a 400 ft section of a creek that flowed through the monument. We netted for only one night, with no captures, and compiled a total of 863 trap nights during which we captured 91 individuals of seven rodent species. Rodent captures were primarily deer mice, but also included Ord's kangaroo rat (*Dipodomys ordii*), Great Basin pocket mouse (*Perognathus parvus*), western harvest mouse (*Reithrodontomys megalotis*), and meadow vole. We also captured a bushy-tailed woodrat in the rocky outcrops.

We tallied a total of 80 species of mammals that might occur in the vicinity, only 55 of which seemed somewhat likely given the small size and linear nature of the park. We suspect that our list of "likely" species is still too large but using that number (55) we tabulate that only 25% of mammals have been documented at the park. All groups require additional attention at this park but it seems likely that many species on our current list may not occur on the park.

Hovenweep National Monument. Seven different units compose HOVE and we worked on five of these units. In general, the habitat consists of piñon-juniper forest, sage, yucca, and scattered grasslands. Small seeps and/or springs located in the canyons were important historically to indigenous cultures that occupied the area and these seeps are likewise important to resident wildlife. We surveyed HOVE for a total of 5 mist-net nights and 2016 trap nights. We captured 39 individuals of six bat species, perhaps because there were few nearby water sources and as a result bats were concentrated at these areas. Almost half of the bat captures were of fringed myotis (*M. thysanodes*). At HOVE, as at the habitats where we worked at CARE, terrestrial mammal captures at HOVE were dominated by the piñon mouse (*P. truei*) instead of the deer mouse.

Overall, about 41% of the species likely occurring at HOVE have been documented with fair proportions of lagomorphs (67%) and rodents (60%) documented. Additional work is required on the other groups but ultimately we may need to reduce the number of species that likely occur at the park.

Pipe Springs National Monument. PISP was the smallest (40 acres) of the parks and monuments surveyed in the Northern Colorado Plateau. Located near the Arizona-Utah border, PISP was also the southernmost park where we worked in the NCPN. Some older specimens, mostly in the University of Arizona collection, exist for the park as they are reported in Hoffmeister (1986). Despite the small size of the park, we captured a total of 173 mammals of 15 species during a total of 4 mist-net nights and 360 trap nights. Bats accounted for about one-half of the captures, with a total of 82 individuals of nine species netted. Most of the bats encountered were typical of low elevation and desert habitats and captures were dominated by the pallid bat (*Antrozous*

pallidus) and western pipistrelle (*Pipistrellus hesperus*), which are well adapted to arid regions. We also captured several lactating Allen's big-eared bats, which suggests that a maternity colony may be nearby. Other mammals captured were deer mice, brush mice, piñon mice, harvest mice, and desert woodrat (Appendix C). The pallid bat was the most frequently captured mammal, followed by the deer mouse, western pipistrelle, brush mouse, and piñon mouse.

The bats (59% of likely species) and rodents (72%) are reasonably well-known but no information is currently available on other species on the park; overall, about 47% of likely species are documented. The small size of the park suggests that many species that are currently listed as "likely" to occur probably are not, in fact, resident on the park. Additional work here will include discussions with park staff regarding observations they have made, further attempts to document selected species across mammal groups, and consideration of a smaller pool of resident species.

Timpanogos Cave National Monument. TICA is one of the smaller monuments in the NCPN, however it is unique in that Timpanogos, Middle, and Hansen caves, are located on an 8000 ft peak. These caves house a variety of geologic deposits and crystals, but there is little known usage by vertebrates. Entrances and exits are closed for safety and security and this may have altered the natural airflow and temperature regimes within the cave. Temperature regimes are particularly critical to bats and changes in them may be why bats do not use these areas as permanent or even temporary roosting sites. Park staff are aware that there have been occasional records of bats using the areas near the entrances, but large numbers of bats appear to be unknown. In 2001, we concentrated our efforts outside of the cave and in the surrounding area of American Fork Canyon. At higher elevations, coniferous forest was scattered along the rocky

slopes of the Timpanogos mountain range, whereas riparian cottonwoods and scattered pines were present at the bottom of American Fork Canyon.

In 2001, we captured a total of 42 individuals of 5 species; over 70% of these captures were deer mice, followed by the bushy-tailed woodrat (4), canyon mouse (4), Uinta chipmunk (3), and harvest mouse (1). Six additional species were documented from observation by our efforts or those of park staff: golden-mantled ground squirrel (*Spermophilus lateralis*), rock squirrel (*Spermophilus variegates*), ringtail (*Bassariscus astutus*), mink (*Mustela vison*), mule deer (*Odocoileus hemionus*), and mountain goat (*Oreamnos americanus*). At present, only about 19% of likely mammals have been documented, the lowest of any NCPN park where we worked in 2001. For three groups, level of documentation is: rodents, 32%, carnivores, 14%, and artiodactyls, 67%. Work in 2002 will emphasize the more poorly known groups and ascertain what species are unlikely to occur on the park and should be removed from the list of likely species.

Factors Affecting Species Documentation

Our current efforts to document mammalian species on parklands are very much a work in progress. This is because several factors affect these efforts. One especially problematic area is exactly what list of species should be used as the measuring stick against which documentation is assessed. We have chosen to use a list of species that we deem “likely” to occur, based on our work, our knowledge of mammals of the Colorado Plateau, and pertinent references. For the most part, these “likely” species are those listed as “Present” or “Probably Present” on the Master Species Lists (Appendix A). It seems likely that for some parks, perhaps especially small parks, our lists are currently too inclusive. For larger parks, we suspect that the current lists are

probably good “working” lists, at least at this point in time. The one northern park that we think is at the 90% level of documentation is CARE, a park where we have worked fairly extensively. Our perception is that it is the combination of multiple years of effort, facilitated by knowledgeable park staff, that has enabled us to reach this level of documentation. For the most part, we have continued to use the same list of possible species with only slight refinements.

Our estimates for inventory completeness after less than one year of effort differ considerably from those used by the NCPN as “starting points” for this inventory effort (NPS NCPN Proposal 2000). These figures (NPS estimate, followed by our current estimate) for the nine parks are: BLCA, 80%, 68%; CARE, 65-70%, 90%; CEBR, 80%, 40%; CURE, 75%, 65%; FOBU, 80%, 53%; GOSP, 50%, 25%; HOVE, 75%, 41%; PISP, 20%, 47%; TICA, 50-60%, 19%. The source of the original estimates is unknown but local park staff probably helped to some extent. We believe that most parks overestimated the extent of documentation and also may have worked from a smaller, less-inclusive list than we are using (small, poorly-known and secretive mammals such as bats and small rodents may have been overlooked). CARE seems to have underestimated their level of documentation slightly. In any case, we believe that the planned second year of effort will help resolve many of these differences by allowing additional species to be documented or removed from the working list.

Park size undoubtedly influences species diversity and a variety of mathematical algorithms incorporate size in attempting to predict the numbers of species (but not actual species) that may occur on a park. At present, our results at documenting species occurrence on NCPN parks is poorest for two of the smaller parks (TICA, 101ha, 19% and GOSP, 1107ha, 25%). We think this is because our current species lists for these parks are too inclusive for

these small parks. At both these parks, we exceeded our estimated allotted person-days of effort in 2001. The level of documentation at the smallest park, PISP (16ha, 47%), is better, partly because of our success at documenting bats and rodents there and partly because of the existence of a good recent treatment of mammals in Arizona (Hoffmeister 1986) that allows us to construct a more meaningful list of likely species; no such work is available for Utah mammals. The remaining small park is HOVE (318ha, 41%) where good results with rodents and lagomorphs, and secondarily with bats and carnivores, have bolstered our efforts there. Nonetheless, given the isolated nature of some of the units in HOVE, our species list still may be too inclusive. Until we can gather more data on both occurrence or absence, especially from interviews with park staff and local wildlife officials, we are disinclined to modify the current lists as we think they represent good lists from which to work.

One factor in assessing species occurrence is the biology of the animals that we are trying to document. It is an axiom in biology that only a few species are truly common and most others are much less common to rare. The occurrence of common, widespread, and abundant species, such as *P. maniculatus* (760 individuals captured in 2001), is easy to document and our results offer visible proof of this. However, less common and rare species can be very difficult to document and absolute absence is difficult to prove. Another biological phenomenon that can affect the results of our inventory attempts is whether or not the populations of certain species fluctuate over time. It was our opinion, gained after working many years on the Colorado Plateau, that rodent populations were relatively low, especially in Utah. Concurrent work using the same methodology in New Mexico, Colorado, Wyoming, and Nebraska all suggested that

rodent populations were higher in those areas. Climate, especially precipitation, also interacts with species biology in influencing population levels of rodents.

Aspects of climate and especially availability of water affect our ability to inventory some small mammals (especially bats) and interact with features of biology of each species. Bats are dependent on the availability of roosting sites, water sources, and adequate prey. The extent of available water in a given area, as well as subtleties of pond shape and size, can affect capture success of bats (Kunz and Kurta 1988, K. Geluso personal communication). Typically, captures of bats in mist nets are lower when water is abundant, as the bats seem to be more dispersed over the landscape. When water sources are fewer, bats tend to concentrate at those waterholes that are available (mammalogists exploit this tendency when possible). In general, our level of effort for rodent trapping exceeded the mist-netting effort. This is because, relatively speaking, mist-net sites are limited in occurrence and outnumbered by available trapping locations. Nonetheless, it is not uncommon for the number of bats captured in a given night to exceed the number of rodents captured. For example, at PISP we captured 82 bats in a total of 4 mist-net nights versus 91 rodents captured in 360 trap nights. This phenomena likely reflects the limited extent of available water in the area as well as the occurrence of good roosting habitat in nearby cliffs.

Other more proximate factors that may interfere in inventory efforts include inclement weather, which can depress activity of small mammals (and mammalogists) and the efficiency of methods used to inventory them. Rainfall can dissolve bait, cause traps to trigger, and turn mist nets into soggy, non-functional curtains. Portions of GOSP burned prior to our visit in 2002 and

we do not know how, or if, that influenced our results at that park. Likewise, subtle seasonal changes in species natural history or the physical environment may influence our activities.

Although we do not expect extensive changes in identifications, we have not yet finished processing some voucher specimens taken in 2001. Thus, some identifications remain tentative or perhaps even unknown (e.g., Appendix C has some individuals categorized just as “sp.”). We are continuing to process this material and will provide updates as they become available.

Some species documented in 2001 were considered rare, uncommon, or poorly known, and some of these are recognized by states as “species of concern.” Some of these are former category 2 candidate species (USFWS, 1994). In the NCPN, we documented 11 “species of concern” at five parks and monuments. Six bat species of concern were documented at CARE (Townsend’s big-eared bat, spotted bat, Allen’s big-eared bat, fringed myotis, big free-tailed bat, Brazilian free-tailed bat). Park staff at CARE documented an additional state species of concern, the ringtail. Five state listed species were documented at PISP (Allen’s big-eared bat, western small-footed myotis, fringed myotis, long-legged myotis, Yuma myotis), followed by 1 mammal each at CEBR (montane vole), FOBU (long-eared myotis), and HOVE (fringed myotis).

We are continuing to digest our data from 2001 and reflect on our upcoming field activities in 2002 to further document species that are likely to occur and delete unconfirmed species where that seems appropriate. In 2002, we will focus more of our activities on species or groups that are now known to be poorly documented on a park, and we will likely do less of the widespread trapping done in 2001. In particular, we will use more pitfall traps for insectivores, rely more on bat detectors for bats in parks where netting has not been productive or is not possible, spend more time attempting to observe some species, and continue interviewing park

staff and other knowledgeable individuals for additional information. Where rodents remain to be documented, efforts that are more directed toward those species in their preferred habitat will be used. Finally, we will continue our data mining efforts using published and unpublished literature and voucher specimens in museums.

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APPENDICES:

A. Modified master list of mammalian species on parklands in the NCPN. This electronic file in Excel uses the "Track Changes" option to note changes in the status of mammalian species on each national park or monument. To see these changes click "Tools," then "Track Changes," then "Highlight Changes," and remove any checks from boxes in that menu box.

B. Current levels of documentation for major groups of mammals on nine parks in the NCPN inventoried in 2001 and the overall level of documentation for mammals on that park (Excel database).

C. Working dataset (Excel) of captures, observations, or other documentation of mammals on nine national parks in the NCPN. Work is continuing at MESC to populate this database.

D. Working dataset (Excel) of GPS waypoints and habitat characterization forms for nine national parks in the NCPN.