


Resurvey for bats (Chiroptera) at Dinosaur National Monument, Colorado/Utah, 2008-2009

Final Report

Submitted to: Cindy Heyd, National Park Service, Dinosaur National Monument, Dinosaur, Colorado 81610

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FINAL REPORT
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Executive Summary:

Bats are subjects of conservation concern due to habitat destruction, use of insecticides, low reproduction rates, and vulnerability due to colonial roosting habits. Western bats in particular also may be affected by various land management practices such as grazing, logging, lowering of water tables, and destruction of reservoirs. In addition to such concerns, ongoing changes in the area surrounding parks, monuments, and refuges may conceivably impact bats or the resources upon which they depend. Between 1982 and 1990, biologists associated with the Fish and Wildlife Service (FWS) conducted inventories for mammals, including bats, in Dinosaur National Monument (DINO). These studies by FWS were the first systematic attempts to survey for bats throughout the monument. In 2008, park managers asked for a resurvey of the resident bat fauna. The basic premise was to re-visit localities where bats had been captured between 1982 and 1990 and again use mist nets to assess the general distribution and abundance of bats on the monument and determine if there were any obvious trends in species occurrences, numbers, or distributions on the park.

We attempted to approximate the number of nights in the original sampling; we tallied 60 separate netting events in 1982-1990 and 51 in 2008-2009. We recorded time of capture,

species, sex, reproductive condition, and any miscellaneous comments on standardized field data sheets. We summarized the number of species documented, relative abundance of species (percent of all individuals detected), and prevalence (percent of all possible date and location combinations that a species was captured)

In the original study we netted on or very near the monument in six different years: June and July 1982, August 1985, July 1987, August 1988, June 1989, and July 1990. In 1982, all localities were in either the Yampa or Green river canyons. Most netting in 1985 and later was done primarily at upland sites, including several productive sites on the Yampa Bench and in or near northern areas of the park. Between 1982 and 1990 we captured 468 individuals of 14 species at 26 unique localities. Our average capture rate was 7.8 individuals of 3 species per sampling event.

In 2008 we made three trips to DINO during 29 May to 5 June, 30 June to 12 July, and 1 to 13 August. During this time we netted a total of 27 nights at 15 different localities. We captured 517 bats of 15 species, and averaged 19.1 bats of 4.8 species per night.

In 2009 we made two trips to DINO from 3 to 18 June and from 8 to 19 July, with an emphasis on netting at some of the sites in the river corridors that were netted in 1982. During 2009 we netted 24 nights at 17 different sites and netted a total of 392 individuals of 15 species. On average, we captured 16.3 individuals of 4 species each night we netted.

An examination of the two large data sets, separated by more than two decades, reveals far more similarities than differences. The recent work yielded almost twice as many bats as the former study, yet the inventory of species is essentially unchanged. There are no fundamental differences in the nature or availability of bat-netting sites, although some netting sites were no longer available, and we subjectively believe range conditions have diminished over time. In both time periods a large majority of the total number of bats was taken at higher elevations. In both time periods male bats of two-thirds of the species dominated the composition at higher elevations. Taken together, these observations suggest that the bat fauna is unchanged and doing well.

From a faunal perspective, resident bat species at DINO can be divided into three classes: abundant (> 10% of total captures), common (2-10% of captures), and uncommon (< 2% of captures). Bats that are abundant at DINO include Long-eared myotis, Long-legged myotis, Yuma myotis, Silver-haired bat, and Big brown bat. Bats that are common but somewhat less abundant include California myotis, Small-footed myotis, Fringed myotis, Hoary bat, Townsend's long-eared bat, and Pallid bat. Uncommon species at DINO are Little brown bat, Canyon bat, Spotted bat, and Mexican free-tailed bat. Most species were in the same classes for the earlier work, suggesting the fauna is relatively stable over time.

We consider most of the resident species to be stable in numbers given the results of the two studies. For two species, the Small-footed myotis and the Long-eared myotis, the capture numbers indicate they might be increasing slightly. For two others, the Little brown myotis and Hoary bat, the numbers suggest that there might be some evidence of a downward trend

but we nonetheless call them stable but with a question mark. These are species on which future work on the park would be useful.

Finally, we have made a few recommendations for DINO to consider that we think would help bats to remain stable at the park. Our recommendations are: 1. Acknowledge the importance of upland sites at DINO that have high bat diversity and large numbers of captures and take steps to protect, maintain, and enhance these existing sources of water; 2. Consider enhancing sources of water (and thereby insect biomass) at sites such as Morris Ranch, Hog Canyon, and Pool Creek Ranch; 3. Be alert to roosting concentrations of bats and protect them when found; 4. Continue to monitor bats with mist nets and echolocation devices on a regular basis (perhaps every 10 yrs or so); 5. Consider funding or encouraging a telemetry study of females to obtain information on roosting sites and habits; 6. Encourage research on bats when possible; 7. Consider a public relations display on bat diversity at Dinosaur.

Originally established in 1915 to protect paleontological resources on 80 acres, Dinosaur National Monument (DINO) was expanded in 1938 to include the Green and Yampa river corridors. The present 211,141-acre monument is rich in geological and biological resources and its singular landscapes of river canyons and upland benches are unique among lands managed by the National Park Service. The monument includes among its biological resources a possible sixteen species of bats. Bats are subjects of conservation concern due to habitat destruction, use of insecticides, low reproduction rates, and vulnerability due to colonial roosting habits (O'Shea and Bogan 2004). Western bats in particular also may be affected by land management practices such as grazing, logging, lowering of water tables, and destruction of reservoirs. In addition, ongoing changes in the area surrounding DINO may conceivably impact bats or the resources upon which they depend. Such changes include perceived decline of cottonwood gallery forests, grazing, oil and gas development, increases in recreational use, a floodplain easement on behalf of endangered larval fish, invasion of exotic species and attempts to remove one such exotic (tamarisk), and the appearance of West Nile virus. Finally, ongoing global changes, such as climate warming, may affect bats.

Between 1982 and 1990, biologists associated with the Fish and Wildlife Service (FWS) conducted inventories for mammals, including bats, in the monument. Initially, they surveyed in the river corridors in DINO in support of a "reserved water rights case," then proceeding through the court system. Subsequent survey efforts were expanded to upland areas in the monument, many of which proved rich in numbers of bats. Although some of the oldest records of bats in Colorado are from the area in and around DINO (e.g., Cary 1910, summarized by Armstrong 1972), these studies by FWS were the first systematic attempts to survey for bats throughout the monument (Bogan et al. 1983, 1988). The work resulted in the capture of over 450 individuals from 26 localities on or very near the park; many captured individuals were saved as voucher specimens to document occurrence.

Efforts by other investigators also resulted in a variety of new information for the park and Moffat County, including work by Freeman (1984), who surveyed throughout the state of Colorado but worked extensively in Moffat County, Navo et al. (1992), who conducted the first acoustic survey at the park, and Storz (1995), who obtained interesting new data on spotted bats. Although most information comes from the Colorado (Moffat County) portion of the monument, there also is information from the Utah (Uintah County) side.

In 2008, park managers asked us to conduct what was termed a "resurvey" effort of bats at DINO. The basic premise was to re-visit localities where bats had been captured between 1982 and 1990, assess the general distribution and abundance of bats, and determine if there were changes in species occurrences, numbers, or distributions on the monument. Subsequent discussions resulted in the park funding a two-year field effort to accomplish these general goals.

Background.--The state of Colorado is known to have 19 species of bats (Chiroptera; Armstrong et al. 1994, Fitzgerald et al. 1994, Hayes et al. 2009.). Of these 19, two are species that have recently invaded from the east, the Eastern red bat and Eastern pipistrelle; these two species do not occur on the western slope of Colorado. Another species, Allen's big-eared bat, was recently confirmed from acoustic data in southwestern Colorado (Hayes et al. 2009).

Thus, for much of western Colorado, and DINO (Moffat County) in particular, there are records for 16 species. Utah is known to have 18 species, 16 of which occur in northeastern Utah (Uintah Co.). Only the Western red bat and Allen's big-eared bat are absent from the area. DINO has verified records of 16 species, including an enigmatic record of the Big free-tailed bat from the parking lot at the dinosaur quarry on the Utah side of the park (Mammal Division records, Museum of Southwestern Biology).

We suspect that it is the complex geological, topographical, and biological features of the park that, in part, produce the diverse bat fauna of DINO (e.g., Humphrey 1975). Additionally, the characteristics of each species, coupled with their biogeographic history, contribute to this rich fauna. Biologically, the park is a part of the Colorado Plateau. Indeed, the bat faunas of DINO and Canyonlands National Park (CANY), for example, are remarkably similar (Table 1; Bogan et al. 2006). They each are known to have 16 species but whereas there are records for the Little brown bat but not for Allen's big-eared bat at DINO, the converse is true for CANY. Another well-known area, the Henry Mountains in south-central Utah, is known to have 16 species as well (Mollhagen and Bogan 1997).

At the time of Durrant's (1963) surveys for mammals in DINO, shooting was the common method of obtaining specimens of bats in the field. As no shooting was allowed in the park, Durrant and his crew obtained no bats. However, Durrant, knowledgeable of mammals of the Colorado Plateau (e.g., Durrant 1952), listed 14 species of bats that he presumed occurred on the monument. Indeed, all 14 of these species are known today, along with the California myotis and the Big free-tailed bat. Armstrong (1972), in his study of Colorado mammals, found specimens in collections for just eight species of bats in Moffat County (Yuma myotis, Long-eared myotis, Long-legged myotis, Small-footed myotis, Big brown bat, Hoary bat, Townsend's big-eared bat, and Pallid bat). Armstrong et al. (1994) had records of 14 species from Moffat County, excluding only the molossids (the Brazilian free-tailed and Big free-tailed bats). Distribution maps in Fitzgerald et al. (1994) likewise indicate the presence of 14 species in Moffat County, again excluding only the molossids. There are records for both molossids from DINO, although only from the Utah side of the park.

Four of the possible sixteen species of bats occurring within DINO are state species of concern for Colorado and/or Utah. These are the Townsend's big-eared bat (*Corynorhinus townsendii*) in both states, and Spotted bat (*Euderma maculatum*), Fringed myotis (*Myotis thysanodes*), and Big free-tailed bat (*Nyctinomops macrotis*) in Utah. In Colorado, all bats are protected as nongame animals. National Park Service (NPS) Management Policies state that the NPS will inventory native species that are of special management concern (such as rare, declining, sensitive, or unique species and their habitats) and will manage them to maintain their natural distribution and abundance (NPS Mgt Policies 2006:45).

Objectives.--The primary objective of this resurvey was to attempt to document the occurrence of at least 90% of the bats documented in the previous studies at DINO by means of a two-year field effort, using mist nets, thus duplicating the original field efforts. New, pertinent records and specimens were examined as necessary. The work involved re-visiting sites netted in 1982-1990, setting nets, collecting data on bats, and spending about 30 days per year in the field over two years. Specifically, the goals of the bat inventory are:

- To document through new, targeted field investigations the occurrence of at least 90% of the species of bats previously documented in the park;
- To describe the distribution, nature of occurrence (e.g., resident, breeding status, etc.), and abundance of bat species occurring within park boundaries;
- To provide new data that can be compared with original baseline information so NPS can develop and implement a general monitoring strategy if desired;
- To provide data in formats that are easily accessible to park managers, resource managers, scientists and the public; and
- To develop a mutual working relationship between the investigators and park staff that will further the goals of the study and ensure appropriate steps are taken to incorporate bats into management plans of the park.

Completion of this study will maintain park compliance with NPS policies and assist DINO resource staff in determining if management actions are necessary for bat species.

METHODS

All methods used in the study were consistent with original methods and with methods currently approved by bat biologists for such work (e.g., Kunz and Kurta 1988, Kunz et al. 2009) and are detailed in a written capture and handling protocol approved annually by the Institutional Animal Care and Use Committee (IACUC) at the University of New Mexico. All bats captured were released unharmed as rapidly as possible. No voucher specimens were taken nor were any mortalities incurred in our work in 2008-2009. We obtained a research permit from the park (DINO-2008-SCI-0013) to allow the survey.

Mist-net Surveys.--Mist nets were deployed across and around bodies of water (e.g., Haystack Rock Reservoir) and in perceived flyways (e.g., Hog Canyon, Split Mountain) usually, but not always, at sites and in patterns similar to the original surveys. The lengths of nets ranged from 3-20 m (9-60 ft) and numbers of nets deployed on any single evening varied from one to five, depending on the area and shape of the body of water. Mist nets were set up shortly before sunset and tended for several hours until activity declined. Nets were never left untended. Effort was recorded both as number of nets set each night at each site and as the total number of feet of a standard bat net (height = ca. 7-8 ft) that number of nets represented (Table 2). The number of nets set per night is a standard measure of effort, usually referred to as net-nights (number of mist nets multiplied by number of nights). We attempted to approximate the number of nights in the original sampling; we tallied 60 separate netting events in 1982-1990 and 51 in 2008-2009.

We removed bats from nets immediately following capture and recorded time of capture, species, sex, reproductive condition, and any miscellaneous comments on standardized field data sheets and then released the bats. We later summarized the data from field data sheets in Excel spreadsheets for tabulation of data, calculation of the number of species documented, relative abundance of species (percent of all individuals detected), and prevalence (percent of all possible date and location combinations that a species was captured), and to compare results with earlier data, which likewise were entered into a spreadsheet using data from

original field notes as well as specimen data in the Museum of Southwestern Biology at the University of New Mexico. Copies of field data sheets were provided to DINO.

Location Data.--Each of the 23 sites where we sampled in 2008-2009 was given a waypoint name and a more descriptive name. GPS coordinates, elevation, and EPE were acquired for each locality with Garmin GPS units set to record coordinates in decimal degrees using NAD27 as a datum. Elevations were reconciled against USGS quad maps and when there was a discrepancy between sources, values were interpolated from maps. These data and narrative descriptions of all study locations are provided in Appendix I. In addition, we made daily journal entries when in the field (copies provided to DINO).

RESULTS and DISCUSSION

2008.--We made three trips to DINO, encompassing 83 total person-days of travel, to reconnoiter netting sites and to net bats. Our boots were "on the ground" in DINO during 29 May to 5 June, 30 June to 12 July, and 1-13 August for a total of 68 person-days. During this time we netted a total of 27 nights at 15 different localities for a total of 95 net-nights (Table 2); inclement weather precluded netting on several occasions. Four of the 15 localities were new ones that were not netted in the earlier work. We netted the following localities in 2008: Chew Reservoir (1 time); Buffham Reservoir (2 times); Massey Pond (1, new); Massey Reservoir (1); Bear Draw Reservoir (1, new); Dry Woman Reservoir (2); Haystack Rock Reservoir (3); Vermillion Creek (1); Hog Canyon (1, new); Morris Ranch (4); Pool Creek Ranch (1); Pool Creek Petroglyphs (3); Pool Creek at Echo Park (3); Cub Creek (2); and Split Mountain (1, new).

In 2008, we captured 517 bats of 15 species (Table 3), more individual bats than the total we captured over multiple years in the 1980's. Earlier, we averaged 7.8 bats of 3.0 species per night, whereas in 2008 we averaged 19.1 bats of 4.8 species per night. Included in the 2008 averages are two nights when we set nets but captured no bats (at Hog Canyon and Split Mountain). The best one-night captures came from Haystack Rock Reservoir (96 and 56), Dry Woman Reservoir (51), Morris Ranch (47), Pool Creek at Echo Park (39), Haystack Rock Reservoir (36), and Buffham Reservoir (33). Our earlier efforts convinced us that Haystack Rock Reservoir was an important resource for bats and based on our netting there in July 2008 this continued to be true. Even in August 2008, when the pond was nearly dry and the surrounding area showing the effects of large numbers of cattle, nets set around the periphery of the mud still captured bats.

We captured all species of bats known from DINO except for the Big free-tailed bat, known only by a salvaged specimen from the Quarry area but presumed to be a member of DINO's bat fauna. Among the other (three) species of concern, numbers from the original surveys versus those from 2008 are: Fringed myotis 5, 15; Spotted bats 5, 5; and Townsend's big-eared bat 14, 19. Great caution should be used in extrapolating from these numbers, but they seem to demonstrate that these species of concern are still a part of the bat fauna of DINO and in roughly the same or greater numbers as in the past based on our netting data from 2008 (Table 3).

The most abundant species we captured in 2008 were: Big brown bat, 84; Long-eared myotis, 74; Yuma myotis, 68; Silver-haired bat, 68; Pallid bat, 67; and Long-legged myotis, 46. Total captures of the other species ranged from 1 (Brazilian free-tailed bat) to 33 (Small-footed myotis). Also of note was the capture of 4 Western pipistrelles (now called Canyon bats) in 2008. This species is on the edge of its range at DINO and previously was known by only 2 individuals from the park.

2009.--We made two trips to DINO in 2009, with an emphasis on netting at some of the sites in the river corridors that were netted in 1982. Our total travel was 70 person-days and we worked on the monument from 3 to 18 June and from 8 to 19 July for a total of 56 person-days. In addition, Cindy Ramotnik volunteered 27 person-days on the river trips. We also had the assistance of Cindy Heyd on the first river trip and Dave Worthington from Capitol Reef National Park on the second river trip. During our time on the monument we netted 24 nights at 17 different sites for a total of 100 net-nights (Table 2). Specifically, we netted at Snow Reservoir (1 night, new), Massey Reservoir (1), Bear Draw Reservoir (1), Dry Woman Reservoir (1), Haystack Rock Reservoir (2), Split Mountain (2), Morris Ranch (2), Cub Creek (2), Pool Creek at Echo Park (1), Pool Creek Petroglyphs (2), Big Joe Campground (2, Yampa River), Harding Hole (2, Yampa River), Laddie Park (1, Yampa River), Pot Creek (1, Green River), Rippling Brook (1, Green River), Jones Hole Campground (1, Green River), and Ely Creek (1, at Jones Hole, Green River).

In 2009 we netted a total of 392 individuals of 15 species (Table 4); we did not capture any Big free-tailed bats. On average, we captured 16.3 individuals of 4 species each night we netted, down slightly from the 2008 averages (19.1; 4.8). Included in these averages are 3 nights when we captured no bats. The most productive localities were Haystack Rock Reservoir (101 individuals), Dry Woman Reservoir (71), Bear Draw Reservoir (65), Haystack Rock Reservoir (38), and Snow Reservoir (27), all upland sites south of the Yampa River Corridor. Among the river sites, Laddie Park (7) and Harding Hole (6) were the most productive. In general, our captures at the river sites were disappointingly low, perhaps because of some combination of low temperatures in June, netting sites cluttered by vegetation, and abundant water. Among the supposed species of concern we captured 7 Fringed myotis, 6 Spotted bats, and 10 Townsend's long-eared bats, numbers similar to captures in 2008. Again, these species were captured at roughly the same proportion as in years past.

The most frequently captured species in 2009 were Silver-haired bats, 119; Big brown bat, 64; Long-eared myotis, 47; Long-legged myotis, 38; and Western small-footed bat, 31. Total captures of other species ranged from 1 (Mexican free-tailed bat) to 17 (Hoary bat) to 23 (Yuma myotis, Table 4). The most notable difference between captures in the two years was the near-doubling of numbers of silver-haired bats, the large reduction in numbers of Pallid bats, fewer Long-eared and Yuma myotis, and the slight reduction in numbers of Big brown bats and Long-legged myotis. Although there are multiple biases in using mist nets, we are more inclined to suspect that many, or all, of the between-year differences are the result of more mundane factors including somewhat lower temperatures in June 2009 as well as random chance in our choice of when to net a given site. For example, in 2008 we had the good fortune to encounter a large number of female Yuma myotis, likely a maternity colony,

at Pool Creek at Echo Park one night and, similarly, we captured almost 30 pallid bats at the Morris Ranch one night (Table 3). Although we netted both sites in 2009 it was at different times and we did not encounter such numbers. Male Silver-haired bats are common to abundant in midsummer at DINO and at times may account for up to 50% of all bats captured on the Yampa bench (Tables 3, 4). The large number caught in 2009 reflects this abundance.

Bat surveys in DINO 1982-1990.--Although annual reports were provided to DINO during our work there from 1982 to 1990, no overall synthesis of the data was ever completed. To provide a database for comparison with the recent work, we entered the earlier data into a spreadsheet. We included data from specimens in the Museum of Southwestern Biology collected by us during this time period as well as capture numbers from field notes that we deemed reliable. As a part of this phase, we also re-examined the museum specimens to verify identifications.

We and our associates netted on or very near the park in six different years: June and July 1982, August 1985, July 1987, August 1988, June 1989, and July 1990. In 1982, all localities were in either the Yampa or Green river canyons, areas where we believe bat netting is not very productive due to the abundance of available water. Most netting from 1985 on was done primarily at upland sites, including several productive sites on the Yampa Bench and in or near northern areas of the park. The exact times of our visits were generally determined by a variety of factors (e.g., work scheduled elsewhere) rather than by phenomena such as moon phase or expected temperatures.

Between 1982 and 1990 we captured 468 individuals of 14 species (Table 5); neither of the molossids was taken. Our average capture rate was 7.8 individuals of 3 species per sampling event. On 8 of 60 (13%) separate combinations of locations and dates, we took no bats. We had good catches at Massey Reservoir (average/night= 21.4), Big Joe Campground (19.5), Dry Woman Reservoir (18), Haystack Rock Reservoir (15.4), Canyon Overlook (11.3), Pool Creek Petroglyphs (11), and Cub Creek (6.8). Most of the productive sites ranged in elevation from 6478 ft to 7697 ft although Big Joe, Pool Creek Petroglyphs, and Cub Creek ranged only from 5138 ft to 5249 ft.

In terms of average number of species, the most productive netting sites were Massey Reservoir (7 species), Haystack Rock Reservoir (6.7), Canyon Overlook (4.7), Dry Woman Reservoir (4.5), Big Joe Campground (4.5), Pool Creek Petroglyphs (4), and Cub Creek (2.8, Table 5). At most other sites we usually took 1-3 species per night. Typically, the best of these sites were above 6478 ft, had moderately large, still waters that allowed many species to use them, and the pools were often isolated from other water resources. The small pools upstream from Big Joe Campground on the Yampa River were an exception, perhaps due to an abundant insect resource or nearby favorable roosting sites.

Among presumed species of concern, we took only 7 Fringed myotis (1.5% of total bats), 5 Spotted bats (1.1%), and 14 Long-eared bats (3%) between 1982 and 1990. By comparison, the most abundant species were Big brown bats (112, 24%), Silver-haired bats (69, 15%), Long-legged myotis (55, 12%), Yuma myotis (52, 11%), and Hoary bats (41, ca. 9%). Most of these more abundant species are known to be common at higher elevations although Yuma

myotis also is common at lower elevations (e.g., Pool Creek at Echo Park). It is worth noting that some species were unusual or missing among our captures. Between 1982 and 1990 we took only 2 (0.4%) Canyon bats and no molossids although we obtained a salvaged Mexican free-tailed bat taken in 1985 from the Green River Housing Area on the Utah side of the monument. The big free-tailed bat was salvaged from the Dinosaur Quarry (Utah, Uintah Co., R23E, T4S, Sec. 26) by W. Dye on 9 December 1996 and is now in the Museum of Southwestern Biology.

Comparison of recent and original surveys.—Among the 26 sites where we worked from 1982 to 1990 (Table 5) we were able to net at 17 of these sites in 2008-2009 (Table 6, Appendix I). The nine we did not net included three that were dry (Buffham Place, Old Bassett Cabin, Massey Troughs), two sites on private property (Five Springs, Canyon Overlook), two sites where bats were shot, not netted (Massey Camp, Haystack Rock on Yampa River), one on the river could not be scheduled (Alcove Brook), and one was deemed too large and deep to net (Cottonwood Creek near Canyon Overlook). Of the seven netting sites, six were upper elevation sites (above 7,000 ft) but accounted for less than 10% of all captures from 1982 to 1990 (n = 45). Only one of these sites, Canyon Overlook, was very productive; we netted a total of 34 bats of nine species there in July 1990.

The 23 sites we netted in 2008-2009 were Chew Reservoir, Buffham Reservoir, Massey Reservoir, Bear Draw Reservoir, Dry Woman Reservoir, Haystack Rock Reservoir, Vermillion Creek, Pool Creek Ranch, Ely Creek, Morris Ranch, Big Joe Campground, Pool Creek Petroglyphs, Pot Creek, Harding Hole, Pool Creek at Echo Park, Cub Creek, and Rippling Brook (Appendix I). We also added new sites to compensate for those no longer available or usable. These included Snow Reservoir, Massey Pond (dry in 2009), Hog Canyon, Laddie Park, Jones Hole Campground, and Split Mountain (Table 6). Technically, Bear Draw Reservoir is a new site but it is less than a mile from the original site in Bear Draw; it does provide more surface area for bats than the original pool.

Overall, we captured almost twice as many bats (909) in the recent work as in the original surveys (468; Tables 5 and 6). We captured 17.8 bats of 4.4 species per netting event compared to 7.8 bats of 3 species per event (Table 6). Among higher-elevation sites, the most productive sites were: Haystack Rock Reservoir (65.4 bats/night), Dry Woman Reservoir (45.3), Bear Draw (39.5), Snow Reservoir (27 on one night), and Buffham Reservoir (22), while the more productive lower-elevation sites were: Morris Ranch (14.8), Pool Creek at Echo Park (14.3), Pool Creek Petroglyphs (8.4), and Cub Creek (8.0). Many of these sites were productive in the earlier study as well (Dry Woman, Haystack, Pool Ck. Petroglyphs, and Cub Ck.) although two sites did not meet previous captures (Massey Reservoir and Big Joe). Several performed better than in previous visits (Buffham Reservoir, Bear Draw, Morris Ranch, and Pool Ck. at Echo Park).

The reasons for increased capture rates are unknown, as we did not attempt to increase our numbers and in fact netted fewer nights (60 vs. 51). One difference between the two periods is that in the earlier work we also conducted rodent surveys and prepared specimens so perhaps our efforts on bats were diluted to some extent. Countering this is the fact that in much of the earlier work we left nets set throughout the night, a practice we no longer conduct

or condone. In the recent work we also made some attempt to schedule our work at the time of the dark (new) moon as many studies indicate bat captures increase at this time. However, in 2009 we were less able to do this due to river trip schedules. There is the possibility that we deployed more long (60 ft) nets in 2008-2009 but we cannot reconstruct data from the original study to facilitate this comparison. Finally, and immodestly, we suspect we might be very slightly better at netting bats as we have had 20-plus years of additional experience.

During our work in 2008-2009 we netted a total of 15 species at DINO. We believe this number represents the number of resident species at the park and consider the Big free-tailed bat as occasionally present. For most of the 15 we obtained evidence of reproduction on the park (Appendix II). In terms of numbers of species per site, the higher-elevation sites demonstrating greater diversity were: Dry Woman Reservoir (10 species/night), Haystack Rock Reservoir (8.6), Buffham Reservoir (8.5), and Snow Reservoir (7, one night). Lower-elevation sites tended to have fewer species: Morris Ranch (4.6), Pool Creek Petroglyphs (4.4), and Cub Creek and Pool Creek at Echo Park (3.5). Again, several of these were diverse in 1982-1990 (Dry Woman, Haystack, Pool Ck. at Petroglyphs, and Cub Ck.) while again, notably, Massey Reservoir and Big Joe failed to meet previous diversity.

It seems axiomatic that sites that have high diversity (and numbers) are important to the bats that occur there and are an important source of food, water, or perhaps social interactions. We recommend that these sites be placed on a list of "high-priority" sites for wildlife at DINO and consideration given to protecting them. This does not mean that sites with low diversity are not important as well; they may have lower diversity because not all species can obtain a given resource there (e.g., too small for large bats to maneuver over but an excellent site for smaller bats). More worrisome is why two sites (Massey Reservoir and Big Joe) that were previously productive in numbers or species performed so poorly in 2008-2009. In the case of Massey, it was our subjective opinion that there were many more cattle present than in 1990. Perhaps there have been detrimental changes in insect populations, roosting sites, or water quality, or maybe it was merely a consequence of timing. Low-level additional work at this site might clarify this situation. In the case of Big Joe, there is the possibility that our memories and notes failed us and we did not net far enough upstream in Starvation Valley in 2009.

In terms of numbers of the species of concern, we were reassured by our captures of three species. We caught over three times as many Fringed myotis and twice as many Spotted bats and Townsend's long-eared bats as in the previous study (Table 10). Among these three species, the percent of total captures went up for the Fringed myotis but stayed about the same for the other two species. Prevalence values for all three went up, suggesting they were more common than before. We did not net any Big free-tailed bats so their status at DINO remains unclear.

Elevational distribution of males and females. One clear similarity between the two periods is the preponderance of bats captured at high-elevation sites. Between 1982 and 1990, we captured 311 (66%) bats at sites above 6,000 ft and 157 (34%) at sites below that elevation. There were 13 sites both above and below 6,000 ft. In 2008-2009, eight sites were above 6,000 ft and 15 sites were below that elevation (Table 6). Nonetheless, sites above 6,000 ft

yielded 657 (72% of the total) bats in 2008-2009, whereas 252 (28%) came from the 15 lower sites. Are bats really more common at higher elevations in the park or are these numbers a result of other factors?

For example, did we spend more time or effort at the higher elevations? In terms of net-nights, in 2008-2009 we expended 69 (35.3%) net-nights above 6,000 ft and 126 (64.6%) net-nights below that elevation. In terms of effort, we deployed 3,648 ft (48.5%) of net at sites above 6,000 ft elevation and 3,864 ft (51.4%) of nets below that elevation. Thus, we had a slightly greater effort at lower elevations than at higher sites, a fact influenced to some degree by revisiting the sites on the rivers. We could not reliably calculate net-nights or net feet deployed for the earlier work but assume it was similar. Thus, time or effort would not seem to account for greater numbers of captures at the high-elevation sites.

Are there inherent differences between the low- and high-elevation sites? Here, there may be some definite trends. DINO is a land of large, rolling, sagebrush-covered benches at the upper elevations broken by multiple small drainages and canyons that ultimately, for the most part, drain into the canyons of the Yampa and Green rivers. An historic land-use pattern in the upper areas is cattle grazing and although some grazing occurs at lower elevations (e.g., Cub Creek), it seems less common and intense. One of the consequences of grazing the benches has been the construction and maintenance of "stock ponds" or reservoirs for livestock. Although such reservoirs are sometimes controversial, and we know of instances where land-management agencies have destroyed such impoundments, many bat biologists see them as a vital resource for bats, especially in areas where the water table has dropped (Mollhagen and Bogan 1997).

These scattered, moderate to large, reservoirs on the benches are attractive sites for bat netting as bats do tend to congregate at such sites. It is possible that such nutrient-rich stock ponds increase aquatic insect biomass, and thus increase forage for bats. These sites do tend to be larger in size than most lowland sites and thus have more surface area for foraging bats. They also may be closer to roosting sites. Virtually all the lower-elevation sites are smaller in size, many of them on small streams often subject to flash flooding (which may affect in situ insect biomass), or are sites where we could not place nets over water (e.g., Morris Ranch and Laddie Park). In turn, most netting sites along the rivers are compromised by the abundance of water where bats can forage or drink, a phenomenon that bat biologists think dilutes concentrations of bats. Whatever the biological reasons may be for apparent concentrations of bats at the high-elevation sites, they are clearly sites that biologists can use to obtain information on bats.

Are there characteristics of bats taken at the higher elevation sites? During our earlier work we had the impression that at high-elevation sites we tended to capture more males than females. Our database for 2008-2009 gave us an opportunity to examine if this might be true. We again used an elevation of 6,000 ft in elevation to separate low and high elevation sites. Although this division is somewhat arbitrary, there is a clear separation among our study sites with 15 sites ranging from 4788 ft (Split Mountain) to 5378 ft (Ely Creek), each differing from the adjacent site by 100 to 200 ft in elevation. The eight high-elevation sites begin 1100

ft above the Ely Creek site at 6478 ft (Haystack Rock Reservoir) and range up to 7423 ft (Chew Reservoir), each differing from adjacent sites by 100 to 300 ft elevation.

Our captures of bats at high- (Table 7) and low-elevation (Table 8) sites indeed reveal a preponderance of males over females at the higher sites. We netted 511 (80% of the total at higher elevations) males and only 126 females (20%) at higher elevations. Conversely, at lower sites the numbers were more similar although we netted slightly more females (141, 59%) than males (98, 41%). Numbers in these tables are slightly different than those shown in Tables 3-6 as Tables 7-8 exclude bats that we identified upon capture but which escaped before all data could be gathered.

Long-eared and Long-legged myotis, known to be common at higher elevations (Fitzgerald et al. 1994), had the largest numbers of females taken at the higher sites (28 for both species; Table 7), presumably reflecting this habitat bias. We were surprised by the relative abundance of female Yuma myotis (19) at the higher sites. This is a species that typically is more common near large rivers but perhaps the large reservoirs on the benches attract them to these sites. Another surprise was the number of reproductive female Townsend's big-eared bats that we captured at Snow Reservoir one cool night in July 2009. When these bats began to drink and forage around the pool we were initially surprised, but soon concluded the bats had been attracted by an extremely large "hatch" of a small, white moth that night. We watched several individuals capture moths. The predilection of Silver-haired bats to be common at higher-elevation sites was mentioned previously.

Only two species exceeded 28 female captures at low-elevation sites (Table 8). At the lower sites we took 44 female Yuma myotis, more in keeping with known habitat predilections of this species, and 29 female big brown bats, a species we often regard as an "elevational" generalist, although in 2008-2009 female Big brown bats clearly preferred lower elevations. We also took 21 female Pallid bats, mostly at the Morris Ranch in early August (Table 8).

At low-elevation sites, where males comprised 41% of the captures, the numbers of captured males exceeded the numbers of captured females in 6 of 15 species (Table 9). Conversely, at high-elevation sites, where males made up 80% of the catch, captured males exceeded captured females in 10 of 15 species (Table 9). At the higher sites, females outnumbered males only for Little brown myotis, Yuma myotis, Townsend's big-eared bat, and Mexican free-tailed bat (n = 1). One species, the Canyon bat, had equal captures.

There are compelling reasons for male and female bats to occupy different areas, roosts, or habitats during the summer (Cryan et al 2000). Cooler temperatures at higher elevations may cause bats to enter torpor. In much of the montane West, pregnant females seem to select low-elevation habitats as it is important that they maintain a constant body temperature to allow either embryos or dependent young to develop in the narrow window of time before food supplies begin to decline. As a part of this strategy, females tend to form maternity colonies in sites where their body heat warms the roost. By contrast, males are common at higher elevations where their strategy is to roost solitarily and enter torpor during the day. Among the bats at DINO, females in general are more common at lower elevations whereas males clearly are more common at higher elevations. Female Long-eared and Long-legged

myotis are an exception to this generalization and we assume they are either making nightly migrations from low- to high-elevation sites or they are roosting at the upper elevations. Both species seem adapted to higher elevations. Telemetry studies would shed light on the roosting habits of female bats at the park.

Reproduction. About 37% (98/267) of the females we captured in 2008-2009 showed some form of reproductive activity: pregnancy, lactation, or sign of recent lactation (post-lactation). Our netting schedule each year precluded any attempt to monitor reproductive cycles in detail. The presumption is that most females are pregnant early in the summer, but it can be difficult during this time to discern definite signs of pregnancy. The earliest date we noted gravid bats was 4 July in 2008 and 16 July in 2009. We captured lactating females from 11 July 2008 and 14 July 2009 and as late as 5 August in 2008. We netted 32 flying young-of-the-year but only in 2008, beginning on 3 August and as late as 12 August that year. We probably did not work late enough in summer 2009 to catch young. During the two years, we tallied 113 reproductive males (vas deferens swollen and intruding into the uropatagium); the earliest dates were 4 July in 2008 and 16 July in 2009. We continued to net reproductive males until we left the park each year (10 August in 2008 and ca. 17 July in 2009. Species-specific comments on reproduction are in Appendix II.

Effects of temperature. Our data suggest that low temperatures in June 2009 likely affected bat captures (Fig. 1). In June 2008 the average temperature when we started a netting event was 74.25 F and ending temperature was 58.25 F; in June 2009 starting temperatures were about 8 F lower (66.3 F); ending temperatures were approximately the same as in 2008. In June 2008 we captured an average of almost 15 bats/night over four nights. In June 2009 we averaged less than half that number (7 bats/night), even with more nights of effort and a good catch at Haystack Rock Reservoir. Three of the 2009 localities were river sites, accounting for five of 12 nights of effort and this may have influenced our captures. It is not clear how the presence of a moon in early June 2009 affected these captures.

Results during the other three capture periods (Fig. 1) were roughly similar with starting temperatures above 74 F and ending temperatures around 60 – 68 F. Nonetheless, July 2009, the period with the highest average start and end temperatures, had the highest average capture rate (25.5 bats/night). Both July efforts included productive nights at Haystack Rock Reservoir (96 and 101 bats) although the 2009 effort also had good nights at Bear Draw and Dry Woman reservoirs. In our only August effort (2008) our best capture numbers were in the dark of the moon.

Other factors. To look for additional patterns we ranked all sites by number of bats captured and then looked at various attributes of the sites (Fig 2). Not surprisingly all the Yampa Bench (upland) sites rank in the top 20 sites in number of captures. Additionally, the top eight sites, all with captures greater than 39/night, were all made when no moon was present. During nights that we characterized as “no moon” we captured a total of 661 (73%) bats, whereas on nights with some or full moon we captured 248 bats. Interestingly, three of five nights when we caught no bats also had no moon, although all five nights were in river or riparian, not upland, sites. Sites we characterized as “upland,” but excluding the Morris Ranch, accounted for 657 (72%) of all bats captured. Sites characterized as “riparian,”

"river," and the Morris Ranch accounted for just 252 bats. Other variables, such as cloud cover and presence of large trees, probably also influence capture rates but perhaps in a more subtle fashion.

CONCLUSIONS

We enjoyed conducting this study and looking for differences across years. In terms of numbers of species, the two periods are very similar. Between 1982-1990, we captured 14 species in nets and obtained a fifteenth, a salvaged Mexican free-tailed bat. In 2008-2009 we were able to capture all 15 resident species in nets. One of the least common species in the earlier work was the canyon bat (two, one of which was shot) but in 2008-2009 we netted a total of seven canyon bats. In the recent study we also netted two Mexican free-tailed bats, including one from Colorado. Both of these species are on or near the margin of their respective geographic ranges. These slight increases suggest to us that these two species are clearly surviving in the area, and may be slowly expanding their ranges (Bogan and Cryan 2000, Genoways et al. 2000). Other species on or near the edge of their ranges include California Myotis, known only to the North from adjacent Sweetwater County, Wyoming; Yuma myotis, not known at all from Wyoming; and Spotted bat and Pallid bat, whose ranges are attenuated to the East although more expansive to the south, west, and north.

When we began this work we had some expectations that we would capture a Big free-tailed bat as there is a salvaged specimen from the Quarry. We are familiar with this bat from our work in New Mexico and Utah and have found reproductive females to be moderately common in some places. We have observed their roosts in slickrock canyon walls with large, incised cracks and have netted them over long, linear pools in streambeds in isolated canyons. The species may well occur at DINO and perhaps we just have not found the ideal net site. Alternatively, they may be absent because some resource is not present or in short supply. Bogan and Cryan (2000) report an isolated individual from West Gros Ventre Butte near Jackson, Wyoming, but the northernmost maternity roosts with females and young are at the latitude of Moab, Utah (Bogan, unpubl.). For the present, we are inclined to conclude that the Big free-tailed bat occurs occasionally at DINO but is not a resident.

A comparison of data from both studies (Table 10) suggests that in general, bat species and numbers are doing well at DINO. Although we caught about twice as many bats in the recent study we do not believe that bats are twice as abundant as they were in 1982-1990. For most species we did capture more individuals, but there are exceptions. For example, we took slightly fewer California myotis and Little brown bats and about three-fourths the number of Hoary bats. Given the relatively small sample sizes, these differences may not be real. Alternatively, possible reasons for the declines are that we may have misidentified a few California myotis as Small-footed myotis; we were less successful at Massey Reservoir where Little brown bats were common in the earlier study; and perhaps we simply were not in the right spot to net more Hoary bats. For all three species, the proportion that species represented out of total bats also declined by about 50%. Interestingly, their general occurrence or distribution on the park, as measured by prevalence, remained about the same (Table 10). Thus, they appear to be perhaps less common but as widespread as before.

Among those species for which we took more individuals, a few increased by factors of three to six times. We took almost three times as many Long-eared myotis and Silver-haired bats, four times as many Small-footed myotis, and six times as many Pallid bats. It is difficult to ignore the possibility that these numbers do not represent some real increase in numbers of these species (Table 10). Nonetheless, such an apparent increase might have resulted from a few very successful nights of netting, such as for Silver-haired bats at Haystack Rock and Pallid bats at Morris Ranch. The same may be true for Long-eared myotis as we had two or three very successful nights for that species. However, for Small-footed myotis, the general pattern is different as we had many nights of fair to moderate captures (3-8 animals). The proportion each species made of the total catch also increased, as did the prevalence value for all. It is possible that these four species represent the best evidence that some species may have increased in numbers.

Another suite of species increased by about one and one-half to two times in abundance (Table 10). These species include Long-legged and Yuma myotis, Big brown bats, Spotted bat, and Townsend's long-eared bat. Total numbers of each of these species in 2008-2009 vary from 11 to 91 and some caution is advised in dealing with smaller samples (e.g., Spotted bat). But, for some of these species (e.g., Townsend's long-eared bat, Big brown bat, and Yuma myotis) we again had a night or two of exceptional captures that influenced total numbers. Interestingly, the percent each species represented of the total remained about the same or decreased slightly. Prevalence values increased in most cases, markedly so in one case (Yuma myotis), and decreased in one case (Big brown bat; Table 10). We are persuaded that the small change in proportions and the slight increase in prevalence suggest these species are healthy at DINO.

From a faunal perspective, resident bat species at DINO can be divided into three classes: abundant (> 10% of total captures), common (2-10% of captures), and uncommon (< 2% of captures). Bats that are abundant at DINO include Long-eared myotis, Long-legged myotis, Yuma myotis, Silver-haired bat, and Big brown bat. Bats that are common include California myotis, Small-footed myotis, Fringed myotis, Hoary bat, Townsend's long-eared bat, and Pallid bat. Uncommon species at DINO are Little brown bat, Canyon bat, Spotted bat, and Mexican free-tailed bat. Most species were in the same categories for the earlier work, suggesting the fauna is relatively stable over time. The exceptions are slight differences in percentages for Long-eared myotis, Fringed myotis, and Little brown bat.

In many ways, we found DINO unchanged after all these years and, reassuringly, the bat fauna of the park still seemed healthy. Nonetheless, we urge that our current results be interpreted cautiously at this juncture. Why is DINO so "good" for bats? Our guess would be that it is a combination of the presence of good foraging and roosting sites, coupled with a fortuitous distribution of water sources, especially in the uplands. The relative paucity of visitors to large, wild parts of the park may also play a role, as may the general lack of intensive agriculture near the park. Grazing continues to be a visible land use in and near the park and it was our subjective opinion that in some areas, in spite of what appeared to be a year of good winter precipitation in 2007-08, the effects of grazing pressure were more obvious than during our earlier work.

Bats at DINO face a variety of local pressures but like all organisms they also face global threats. In particular, most climate scientists are convinced that global warming is occurring. How would warming temperatures affect bats at DINO? Depending on the degree of warming, the summer habits of many bats, especially males that use torpor at upper elevations, could change. How warmer temperatures would affect female bats in the summer at DINO is more conjectural but presumably some of them would move upward in elevation. We know almost nothing about the wintering habits of most bats at DINO other than that some (Silver-haired bat, Hoary bat, Mexican free-tailed bat) migrate to other, warmer, areas where food remains available, whereas the other species probably make, at most, local migrations to hibernacula to overwinter. Again, depending on the degree of warming, some hibernacula might become too warm to be used by bats.

RECOMMENDATIONS

1. Acknowledge the importance of upland sites at DINO that have high bat diversity and large numbers of captures of bats and take steps to protect, maintain, and enhance existing sources of water for bats at these sites;
2. Consider enhancing sources of water (and thereby insect biomass) at sites such as Morris Ranch, Hog Canyon, and Pool Creek Ranch;
3. Be alert to roosting concentrations of bats and protect them when found;
4. Continue to monitor bats with mist nets and echolocation devices on a regular basis (minimally every 10 yrs);
5. Consider funding or encouraging a telemetry study of female bats to obtain information on roosting sites and habits;
6. Encourage research on bats when possible;
7. Consider a public relations display on bat diversity at Dinosaur.

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Table 1. Master list of 17 species of bats (Chiroptera) known to occur on the Colorado Plateau (Hall 1981, Durrant 1952, Fitzgerald et al. 1994, Mollhagen and Bogan 1997, Bogan et al. 2006). Scientific and common names follow Baker et al. (2003) except for *Parastrellus* which follows Hoofer et al. (2006).

Myotis californicus (California myotis) Present
M. ciliolabrum (Western small-footed myotis) Present
M. evotis (Long-eared myotis) Present
M. lucifugus (Little brown myotis) Present in some areas
M. thysanodes (Fringed myotis) Present
M. volans (Long-legged myotis) Present
M. yumanensis (Yuma myotis) Present
Lasionycteris noctivagans (Silver-haired bat) Present
Lasiurus cinereus (Hoary bat) Present
Parastrellus hesperus (Western pipistrelle or Canyon bat) Present
Eptesicus fuscus (Big brown bat) Present
Euderma maculatum (Spotted bat) Present
Corynorhinus townsendii (Townsend's big-eared bat) Present
Idionycteris phyllotis (Allen's big-eared bat) Present in some areas
Antrozous pallidus (Pallid bat) Present
Tadarida brasiliensis (Brazilian free-tailed bat) Present
Nyctinomops macrotis (Big free-tailed bat) Present

Table 2. Level of effort at all sites in 2008-2009 showing number and size of nets at each netting event, total feet of net deployed at each event, and total numbers of nets (= number of net nights) for each netting event.

Location	Date	9	18	30	42	60	Total Feet	Total Nets
Chew Reservoir	8-Aug-08					3	180	3
Snow Reservoir	9-Jul-09					5	300	5
Buffham Reservoir	8-Jul-08				1	3	222	4
	9-Jul-08			1	1	2	192	4
Massey Pond	1-Jul-08		1		1	1	120	3
Massey Reservoir	30-Jun-08			2		2	180	4
	18-Jul-09				1	3	222	4
Bear Draw Reservoir	5-Aug-08					4	240	4
	17-Jul-09		1	1	1	1	150	4
Dry Woman Reservoir	6-Jul-08				2	1	144	3
	4-Aug-08					4	240	4
	17-Jul-09			2	1	2	222	5
Haystack Rock Res.	4-Jul-08			1	1	2	192	4
	5-Jul-08				1	3	222	4
	3-Aug-08					4	240	4
	4-Jun-09					5	300	5
	16-Jul-09				1	4	282	5
Ely Creek	14-Jul-09		2		1		78	3
Vermillion Creek	7-Jul-08		3				54	3
Hog Canyon	1-Jun-08				2	1	144	3
Pool Creek Ranch	12-Aug-08		1			3	198	4
Morris Ranch	31-May-08		1	1		2	168	4
	2-Jul-08				3	2	246	5
	1-Aug-08					4	240	4
	10-Aug-08					4	240	4
	3-Jun-09					5	300	5
	17-Jun-09				2	2	204	4
Big Joe Campground	9-Jun-09	2	2	1			84	5
	10-Jun-09	1	3	1			93	5
Pool Creek Petroglyphs	3-Jun-08	3	1				45	4
	10-Jul-08	3					27	3
	11-Aug-08	2			1	1	120	4
	15-Jun-09	2	1	1	1		108	5
	8-Jul-09	2	1				36	3
Pot Creek	12-Jul-09			1	1	2	192	4
Harding Hole	11-Jun-09	2	2	1			84	5
	12-Jun-09	4		1			66	5
Pool Creek, Echo Park	2-Jun-08		4	1			102	5
	11-Jul-08	1	2				45	3
	6-Aug-08		1				18	1
	16-Jun-09	1	2	1			75	4
Cub Creek	3-Jul-08		3				54	3
	2-Aug-08		3				54	3
	7-Jun-09		4				72	4
	10-Jul-09		3				54	3
Laddie Park	13-Jun-09			1	2	2	234	5
Rippling Brook	13-Jul-09	1	2		1		87	4
Jones Hole	14-Jul-09		2				36	2
Split Mountain	9-Aug-08				1		42	1
	6-Jun-09				2	1	144	3
	10-Jul-09			2		1	120	3
	Total	24	45	19	28	79	7512	195
						Min	18	1
						Max	300	5

Table 3. Localities, dates, and bat species captured in Dinosaur National Monument in the summer of 2008. The acronyms for the 15 species are as follows: Anpa, *Antrozous pallidus*; Coto, *Corynorhinus townsendii*; Epfu, *Eptesicus fuscus*; Euma, *Euderma maculatum*; Laci, *Lasiurus cinereus*; Lano, *Lasionycteris noctivagans*; Myca, *Myotis californicus*; Myci, *M. ciliolabrum*; Myev, *M. evotis*; Mylu, *M. lucifugus*; Myth, *M. thysanodes*; Myvo, *M. volans*; Myyu, *M. yumanensis*; Pahe, *Parastrellus hesperus*; and Tabr, *Tadarida brasiliensis*. The columns on the right side indicate the total number of bats and total bat species captured by locality and date. Summaries at the bottom include the total individuals of each species, the percentage that species comprises of the 517 total bats captured, and the percentage of times at least one individual of that species was captured among the 27 separate combinations of sampling locations and dates (Prevalence). Descriptions and coordinates of the capture localities are found in the locality accounts (Appendix I).

Elev. (ft)	Location	Date	Myca	Myci	Myev	Mylu	Myth	Myvo	Myyu	Laci	Lano	Pahe	Epfu	Euma	Coto	Anpa	Tabr	Total Bats	Total Spec.
7423	Chew Reservoir	8-Aug-08	-	-	3	-	1	2	1	-	-	-	-	-	2	-	-	9	5
7160	Buffham Reservoir	8-Jul-08	1	2	9	-	2	6	1	-	5	-	2	-	2	3	-	33	10
		9-Jul-08	-	4	-	-	1	2	1	-	1	-	1	-	-	1	-	11	7
6872	Massey Pond	1-Jul-08	-	2	1	1	-	-	2	2	3	-	-	-	-	-	-	11	6
6817	Massey Reservoir	30-Jun-08	-	-	-	6	-	-	1	2	5	-	-	-	-	-	-	14	4
6492	Bear Draw Reservoir	5-Aug-08	-	-	8	-	-	2	1	3	-	-	-	-	-	-	-	14	4
6481	Dry Woman Reservoir	6-Jul-08	-	4	2	-	-	4	1	-	1	-	2	-	-	-	-	14	6
		4-Aug-08	-	3	19	2	5	5	4	2	-	-	6	-	2	3	-	51	10
6478	Haystack Rock Reservoir	4-Jul-08	-	5	8	-	-	5	9	-	40	-	22	3	-	4	-	96	8
		5-Jul-08	-	3	4	-	-	2	3	2	4	1	14	1	-	2	-	36	10
		3-Aug-08	-	3	11	-	-	6	-	-	3	-	16	1	10	6	-	56	8
5364	Vermillion Creek	7-Jul-08	-	3	1	-	-	-	-	1	-	-	-	-	-	-	-	5	3
5362	Hog Canyon	1-Jun-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5361	Pool Creek Ranch	12-Aug-08	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1
5351	Morris Ranch	31-May-08	2	-	-	-	-	-	1	-	-	-	3	-	1	1	-	8	5
		2-Jul-08	-	-	3		1	-	3	1	-	-	-	-	-	2	-	10	5
		1-Aug-08	1	-	2	-	-	5	-	1	-	-	8	-	2	28	-	47	7
		10-Aug-08	-	-	1	-	-	2	-	-	-	-	6	-	-	13	-	22	4
5226	Pool Creek Petroglyphs	3-Jun-08	-	-	-	-	1	1	6	-	4	-	-	-	-	-	-	12	4
		10-Jul-08	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	3	2
		11-Aug-08	-	-	-	-	1	-	-	1	-	1	-	-	-	1	-	4	4
5155	Pool Creek at Echo Park	2-Jun-08	5	-	1	-	-	-	32	-	1	-	-	-	-	-	-	39	4
		11-Jul-08	-	2	-	-	2	3	1	-	1	-	-	-	-	-	-	9	5
		6-Aug-08	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1
5136	Cub Creek	3-Jul-08	-	-	1	-	-	-	-	-	-	2	2	-	-	-	1	6	4
		2-Aug-08	-	-	-	-	-	-	-	-	-	-	2	-	-	3	-	5	2
4788	Split Mountain	9-Aug-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
		Sum	9	33	74	9	15	46	68	15	68	4	84	5	19	67	1	517	15
		% Total Bats	1.7	6.4	14.3	1.7	2.9	8.9	13.2	2.9	13.2	0.8	16.2	1.0	3.7	13.0	0.2		
		Prevalence	14.8	40.7	55.6	11.1	33.3	51.9	59.3	33.3	40.7	11.1	44.4	11.1	22.2	44.4	3.7		
																	Average	**19.1**	**4.8**

Table 4. Localities, dates, and bat species captured in Dinosaur National Monument in the summer of 2009. The acronyms for the 15 species are given in Table 3. The columns on the right side indicate the total number of bats and total bat species captured for each netting event. Summaries at the bottom of the table include the total individuals of each species captured, the percentage that species comprises of the 392 total bats captured, and the percentage of times at least one individual of that species was captured among the 24 separate combinations of sampling locations and dates (Prevalence). Descriptions and decimal coordinates of the capture localities are found in the locality accounts (Appendix I).

Elev. (ft)	Location	Date	Myca	Myci	Myev	Mylu	Myth	Myvo	Myyu	Laci	Lano	Pahe	Epfu	Euma	Coto	Anpa	Tabr	Total Bats	Total Spec.
7363	Snow Reservoir	9-Jul-09	2	3	2	-	-	9	1	-	3	-	-	-	7	-	-	27	7
6817	Massey Reservoir	18-Jul-09	-	2	-	1	1	-	2	2	1	-	1	-	-	-	-	10	7
6492	Bear Draw Reservoir	17-Jul-09	-	8	7	-	-	4	-	7	32	-	4	3	-	-	-	65	7
6481	Dry Woman Reservoir	17-Jul-09	1	7	18	-	1	5	1	5	17	1	9	2	1	2	1	71	14
6478	Haystack Rock Reservoir	4-Jun-09	2	8	1	-	-	1	5	-	16	-	5	-	-	-	-	38	7
		16-Jul-09	-	2	8	-	-	11	1	2	46	-	25	1	1	4	-	101	10
5378	Ely Creek	14-Jul-09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5351	Morris Ranch	3-Jun-09	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	2	2
		17-Jun-09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5249	Big Joe Campground	9-Jun-09	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	1
		10-Jun-09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5226	Pool Creek Petroglyphs	15-Jun-09	1	1	-	-	1	1	2	1	3	-	4	-	-	-	-	14	8
		8-Jul-09	1	-	-	-	-	4	1	-	-	-	3	-	-	-	-	9	4
5202	Pot Creek	12-Jul-09	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
5169	Harding Hole	11-Jun-09	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1
		12-Jun-09	1	-	3	-	-	2	-	-	-	-	-	-	-	-	-	6	3
5155	Pool Creek at Echo Park	16-Jun-09	2	-	2	-	-	-	3	-	1	-	-	-	-	-	-	8	4
5136	Cub Creek	7-Jun-09	-	-	-	-	-	-	2	-	-	-	2	-	-	-	-	4	2
		10-Jul-09	1	-	-	-	3	1	1	-	-	2	9	-	-	-	-	17	6
5124	Laddie Park	13-Jun-09	1	-	1	-	2	-	-	-	-	-	-	-	-	3	-	7	4
4788	Split Mountain	6-Jun-09	-	-	-	-	-	-	2	-	-	-	1	-	1	-	-	4	3
		10-Jul-09	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1
5111	Rippling Brook	13-Jul-09	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	2	2
5030	Jones Hole Campground	14-Jul-09	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	2	2
		Sum	12	31	47	1	9	38	23	17	119	3	64	6	10	11	1	392	15
		% Total Bats	3.1	7.9	12.0	0.3	2.3	9.7	5.9	4.3	30.4	0.8	16.3	1.5	2.6	2.8	0.3		
		Prevalence	37.5	29.2	50.0	4.2	25.0	37.5	54.2	20.8	33.3	8.3	45.8	12.5	16.7	20.8	4.2		
																	Average	**16.3**	**4.0**

Table 5. Localities, dates, and bat species captured in Dinosaur National Monument, 1982-1990. The acronym for each species is in Table 3. The columns on the right side give the total number of bats and total bat species captured for each netting event. Summaries at the bottom include the total individuals of each species captured, the percentage that species comprises of the 468 total bats, and the percentage of times that species was captured among the 60 separate combinations of sampling locations and dates (Prevalence). Descriptions and coordinates of the capture localities are found in the locality accounts (Appendix I).

Elev. (ft)	Location	Date	Myca	Myci	Myev	Mylu	Myth	Myvo	Myyu	Laci	Lano	Pahe	Epfu	Euma	Coto	Anpa	Tabr	Total Bats	Total Spec.
7727	Five Springs	7-Aug-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
		8-Aug-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
7697	Canyon Overlook	17-Jul-90	1	3	4	1	-	2	4	3	-	-	6	-	1	-	-	25	9
		18-Jul-90	-	-	-	-	-	1	2	1	-	-	1	-	-	-	-	5	4
		19-Jul-90	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	4	1
7603	Cottonwood Creek	19-Jul-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
		20-Jul-90	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1
7423	Chew Reservoir	20-Jul-90	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
7334	Buffham Place	4-Aug-88	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	8	1
		5-Aug-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
7198	Old Bassett Cabin	2-Aug-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
		3-Aug-88	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1
7160	Buffham Reservoir	6-Aug-88	-	1	-	-	-	1	4		2	-	-	-	-	1	-	9	5
7099	Massey Camp	15-Jul-90	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	2	2
7000?	Massey Troughs	11-Jul-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
		12-Jul-00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
6817	Massey Reservoir	11-Jul-90	-	1	-	8	-	1	2	3	4	-	3	-	-	-	-	22	7
		12-Jul-90	-	1	1	2	-	-	7	5	8	-	3	-	2	1	-	30	9
		13-Jul-90	-	2	-	3	1	-	4	1	11	-	1	2	-	-	-	25	8
		14-Jul-90	-	-	2	2	-	5	-	2	8	-	3	-	-	-	-	22	6
		15-Jul-90	-	2	-	-	-	2	2	-	1	-	1	-	-	-	-	8	5
6568	Bear Draw	5-Jul-87	-	-	6	-	-	4	-	-	-	-	-	-	1	-	-	11	3
6481	Dry Woman Reservoir	6-Jul-87	1	2	4	-	-	3	-	3	8	-	5	-	-	-	-	26	7
		7-Jul-87	-	-	-	-	-	5	-	-	-	-	5	-	-	-	-	10	2
6478	Haystack Rock Reservoir	12-Aug-85	-	1	4	-	-	1	2	-	1	-	2	-	3	-	-	14	7
		2-Jul-87	1	-	1	-	-	4	1	1	14	1	14	-	-	-	-	37	8
		3-Jul-87	1	-	-	-	-	1	-	1	5	-	1	1	-	-	-	10	6
		4-Jul-87	-	1	2	-	-	1	-	-	-	-	5	1	-	-	-	10	5
		15-Jun-89	4	-	2	-	-	1	-	2	2	-	5	1	1	-	-	18	8
		17-Jun-89	-	1	2	-	-	2	1	-	-	-	5	-	-	1	-	12	6
5442	Haystack Rock	6-Jun-82	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	2
5364	Vermillion Creek	9-Aug-85	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1
5361	Pool Creek Ranch	11-Aug-88	-	-	1	-	-	2	3	-	-	-	-	-	-	-	-	6	3
		12-Aug-88	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1
		18-Jun-89	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	1
		20-Jun-89	-	-	-	-	2	1	-	-	-	-		-	-	-	-	3	2
5358	Ely Creek	14-Jun-82	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	2	2
		26-Jul-82	-	-	-	-	-	-	1	1	-	-	-	-	-	1	-	3	3
		27-Jul-82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5351	Morris Ranch	23-Jun-89	-	-	1	-	1	-	-	-	-	-	-	-	-	1	-	3	3
		9-Jul-90	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
		10-Jul-90	-	-	-	-	-	-	-	-	-	-	3	-	-	3	-	6	2
5249	Big Joe Campground	19-Jul-82	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3	1
		20-Jul-82	9	-	1	-	1	4	9	-	-	-	4	-	6	2	-	36	8
5226	Pool Creek Petroglyphs	12-Aug-88	-	-	-	-	1	5		1	1	-	4	-	-	-	-	12	5
		19-Jun-89	1	-	-	-	-	4	1	-	1	-	11	-	-	-	-	18	5
		20-Jun-89	1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	3	2
5202	Pot Creek	12-Jun-82	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	3	2
5169	Harding Hole	7-Jun-82	1	-	-	-	-	1	-	-	-	-	-	-	-	1	-	3	3
		8-Jun-82	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
5155	Pool Creek at Echo Park	10-Jun-82	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	1
		22-Jul-82	2	-	-	-	-	-	2	-	-	-	-	-	-	-	-	4	2
5138	Cub Creek	22-Jun-89	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1
		6-Jul-90	-	-	-	-	-	-	-	1	-	-	6	-	-	-	-	7	2
		7-Jul-90	-	-	-	-	-	1	1	1	-	-	7	-	-	-	-	10	4
		8-Jul-90	-	-	-	-	-	1	2	2	-	-	3	-	-	1	-	9	5
		9-Jul-90	-	-	-	-	-	-	-	9	-	-	1	-	-	1	-	11	3
		10-Jul-90	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	2	2
5111	Rippling Brook	13-Jun-82	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
5096	Alcove Brook	11-Aug-85	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
		Sum	24	17	41	16	7	55	52	41	69	2	112	5	14	13	0	468	14
		% Total Bats	5.1	3.6	8.8	3.4	1.5	11.8	11.1	8.8	14.7	0.4	23.9	1.1	3.0	2.8	0.0		
		Prevalence	20.0	18.3	26.7	8.3	10.0	40.0	30.0	33.3	26.7	3.3	53.3	6.7	10.0	16.7	0.0		
																	Average	**7.8**	**3.0**

Table 6. Localities, dates, and bat species captured in Dinosaur National Monument, 2008-2009. The acronyms for each species are in Table 3. The columns on the right side give the total number of bats and total species captured for each netting event. Summaries at the bottom include the total individuals of each species captured, the percentage that species comprises of the 909 total bats captured, and the percentage of times that species was captured among the 51 separate combinations of locations and dates (Prevalence). Descriptions and coordinates of the capture localities are found in the locality accounts (Appendix I).

Elev. (ft)	Location	Date	Myca	Myci	Myev	Mylu	Myth	Myvo	Myyu	Laci	Lano	Pahe	Epfu	Euma	Coto	Anpa	Tabr	Total Bats	Total Spec.
7423	Chew Reservoir	8-Aug-08	-	-	3	-	1	2	1	-	-	-	-	-	2	-	-	9	5
7363	Snow Reservoir	9-Jul-09	2	3	2	-	-	9	1	-	3	-	-	-	7	-	-	27	7
7160	Buffham Reservoir	8-Jul-08	1	2	9	-	2	6	1	-	5	-	2	-	2	3	-	33	10
		9-Jul-08	-	4	-	-	1	2	1	-	1	-	1	-	-	1	-	11	7
6872	Massey Pond	1-Jul-08	-	2	1	1	-	-	2	2	3	-	-	-	-	-	-	11	6
6817	Massey Reservoir	30-Jun-08	-	-	-	6	-	-	1	2	5	-	-	-	-	-	-	14	4
		18-Jul-09	-	2	-	1	1	-	2	2	1	-	1	-	-	-	-	10	7
6492	Bear Draw Reservoir	5-Aug-08	-	-	8	-	-	2	1	3	-	-	-	-	-	-	-	14	4
		17-Jul-09	-	8	7	-	-	4	-	7	32	-	4	3	-	-	-	65	7
6481	Dry Woman Reservoir	6-Jul-08	-	4	2	-	-	4	1	-	1	-	2	-	-	-	-	14	6
		4-Aug-08	-	3	19	2	5	5	4	2	-	-	6	-	2	3	-	51	10
		17-Jul-09	1	7	18	-	1	5	1	5	17	1	9	2	1	2	1	71	14
6478	Haystack Rock Reservoir	4-Jul-08	-	5	8	-	-	5	9	-	40	-	22	3	-	4	-	96	8
		5-Jul-08	-	3	4	-	-	2	3	2	4	1	14	1	-	2	-	36	10
		3-Aug-08	-	3	11	-	-	6	-	-	3	-	16	1	10	6	-	56	8
		4-Jun-09	2	8	1	-	-	1	5	-	16	-	5	-	-	-	-	38	7
		16-Jul-09	-	2	8	-	-	11	1	2	46	-	25	1	1	4	-	101	10
5378	Ely Creek	14-Jul-09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5364	Vermillion Creek	7-Jul-08	-	3	1	-	-	-	-	1	-	-	-	-	-	-	-	5	3
5362	Hog Canyon	1-Jun-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5361	Pool Creek Ranch	12-Aug-08	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1
5351	Morris Ranch	31-May-08	2	-	-	-	-	-	1	-	-	-	3	-	1	1	-	8	5
		2-Jul-08	-	-	3		1	-	3	1	-	-	-	-	-	2	-	10	5
		1-Aug-08	1	-	2	-	-	5	-	1	-	-	8	-	2	28	-	47	7
		10-Aug-08	-	-	1	-	-	2	-	-	-	-	6	-	-	13	-	22	4
		3-Jun-09	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	2	2
		17-Jun-09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5249	Big Joe Campground	9-Jun-09	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	1
		10-Jun-09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
5226	Pool Creek Petroglyphs	3-Jun-08	-	-	-	-	1	1	6	-	4	-	-	-	-	-	-	12	4
		10-Jul-08	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	3	2
		11-Aug-08	-	-	-	-	1	-	-	1	-	1	-	-	-	1	-	4	4
		15-Jun-09	1	1	-	-	1	1	2	1	3	-	4	-	-	-	-	14	8
		8-Jul-09	1	-	-	-	-	4	1	-	-	-	3	-	-	-	-	9	4
5202	Pot Creek	12-Jul-09	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1
5169	Harding Hole	11-Jun-09	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1
		12-Jun-09	1	-	3	-	-	2	-	-	-	-	-	-	-	-	-	6	3
5155	Pool Creek at Echo Park	2-Jun-08	5	-	1	-	-	-	32	-	1	-	-	-	-	-	-	39	4
		11-Jul-08	-	2	-	-	2	3	1	-	1	-	-	-	-	-	-	9	5
		6-Aug-08	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1
		16-Jun-09	2	-	2	-	-	-	3	-	1	-	-	-	-	-	-	8	4
5136	Cub Creek	3-Jul-08	-	-	1	-	-	-	-	-	-	2	2	-	-	-	1	6	4
		2-Aug-08	-	-	-	-	-	-	-	-	-	-	2	-	-	3	-	5	2
		7-Jun-09	-	-	-	-	-	-	2	-	-	-	2	-	-	-	-	4	2
		10-Jul-09	1	-	-	-	3	1	1	-	-	2	9	-	-	-	-	17	6
5124	Laddie Park	13-Jun-09	1	-	1	-	2	-	-	-	-	-	-	-	-	3	-	7	4
5111	Rippling Brook	13-Jul-09	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	2	2
5030	Jones Hole Campground	14-Jul-09	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	2	2
4788	Split Mountain	9-Aug-08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
		6-Jun-09	-	-	-	-	-	-	2	-	-	-	1	-	1	-	-	4	3
		10-Jul-09	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1
		Sum	21	64	121	10	24	84	91	32	187	7	148	11	29	78	2	909	15
		% Total Bats	2.3	7.0	13.3	1.1	2.6	9.2	10.0	3.5	20.6	0.8	16.3	1.2	3.2	8.6	0.2		
		Prevalence	25.5	35.3	52.9	7.8	29.4	45.1	56.9	27.5	37.3	9.8	45.1	11.8	19.6	33.3	3.9		
																	Average	**17.8**	**4.4**

Table 7. Captures of males and females at sites above 6,000 ft elevation. For each net event the number of males is given first, then the number of females. Abbreviations for species are provided in Table 3.

Elev. (ft)	Location	Date	Myca	Myci	Myev	Mylu	Myth	Myvo	Myyu	Laci	Lano	Pahe	Epfu	Euma	Coto	Anpa	Tabr
7423	Chew Reservoir	8-Aug-08			3/0		1/0	2/0	0/1						0/2		
7363	Snow Reservoir	9-Jul-09	1/1	3/0	2/0			8/1	1/0		3/0				0/7		
7160	Buffham Res.	8-Jul-08	1/0	2/0	8/1		0/2	3/3	1/0		5/0		2/0		0/2	3/0	
		9-Jul-08		4/0			1/0	2/0	0/1		1/0		1/0			1/0	
6872	Massey Pond	1-Jul-08		2.0	0/1	0/1			0/1	2/0	3/0						
6817	Massey Reservoir	30-Jun-08				0/6			0/1	2/0	5/0						
		18-Jul-09		2/0		0/1	1/0		1/1	2/0	1/0		1/0				
6492	Bear Draw Res.	5-Aug-08			4/4			0/2	0/1	2/1							
		17-Jul-09		6/1	3/4			2/2		6/0	28/0		4/0	1/2			
6481	Dry Woman Res.	6-Jul-08		4/0	0/2			0/3	0/1		1/0		2/0				
		4-Aug-08		2/1	15/4	2/0	5/0	3/2	4/0	2/0			6/0		2/0	0/3	
		17-Jul-09	1/0	7/0	13/4		1/0	4/1		5/0	17/0	0/1	8/0	1/1	0/1	0/2	0/1
6478	Haystack Rock Res.	4-Jul-08		5/0	7/1			2/3	4/5		40/0		20/1	2/0		4/0	
		5-Jul-08		3/0	2/2			1/1	0/3	2/0	4/0	1/0	12/0	1/0		2/0	
		3-Aug-08		2/1	7/4			2/4			3/0		14/0	1/0	1/9	6/0	
		4-Jun-09	2/0	7/1	1/0			1/0	1/4		15/0		4/1				
		16-Jul-09	2/0		7/1			5/6	1/0	1/0	46/0		24/0	0/1	0/1	4/0	
	511	**Males**	7	49	72	2	9	35	13	24	172	1	98	6	3	20	0
	126	**Females**	1	4	28	8	2	28	19	1	0	1	2	4	22	5	1

Table 8. Numbers of males and females from sites below 6,000 ft elevation. For each net event the number of males is given first, then the number of females. Abbreviations for species are provided in Table 3.

Elev. (ft)	Location	Date	Myca	Myci	Myev	Mylu	Myth	Myvo	Myyu	Laci	Lano	Pahe	Epfu	Euma	Coto	Anpa	Tabr
5378	Ely Creek	14-Jul-09															
5364	Vermillion Creek	7-Jul-08		2/1	0/1					1/0							
5362	Hog Canyon	1-Jun-08															
5361	Pool Creek Ranch	12-Aug-08					0/1										
5351	Morris Ranch	31-May-08	0/2						1/0				0/3		0/1	0/1	
		2-Jul-08			3/0		1/0		3/0	1/0						2/0	
		1-Aug-08	1/0		2/0			1/4		1/0			1/7		1/1	12/15	
		10-Aug-08			1/0			0/1					1/5			11/2	
		3-Jun-09					0/1									1/0	
		17-Jun-09															
5249	Big Joe C	9-Jun-09															
		10-Jun-09															
5226	Pool Creek,	3-Jun-08					1/0	0/1	0/6		4/0						
	Petroglyphs	10-Jul-08		1/1				1/0									
		11-Aug-08					0/1			0/1						1/0	
		15-Jun-09	0/1	0/1			0/1	0/1	0/2	1/0	3/0		0/4				
		8-Jul-09	0/1					2/2	0/1				1/2				
5202	Pot Creek	12-Jul-09											1/0				
5169	Harding Hole	11-Jun-09			0/1												
		12-Jun-09	0/1		2/1			0/1									
5155	Pool Creek, Echo	2-Jun-08	2/3		0/1				2/30		1/0						
	Park	11-Jul-08		1/0			0/2	1/1	0/1		1/0						
		6-Aug-08							1/0								
		16-Jun-09	1/1		1/1				2/1		1/0						
5136	Cub Creek	3-Jul-08			1/0							0/2	0/2				1/0
		2-Aug-08											1/1			0/3	
		7-Jun-09							1/1				2/0				
		10-Jul-09	0/1				2/1	0/1	1/0			0/2	4/5				
5124	Laddie Park	13-Jun-09	0/1		0/1		0/2									1/2	
5111	Rippling Brook	13-Jul-09							0/1							1/0	
5030	Jones Hole	14-Jul-09			0/1				0/1								
4788	Split Mountain	9-Aug-08															
		6-Jun-09							2/0				1/0		0/1		
		10-Jul-09			1/0												
	98	**Males**	4	4	11	0	4	5	13	4	10	0	12		1	29	1
	141	**Females**	8	3	7	0	9	12	44	1	0	4	29		3	21	0

Table 9. Numbers of males and females for low- and high-elevation sites for all bats captured 2008-2009. High sites (n = 8) are those above 6,000 ft; low sites (n = 15) are below that elevation. Bats that escaped before examination are not shown.

Species	Males Low sites	Females Low sites	Percent Male, low sites	Males High sites	Females High sites	Percent Male, high sites
Myca	4	8	50%	7	1	88%
Myci	4	3	57%	49	4	92%
Myev	11	7	61%	72	28	72%
Mylu	0	0	0	2	8	20%
Myth	4	9	31%	9	2	82%
Myvo	5	12	31%	35	28	56%
Myyu	13	44	23%	13	19	41%
Laci	4	1	80%	24	1	96%
Lano	10	0	100%	172	0	100%
Pahe	0	4	0	1	1	50%
Epfu	12	29	29%	98	2	98%
Euma	0	0	0	6	4	60%
Coto	1	3	25%	3	22	12%
Anpa	29	21	58%	20	5	80%
Tabr	1	0	100%	0	1	0
Totals	98	141	41%	511	126	80%

Table 10. Tabulation of all bats captured, percent of the total for each species, and prevalence of occurrence across netting events 1982-1990 and 2008-2009. Trend is a conservative and subjective assessment of population trends.

Species	Total Nos. and %, 1982-1990	Total Nos. and %, 2008-2009	Prevalence among 60 net events, 1982-1990	Prevalence among 51 net events, 2008-2009	Trend
Myca	24 (5.1)	21 (2.3)	20.0	25.5	Stable
Myci	17 (3.6)	64 (7.0)	18.3	35.3	Increasing?
Myev	41 (8.8)	121 (13.3)	26.7	52.9	Increasing?
Mylu	16 (3.4)	10 (1.1)	8.3	7.8	Stable?
Myth	7 (1.5)	24 (2.6)	10.0	29.4	Stable
Myvo	55 (11.8)	84 (9.2)	40.0	45.1	Stable
Myyu	52 (11.1)	91 (10.0)	30.0	56.9	Stable
Laci	41 (8.8)	32 (3.5)	33.3	27.5	Stable?
Lano	69 (14.7)	187 (20.6)	26.7	37.3	Stable
Pahe	2 (0.4)	7 (0.8)	3.3	9.8	Stable
Epfu	112 (23.9)	148 (16.3)	53.3	45.1	Stable
Euma	5 (1.1)	11 (1.2)	6.7	11.8	Stable
Coto	14 (3.0)	29 (3.2)	10.0	19.6	Stable
Anpa	13 (2.8)	78 (8.6)	16.7	33.3	Stable
Tabr	0 (0)	2 (0.2)	0	3.9	Stable
Totals	468 (100%)	909 (100%)			

Figure 1. Graphic depicting starting and ending temperatures, status of moon, and total captures for netting localities in 2008 and 2009.

Location	Date	Start Temp	End Temp	Moon	Total Bats
Morris Ranch	31-May-08	72	61		8
Hog Canyon	1-Jun-08	77	54		0
Pool Creek at Echo Park	2-Jun-08	78	62		39
Pool Creek Petroglyphs	3-Jun-08	70	56		12
	Average	74.25	58.25		14.75
Massey Reservoir	30-Jun-08	76	45		14
Massey Pond	1-Jul-08	76	48		11
Morris Ranch	2-Jul-08	81	72		10
Cub Creek	3-Jul-08	78	53		6
Haystack Rock Reservoir	4-Jul-08	73	61		96
Haystack Rock Reservoir	5-Jul-08	73	63		36
Dry Woman Reservoir	6-Jul-08	65	60		14
Vermillion Creek	7-Jul-08	77	61		5
Buffham Reservoir	8-Jul-08	64	51		33
Buffham Reservoir	9-Jul-08	72	65		11
Pool Creek Petroglyphs	10-Jul-08	70	64		3
Pool Creek at Echo Park	11-Jul-08	85	70		9
	Average	74.17	59.42		20.67
Morris Ranch	1-Aug-08	90	75		47
Cub Creek	2-Aug-08	82	71		5
Haystack Rock Reservoir	3-Aug-08	82	70		56
Dry Woman Reservoir	4-Aug-08	72	64		51
Bear Draw Reservoir	5-Aug-08	70	71		14
Pool Creek at Echo Park	6-Aug-08	72	68		1
Chew Reservoir	8-Aug-08	74	66		9
Split Mountain	9-Aug-08	73	73		0
Morris Ranch	10-Aug-08	77	67		22
Pool Creek Petroglyphs	11-Aug-08	75	65		4
Pool Creek Ranch	12-Aug-08	82	68		1
	Average	77.18	68.91		19.09

Location	Date	Start Temp	End Temp	Moon	Total Bats
Morris Ranch	3-Jun-09	70	57		2
Haystack Rock Reservoir	4-Jun-09	68	59		38
Split Mountain	6-Jun-09	75	59		4
Cub Creek	7-Jun-09	63	54		4
Big Joe Campground	9-Jun-09	61	56		2
Big Joe Campground	10-Jun-09	62	63		0
Harding Hole	11-Jun-09	58	50		1
Harding Hole	12-Jun-09	68	59		6
Laddie Park	13-Jun-09	69	65		7
Pool Creek Petroglyphs	15-Jun-09	68	52		14
Pool Creek at Echo Park	16-Jun-09	70	62		8
Morris Ranch	17-Jun-09	64	57		0
	Average	66.33	57.75		7.167
Pool Creek Petroglyphs	8-Jul-09	79	73		9
Snow Reservoir	9-Jul-09	73	47		27
Cub Creek	10-Jul-09	71	57		17
Split Mountain	10-Jul-09	80	70		1
Pot Creek	12-Jul-09	74	70		1
Rippling Brook	13-Jul-09	81	77		2
Ely Creek	14-Jul-09	78	61		0
Jones Hole	14-Jul-09	80	77		2
Haystack Rock Reservoir	16-Jul-09	81	66		101
Bear Draw Reservoir	17-Jul-09	84	62		65
Dry Woman Reservoir	17-Jul-09	82	66		71
Massey Reservoir	18-Jul-09	74	57		10
	Average	78.08	65.25		25.5

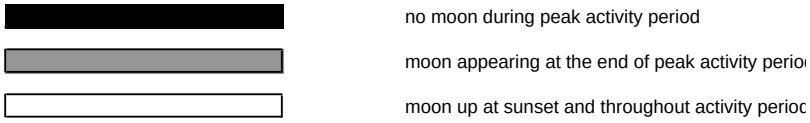

Figure 2. Graphic ranking each netting event by the total number of bats captured from most to fewest captures. Moon event codes are black: no moon during peak activity period; gray: moon appearing at end of peak activity period; and white: moon up at sunset and throughout peak activity period. Temperatures were recorded at the beginning and end of each netting session.

Rank	Bats	Location	Date	Start Temp	End Temp	Moon	Skies	Shade	Habitat
1	101	Haystack Rock Reservoir	16-Jul-09	81	66		Mostly clear		Upland
2	96	Haystack Rock Reservoir	4-Jul-08	73	61		Mostly cloudy/mostly clear		Upland
3	71	Dry Woman Reservoir	17-Jul-09	82	66		Clear		Upland
4	65	Bear Draw Reservoir	17-Jul-09	84	62		Mostly clear		Upland
5	56	Haystack Rock Reservoir	3-Aug-08	82	70		Cloudy/mostly clear		Upland
6	51	Dry Woman Reservoir	4-Aug-08	72	64		Partly cloudy/clear		Upland
7	47	Morris Ranch	1-Aug-08	90	75		Cloudy/clear	Big trees	Upland/riparian
8	39	Pool Creek at Echo Park	2-Jun-08	78	62		Overcast	Big trees; canyon	Riparian
9	38	Haystack Rock Reservoir	4-Jun-09	68	59		Mostly cloudy		Upland
10	36	Haystack Rock Reservoir	5-Jul-08	73	63		Mostly cloudy		Upland
11	33	Buffham Reservoir	8-Jul-08	64	51		Clear		Upland
12	27	Snow Reservoir	9-Jul-09	73	47		Clear		Upland
13	22	Morris Ranch	10-Aug-08	77	67		Partly cloudy	Big trees	Upland/riparian
14	17	Cub Creek	10-Jul-09	71	57		High, thin clouds		Riparian
15	14	Massey Reservoir	30-Jun-08	76	45		Partly cloudy/clear		Upland
16	14	Dry Woman Reservoir	6-Jul-08	65	60		Cloudy/overcast		Upland
17	14	Bear Draw Reservoir	5-Aug-08	70	71		Cloudy/clearing		Upland
18	14	Pool Creek Petroglyphs	15-Jun-09	68	52		Clear	Big trees; canyon	Riparian
19	12	Pool Creek Petroglyphs	3-Jun-08	70	56		Cloudy	Big trees; canyon	Riparian
20	11	Massey Pond	1-Jul-08	76	48		Mostly cloudy/clear		Upland
21	11	Buffham Reservoir	9-Jul-08	72	65		Mostly cloudy/mostly clear		Upland
22	10	Morris Ranch	2-Jul-08	81	72		Cloudy	Big Trees	Upland/riparian
23	10	Massey Reservoir	18-Jul-09	74	57		Mostly clear		Upland
24	9	Pool Creek at Echo Park	11-Jul-08	85	70		Mostly cloudy/clear	Big trees; canyon	Riparian

Figure 2. Continued.

25	9	Chew Reservoir	8-Aug-08	74	66		Cloudy		Upland
26	9	Pool Creek Petroglyphs	8-Jul-09	79	73		Clear	Big trees; canyon	Riparian
27	8	Morris Ranch	31-May-08	72	61		Clear	Big trees	Upland/riparian
28	8	Pool Creek at Echo Park	16-Jun-09	70	62		Overcast	Big trees; canyon	Riparian
29	7	Laddie Park	13-Jun-09	69	65		Mostly clear/cloudy		River
30	6	Cub Creek	3-Jul-08	78	53		Clear		Riparian
31	6	Harding Hole	12-Jun-09	68	59		Overcast	Big trees; canyon	Riparian
32	5	Vermillion Creek	7-Jul-08	77	61		Clear		Riparian
33	5	Cub Creek	2-Aug-08	82	71		Cloudy		Riparian
34	4	Pool Creek Petroglyphs	11-Aug-08	75	65		Mostly clear	Big trees; canyon	Riparian
35	4	Split Mountain	6-Jun-09	75	59		Mostly cloudy		River
36	4	Cub Creek	7-Jun-09	63	54		Overcast/clear		Riparian
37	3	Pool Creek Petroglyphs	10-Jul-08	70	64		Clear	Big trees; canyon	Riparian
38	2	Morris Ranch	3-Jun-09	70	57		Partly cloudy	Big trees	Upland/riparian
39	2	Big Joe Campground	9-Jun-09	61	56		Overcast/partly cloudy		River
40	2	Rippling Brook	13-Jul-09	81	77		Clear		River
41	2	Jones Hole	14-Jul-09	80	77		Clear		River
42	1	Pool Creek at Echo Park	6-Aug-08	72	68		Overcast	Big trees; canyon	Riparian
43	1	Pool Creek Ranch	12-Aug-08	82	68		Cloudy/mostly clear		Upland/riparian
44	1	Harding Hole	11-Jun-09	58	50		Clear		Riparian
45	1	Split Mountain	10-Jul-09	80	70		Hazy		River
46	1	Pot Creek	12-Jul-09	74	70		Partly cloudy/clear		River
47	0	Hog Canyon	1-Jun-08	77	54		Clear		Riparian
48	0	Split Mountain	9-Aug-08	73	73		Overcast		River
49	0	Big Joe Campground	10-Jun-09	62	63		Overcast		River
50	0	Morris Ranch	17-Jun-09	64	57		Overcast/clear	Big trees	Upland/riparian
51	0	Ely Creek	14-Jul-09	78	61		Clear		Riparian

Appendix 1. Locality Accounts

To enable us to locate potential sampling sites for this work, we examined specimens and field notes from the surveys conducted in the years 1982-1990. An artifact of the former survey was to label all specimens taken in the vicinity of a base camp with the location of that base camp. However, archived field notes, modern mapping software and GPS devices permitted us to precisely locate most of the earlier, and all of the current sampling sites. The paragraphs below provide this information, including coordinates (decimal degrees, NAD27 map datum), elevation, site descriptions, site access and other observations. Locations were plotted and elevations determined with the Utah and Colorado packages of the Terrain Navigator Pro (Maptech) mapping software interfaced with a Garmin Map60 GPS unit.

The accounts are arranged alphabetically. Localities from the previous study are verbatim as recorded on specimen labels and are cross-referenced to abbreviated, more easily discussed place names. Corrections to, or clarifications of, these localities are in brackets. Capture sites unique to this study period are identified as such and are integrated into this list.

Acronyms used for the bat species captured at each site are as follows: Anpa, *Antrozous pallidus*; Coto, *Corynorhinus townsendii*; Epfu, *Eptesicus fuscus*; Euma, *Euderma maculatum*; Laci, Lasiurus *cinereus*; Lano, *Lasionycteris noctivagans*; Myca, *Myotis californicus*; Myci, *M. ciliolabrum*; Myev, *M. evotis*; Mylu, *M. lucifugus*; Myth, *M. thysanodes*; Myvo, *M. volans*; Myyu, *M. yumanensis*; Pahe, *Parastrellus hesperus*; and Tabr, *Tadarida brasiliensis*.

0.5 mi SE Canyon Overlook. See Canyon Overlook.

0.7 mi NNE Massey Cabin. See Massey Pond.

2.5 mi W Haystack Rock Turnoff. See Bear Draw.

2.6 mi N Massey Cabin. See Massey Troughs.

5.4 mi [by rd] **W Haystack Rock Turnoff.** See Dry Woman Reservoir.

ca. 1 mi NNW Iron Springs Bench Overlook. See Chew Reservoir.

ca. 1 mi SE Canyon Overlook. See Cottonwood Creek.

ca. 1.1 mi N Massey Cabin. See Massey Reservoir.

Alcove Brook. (N 40.56349 x W 108.96549 , elev. 5096 ft.). The Epfu taken at this locality in the former study is labeled River mi 228.5, lt. bank Green R., Alcove Brook. It was shot over camp. We did not stop at this site on our raft trip down the river in July 2009.

Bassett Cabin [= Camp], Old (N 40.6281896 x W 108.8933419, elev. 7198 ft.). See the account of Zenobia Basin for access. On the quad map this site is labeled Old Bassett Camp. A Myev taken here on 3 August 1988 was captured in a net arrayed horizontally across the top of a metal tank. There is another Bassett Cabin on the quad map (N 40.63470 x W 108.87345) that was historically occupied at a later time. Some trapping was done there in the former study, but no netting. We understand that the wooden structures associated with both Bassett Cabin localities burned in a runaway grass fire. In July 2008 there was no evidence of the structures or the metal tank that were at the Old Bassett Camp site. Neither were there pools below the springs still issuing from the slope.

Bear Draw (N 40.4487044 x W 108.7066449, elev. 6566 ft.). Specimens taken from this locality in the former study are labeled Bear Draw, 2.5 mi W Haystack Rock Turnoff. A small plunge pool in a cleft 40 yards below the ledge concealing the log hideout was netted at that time. Bats captured included 6 Myev, 4 Myvo and 1 Coto. In June, 2008 this pool was barely evident and was dry the following month. There was some water again in June, 2009, but since we had located the much larger Bear Draw Reservoir in the meantime, we elected not to work it again. Access is 100 yds NE down the draw from the same hiking access point on the Mantle Ranch road (Co Hwy 14N) as for the Bear Draw Reservoir.

Bear Draw Reservoir (N 40.4538407 x W 108.7065531, elev. 6492 ft.). This is a new site that is accessed from N 40.4481183 x W 108.7074982 (Bear Draw) on the Mantle Ranch (Yampa Bench or Co Hwy 14N) road. From there it is an easy 0.4 mi hike on cattle trails down to the reservoir. In 2009 we discovered and used a two-track from the road to the reservoir, instead of hiking. We do not believe this reservoir existed at the time of the former study. The area around this site burned between study periods, but it was clearly a P-J grassland. When we netted in August 2008 the water surface was approximately square, 60 ft on each side. It was slightly smaller in July of 2009. At one time the reservoir had substantial storage capacity but the dam has been partially breached at the overflow. Still, the water is probably permanent with normal precipitation. We netted the pond once each in 2008 and 2009, capturing a total of 79 bats of eight species as follows: 8 Myci, 15 Myev, 6 Myvo, 1 Myyu, 10 Laci, 32 Lano, 4 Epfu and 3 Euma.

Big Joe Campground (N 40.49202 x W 108.81524, elev. 5249 ft.). Big Joe Campground, (2009) (N 40.49202 x W 108.81381); "Big Joe" (2009) (N 40.49388 x W 108.82280); Lower Big Joe, (2009) (N 40.49191 x W 108.81524). All these sites are in the lower part of Starvation Valley on the Yampa River. We netted two consecutive nights in July of 1982 capturing a total of 39 bats of eight species as follows: 9 Myca, 1 Myev, 1 Myth, 4 Myvo, 9 Myyu, 7 Epfu, 6 Coto and 2 Anpa. We netted here for two nights in the present study and caught only 2 Myev. There is a possibility that we did not hike far enough up-canyon to reach the original site. Possible coordinates for the original site, taken from Google Earth, may be 40.495 x 108.820.

Browns Hole Store (N 40.7832300 x W 108.8531300). Access is off Hwy. 318. The store is in a mobile home. This is the last chance for fuel and provisions before going into Zenobia Basin. The fuel costs substantially more than anywhere else in the region.

Buffham Place, Zenobia Basin (N 40.6017733 x W 108.8923799, elev. 7337 ft.). See the account of Zenobia Basin for access. We camped here during the former study. A small metal tank behind the house and slightly up the hill was netted on consecutive nights in the former study, capturing 8 Myev. Nine specimens captured on 6 August 1988 and bearing this locality were actually taken at the reservoir down slope (see Buffham Reservoir). In July of 2008, the plastic pipe that might keep water in the metal tank was on the ground and the tank was dry. The house is in very poor repair. We did not work the site in the present study.

Buffham Reservoir (N 40.6018364 x 108.9016878, elev. 7160 ft.). See the account of Zenobia Basin for access. We labeled this reservoir Buffham out of convenience, but it may have another local name. The location is 0.5 mi due west (270 deg) of the Buffham Place. It is just off the two-track into Zenobia Basin but it could easily go unnoticed from the trail. A 50-yd long, slick-rock portion of the track marks the location. We camped on this slick-rock in 2008.

There is yellow pine on the slopes and dense grass with sage on the basin floor. There is little sage away from the fence lines, giving evidence of the prescription burn that occurred between the study periods. Nine specimens labeled from the Buffham Place and captured on 6 August 1988, were actually taken at this reservoir. The identifications are as follows: 1 Myci, I Myvo, 4 Myyu, 2 Lano and 1 Anpa. We netted this location on consecutive nights in July 2008, capturing a total of 44 bats of ten species as follows: 1 Myca, 6 Myci, 9 Myev, 3 Myth, 8 Myvo, 2 Myyu, 6 Lano, 3 Epfu, 2 Coto and 4 Anpa.

Canyon Overlook (N 40.4517219 x W 109.0152694). During fieldwork in 1990 we camped and worked out of here. The overlook is also a reference landmark for two former sampling sites in the area, 0.5 mi SE Canyon Overlook and ca. 1 mi SE Canyon Overlook. We have abbreviated the former locality to this name, as it is only a short distance away. The latter locality is in Cottonwood Creek so that name is applied there. The actual capture site (0.5 mi SE) is a pond at N 40.4470846 x W 109.0077355, elev. 7697 ft. We were unable to get permission to visit this site to confirm the location for the present study, but we believe these coordinates are correct. This location is 0.48 mi SE (126 deg) from the overlook. We netted here on three consecutive nights in July 1990, capturing a total of 34 bats of nine species as follows: 1 Myca, 3 Myci, 4 Myev, 1 Mylu, 3 Myvo, 10 Myyu, 4 Laci, 7 Epfu and 1 Coto. The region is high sagebrush grassland.

Chew/Snow turnoff (N 40.5035888 x W 109.0642579). This is the turnoff from the Harper's Corner Road that provides access to both the Chew and Snow reservoirs.

Chew Reservoir (N 40.5034491 x W 109.0793734, elev. 7423 ft.). This site is on private property so we obtained access through the Park Service. We refer to it as the Chew Reservoir to distinguish it from the nearby Snow Reservoir. The single Epfu taken at this locality in the former study is labeled ca. 1 mi NNW Iron Springs Bench Overlook. In August of 2008 we captured nine bats of five species as follows: 3 Myev, 1 Myth, 2 Myvo, 1 Myyu and 2 Coto. The pool was seemingly maintained by precipitation runoff and by a spring with very low discharge. It was heavily used by livestock. On the date we netted there, the pool was approximately 60 ft in diameter. Based on the overflow position, it will probably never be wider than 75 ft across, but the water might be permanent. The habitat is high sagebrush grassland. Allen Chew was present when we worked here and we appreciate his assistance.

Cottonwood Creek (N 40.4422509 x W 108.9958953, 7603 ft.). This location is in Cottonwood Creek and is a straight-line 1.1 mi SE (123 deg) from Canyon Overlook. It is accessed from the Cottonwood Creek Turnoff. A single Laci captured here after two consecutive nights of netting during the former study is labeled ca. 1 mi SE Canyon Overlook. When we visited the site in August 2008, the long, triangular water surface stepped off to 150 ft wide at the dam and 270 ft in length. At this time it was far too large for a two-person crew to net effectively. Unusual features of the reservoir were the clear water and vegetation growing to the water margin. Clearly, cattle were not in the area on the date of our visit. We did not revisit the site in 2009. The habitat is high sagebrush grassland.

Cottonwood Creek Turnoff (N 40.43066 x W 108.99087) Since this site is not on monument property we camped at this junction on several occasions during the present study. It is also the point of access to the Cottonwood Creek locality.

Cub Creek (N 40.41830 x W 109.18822, elev. 5136 ft.). Specimens taken here in the former study are labeled Cub Creek, 1 mi (by rd) SW Morris Ranch. This site is 0.9 mi SW (234

deg) of the Morris Ranch. Access is a narrow, overgrown two-track from the paved road to the Morris Ranch. The coordinates given are those of the sampling site of the former study. At that time we worked several long beaver-constructed pools. We netted here once in 1989 and on five consecutive nights in 1990 capturing a total of 41 bats of six species as follows: 2 Myci, 2 Myvo, 3 Myyu, 14 Laci, 18 Epfu and 2 Anpa. In July 2008 there were no beaver dams at the original site and it was overgrown by herbaceous and woody vegetation. Thus we moved our netting efforts about 50 yds downstream to a short, straight reach with two pools, above an old, but still functioning beaver dam. By August 2008 a flash flood had taken out that dam and silted in the pools so we netted flyways at the same location. Sometime before June of 2009 another flood had scoured the pools, making them serviceable again. We netted here on four occasions over the two summers capturing a total of 32 bats of nine species as follows: 1 Myca, 1 Myev, 3 Myth, 1 Myvo, 3 Myyu, 4 Pahe, 15 Epfu, 3 Anpa and 1 Tabr. The area is wholly riparian, with boxelder being the most prominent woody species.

Deerlodge Park (N 40.45014 x W 108.52214). This is the put-in location for rafting to capture sites on the Yampa River. We did not net at this site.

Dry Woman Reservoir (N 40.4579545 x W 108.7403557, elev. 6481 ft.). Specimens taken at this locality in the former study are labeled Dry Woman Reservoir, 5.4 mi [by rd] W Haystack Rock Turnoff. This site is 3.8 straight-line miles WNW (279 deg) of the Haystack Rock turnoff. The distance between the reservoir and the Haystack Rock turnoff via the Mantle Ranch road and the two-track to the reservoir is 5.4 miles. The coordinates of Dry Woman Reservoir turnoff on the Yampa Bench Road are N 40.4544869 x W 108.7452750. On consecutive nights in July 1987 we captured a total of 36 bats of seven species as follows: 1 Myca, 2 Myci, 4 Myev, 8 Myvo, 3 Laci, 8 Lano and 10 Epfu. On three nights of the present study we captured a total of 136 bats of 15 species as follows: 1 Myca, 14 Myci, 39 Myev, 2 Mylu, 6 Myth, 14 Myvo, 6 Myyu, 7 Laci, 18 Lano, 1 Pahe, 17 Epfu, 2 Euma, 3 Coto, 5 Anpa and 1 Tabr. During visits in the months of July 2008 and 2009, the water surface was a long pyramid, measuring approximately 60 x 150 ft. We were unable to plumb the depth. In August 2008, the length of the pond had been slightly reduced to 120 ft. The height of the dam suggests a great storage capacity and the presence of water into August also suggests the water may be permanent. The habitat is P-J grassland.

Ely Creek. (N 40.56472 x W 109.05899 , elev. 5378 ft.). Specimens from this location are labeled 2 mi N Jones Hole Campground. Access to this site is a scenic, two-mile hike up a well-marked trail from Jones Hole Campground on the Green River. The path follows Jones Hole Creek to the discharge from Ely Creek at N 40.56558 x W 109.05707, at which point the hiker must take the trail up Ely Creek to the waterfall. In the former study all of the nets were placed below the waterfall. At that time (1982) the woody vegetation was mostly low-lying brush. In 2009 there was a heavy undergrowth of brush and an overstory of trees (mostly of boxelder) that extended well above the height of the waterfall. We placed one net below and two nets above the waterfall. On three nights of the former study we captured a total of five bats of four species as follows: 1 Myyu, 2 Laci, 1 Lano and 1 Anpa. We caught no bats on our only visit during the present study. It was uncomfortably cool that night, but nonetheless a beautiful setting in which to work.

Five Springs (N 40.6048628 x W 108.8388439, elev. 7727 ft.). This site is not on Dinosaur National Monument. It is depicted on the quad map and also is called, or is near, the

Maddox Place. See the account of Zenobia Basin for access. Since no bats were captured there during two night's netting in the former study, we elected not to travel the difficult road to it to confirm the coordinate of the locality.

Harding Hole (N 40.46603 x 108.84192, elev. 5169 ft.). This site is on left bank of the Yampa River. On two consecutive nights in June, 1982, we captured a total of four bats of three species as follows: 2 Myca, 1 Myvo and 1 Anpa. The field notes are not clear on the distribution of the nets, but one or more were placed over water in lower Bull Canyon, just above camp. Another one or more nets were set under a ledge in what may have been East Serviceberry Draw somewhere near N 40.46508 x W 108.83731. In June 2009 we worked two riparian sites. We netted over water once in lower Bull Canyon at N 40.46532 x W 108.83936. These coordinates were on a high spot on the trail between two sets of nets on the stream below. On the next night we netted in flyways and over water in West Serviceberry Draw near N 40.46365 x W 108.83980. These coordinates were extrapolated from coordinates taken at the mouth of the draw—we could not get a GPS reading while in the narrow draw itself. The nets were all placed below the rise of a small spring. For both nights we captured a total of seven bats of three species as follows: 1 Myca, 4 Myev and 2 Myvo.

Haystack Rock (N 40.46762 x W 108.66974, elev. 5442 ft.). The two specimens shot over camp at this locality on 6 June 1982 (1 Myca, 1 Pahe) are labeled River mi 34, rt. bank Yampa R., Haystack Rock. Haystack Rock looms up from the cliff face on the opposite side of the river at N 40.46351 x W 108.66812. We did not stop at this location when we floated the river in June 2009.

Haystack Rock Reservoir (N 40.45226 x W 108.67282, elev. 6478 ft.). This locality is on the Yampa Bench, above the river, 0.8 mi SSE (197 deg) on a straight line from Haystack Rock. Access to it is from the Yampa Bench (Mantle Ranch or Co Hwy 14N) road. The coordinates for the turnoff to it are noted below, but there is a locked gate on the two-track for which a key must be obtained from the Park Service. During both study periods we camped on the slab of slickrock on the east side of the reservoir when we were working sampling sites on the east end of the Yampa Bench. Much of the area around the site burned in the intervening years, but the vegetation directly around the reservoir is mostly intact; the habitat is P-J sage grassland. In June 2008, the pool was basically D-shaped, measuring about 100 x 120 ft. On 3 August, we netted around a pool that was reduced to a 20 ft circle and no more than 2 in deep; by 6 August, there was no standing water, only mud. In June 2009 it had more water than any time during the previous year, but it was still below the overflow depth. This was our most consistently productive netting locality. Over six evenings in the former study we captured 101 bats of 12 species as follows: 6 Myca, 3 Myci, 11 Myev, 10 Myvo, 4 Myyu, 4 Laci, 22 Lano, 1 Pahe, 32 Epfu, 3 Euma, 4 Coto and 1 Anpa. Over five nights in 2008-09 we captured a total of 327 bats of 12 species as follows: 2 Myca, 21 Myci, 32 Myev, 25 Myvo, 18 Myyu, 4 Laci, 109 Lano, 1 Pahe, 82 Epfu, 6 Euma, 11 Coto and 16 Anpa. During our work in 2008-09 the immediate vicinity around the pond was heavily impacted by cattle.

Haystack Rock Turnoff (N 40.44893 x W 108.66898). These coordinates are on the Mantle Ranch Road (also called Yampa Bench Road or County Road 14N) and are a point of reference for Haystack Rock Reservoir and Dry Woman Reservoir. The main trail goes straight to Haystack Rock, but a side trail leads to Haystack Rock Reservoir. The road has a locked gate and a key must be obtained from the Park Service to pass.

Hog Canyon (N 40.4260455 x W 109.1694044, elev. 5362 ft.). This new site is a short hike on a maintained trail just east of the Morris Ranch. A substantial spring rises about two thirds of the way up the canyon and water drains out, probably continuously, almost to Cub Creek. We were unable to find pools where bats might drink. In June 2008, we deployed three flyway nets, the lowest of which was at the coordinates above. While bats were seen at this time, none were captured. The hiking map shows a "bat cave" part way up the canyon. We may have seen this feature on the canyon wall; it did not strike us as a site with heavy usage by bats.

Iron Spring Bench Overlook. (N 40.4897995 x W 109.0682804). This is a point of reference for a former capture locality in the area. It was never netted.

Jones Hole Campground (N 4054031. x 109.06000, elev. 5030 ft.). This site is on the right bank of the Green River. It is a point of reference for the Ely Creek capture locality, but no bats were netted there in the former study. We did net here in July 2009, over Jones Hole Creek and over a small pool between the campground and the river; we captured only a Myvo and a Myyu. We were entertained by brazen skunks and mice after we returned to camp from our netting efforts. However, the charm of the mice was lost after we went to bed, when they ran into and over our sleeping bags and over exposed faces and limbs.

Josie's Cabin. See Morris Ranch.

Laddie Park. (N 40.48380 x W 108. 90880, elev. 5124 ft.). This site is on the right bank of the Yampa River, at a place that could become an island at a river flood stage. It was not sampled for bats in the former study. In June 2009 we camped below the two established campgrounds at a site designated to become a third campground. We set up flyway nets around our camp capturing seven bats of four species as follows: 1 Myca, 1 Myev, 2 Myth and 3 Anpa.

Lodore Campground (N 40.7277781 x W 108.8874168). This is a point of reference for the Vermillion Creek Site and the put-in location for rafting to capture sites on the Green River.

Massey Cabin (N 40.60759 x W 108.98926). This site is within the monument. No bats were ever taken there, but there were four sites given the identifier Massey out of convenience, Massey Camp, Massey Pond, Massey Reservoir and Massey Tanks. All may have other local names. An old house trailer that has suffered serious weathering and vandalism in the years since we first saw it presently marks the Massey Cabin location. Access to the area can be gained from either the Quarry or Vernal. In Vernal, from the intersection of 500 N x 500 E, proceed east a little more than two miles. Here, the blacktop trends generally NE for approximately 6 mi to a water tank at the roadside at N 40.5186278 x W 109.3948905 that serves as the first landmark. If leaving from the Dinosaur NM Quarry site, proceed generally south toward Jensen to the intersection of Brush Creek Rd at N 40.4060557 x W 109.3412658. Follow Brush Creek Rd, keeping the Brush Creek valley on the right for a little more than 8 mi to the water tank. Do not cross the creek or take any blacktops forking to the left. From the water tank, follow the Diamond Mountain road to N 40.6539137 x W 109.2893381. From there, take the Jones Hole Rd east to N 40.6383059 x W 109.1233612. Turn left (N) onto a dirt road to N 40.6603103 x W 109.1128059 and take the right fork. From here to Massey Cabin, there are many gates, some open, some not; we left them as they were found. After perhaps a mile from the fork, the road goes directly east for 2.5 mi then bends ESE past the state line (there is a corral so marked). Stay on the main road, past the big Offield Reservoir to N 40.6566874 x W 108.9962904. Turn right (S) through the gate. From here the road degenerates to a sometimes

rough two-track, but there aren't many places to stray from the main track. From this point consult the respective accounts for the destination coordinates of the several Massey sites.

Massey Camp (N 40.60994 x W 108.96776, elev. 7099 ft). See the account of Massey Cabin for access to this locality. This site is a straight-line distance of 1.1 mi ENE (81 deg) of Massey Cabin (label locality). The distance is much greater over the two-track that passes between the two. It is on land administered by BLM. The immediate area is mixed PJ-yellow pine-sage. This location was utilized as our campsite anytime we were in the area. However, an earlier fire that took some of the larger ponderosas substantially diminished the shade it provided in 2008 and 2009. There is no water to net there. The bat specimens recorded from this locality in the earlier study period (1 Myev, 1 Epfu) were shot over camp. We did not attempt to duplicate this effort for the present work.

Massey Pond (N 40.61743 x W 108.98640, elev. 6872 ft.). See the account of Massey Cabin for access to the site. This small stock pond is a straight-line distance of 0.7 mi NNE (11 deg) of the Massey Cabin location on the quad map. The distance is slightly greater over the trail that passes between the two. It is on land administered by BLM. The vegetation of the surrounding area is a PJ-grassland, with yellow pine on the distant slopes. This locality was not sampled in the earlier study period, either because it was dry or did not exist. On 1 July 2008 we captured 11 bats of six species as follows: 2 Myci, 1 Myev, 1 Mylu, 2 Myyu, 2 Laci and 3 Lano. The water surface was ovoid, measuring about 60 x 100 ft. The water depth was probably no more than 18 in at the most. The pond was difficult to work because it had a soft, sticky clay bottom made uneven by cattle usage. Water storage is likely only temporary at best. It was dry in July 2009.

Massey Reservoir (N 40.62337 x W 108.98347, elev. 6817 ft.). Specimens taken from this locality in the former study are labeled ca. 1.1 mi N Massey Cabin. See the account of Massey Cabin for access. This site is a straight-line distance of 1.1 mi NNE (15 deg) of Massey Cabin. The distance is slightly greater over the trail that passes between the two. It is on land administered by BLM. When driving in from the north, it can easily be bypassed if the driver is not attentive. Over both study periods this has been a consistently large (ca. 150 x 250 ft) triangle-shaped stock tank. The water is likely permanent. There were no cattle at the site when we netted on five consecutive nights in July 1990. We captured a total of 107 bats of 12 species as follows: 6 Myci, 3 Myev, 15 Mylu, 1 Myth, 8 Myvo, 15 Myyu, 11 Laci, 32 Lano, 11 Epfu, 2 Euma, 2 Coto and 1 Anpa. Cattle were abundant on both visits to the site in the present study, making it a difficult and unpleasant place to work. On two evenings we netted a total of 24 bats of seven species as follows: 2 Myci, 7 Mylu, 1 Myth, 3 Myyu, 4 Laci, 6 Lano and 1 Epfu. The vegetation in the immediate vicinity is P-J sage grassland with Ponderosa pine on the distant slopes. We are puzzled why we didn't capture more bats here in 2008-09 as general conditions appeared the same as on out visits in 1990, although cattle usage was heavier in our recent work.

Massey Troughs. According to our field notes from the former study, we netted some metal troughs 2.6 mi north of Massey Cabin. Based on the narrative directions, they should be along the trail into Massey Cabin, but we found no evidence of them. Thinking the direction might be in error, we noted on the map that there is a trail leading to some springs 2.6 mi NNW of Massey Cabin, on the flank of Wild Mountain. A locked gate prevented our getting there. However, along the trail to that location are a set of familiar-looking troughs, but they are only

1.1 mi NNW of the cabin. Inasmuch as no bats were captured on either night we netted, we abandoned the effort to document the site in the present study.

Morris Ranch [Josie's Cabin] (N 40.42568 x W 109.17458, elev. 5351 ft.). This site is located at the end of the park road to the site. The cabin is at the mouth of a wooded canyon and is still in pretty good shape. There are many large trees, mostly white poplar, around and down-slope from the cabin that provide protection from wind and moonlight. During both study periods we netted under the tree canopy around the cabin and at the small, spring-fed reservoir 50 yds SE of the cabin. A pond shown southwest of the cabin on the quad map does not seem to exist. When travel or weather forced us to find a place to set out nets on short notice, we commonly used this location as a "go to" site because of the easy access. During the former study, the site was worked on three evenings in 1989-90. A total of 10 bats of fours species was captured as follows: 1 Myev, 1 Myth, 4 Epfu and 4 Anpa. We netted there on six occasions in 2008-09, capturing a total of 89 bats of seven species as follows: 3 Myca, 6 Myev, 2 Myth, 7 Myvo, 4 Myyu, 2 Laci, 17 Epfu, 3 Coto and 45 Anpa.

Old Bassett Cabin, Zenobia Basin. See Bassett Cabin [= Camp], Old.

Pool Creek, 1 mi S Echo Park. See Pool Creek Petroglyphs.

Pool Creek at Echo Park (N 40.51675 x W 108.99480, elev. 5153 ft.). This site was worked in both the former and present study. It is at the first crossing above Echo Park over which water flows. It is approximately 0.5 mi by rd from the campground. Personnel netted here twice in the former study, capturing six bats of three species as follows; 2 Myca, 2 Myvo and 2 Myyu. In the present study we netted on four evenings, capturing 57 bats of seven species as follows: 7 Myca, 2 Myci, 3 Myev, 2 Myth, 3 Myvo, 37 Myyu and 3 Lano. Although we always had nets above and/or below the bridge, our most successful net was always the one spanning the upper side of the bridge at the lower end of a large, quiet pool. However, the bridge was reconstructed after our 2008 season and the pool disappeared. This is a riparian community dominated by boxelder. The water is seemingly permanent.

Pool Creek Petroglyphs (N 40.51205 x W 108.98783, elev. 5149 ft.). Specimens collected here in the former study are labeled Pool Creek, I mi S Echo Park. According to field notes, a few specimens from the former study labeled as being taken at Pool Creek Ranch on 12 August 1988 were actually captured here. During the former study the site was netted three times, yielding a total of 33 bats of seven species as follows; 2 Myci, 1 Myth, 9 Myvo, 1 Myyu, 1 Laci, 2 Lano and 17 Epfu. We know the crossing upstream of the petroglyphs was netted but old field notes don't remark on other net locations. In the present study we always placed at least two nets over water, one right below the petroglyphs, the other about 20 yards downstream. We variously placed other nets under the tree canopy, at the roadside and sometimes over water upstream to as far as the upper side of the crossing. We netted this location five times and captured a total of 42 bats of 10 species as follows: 2 Myca, 3 Myci, 3 Myth, 7 Myvo, 9 Myyu, 2 Laci, 7 Lano, 1 Pahe, 7 Epfu and 1 Anpa. The site is decidedly riparian, being dominated by boxelder. The water is permanent, but late in the season the narrow stream becomes overgrown by grassy vegetation.

Pool Creek Ranch [Chew Ranch] (N 40.50003 x W 109.00835, elev. 5361 ft.). This site was netted during both study periods. According to field notes, the specimens from the former study labeled as being taken here on 12 Aug 1988 were actually captured at the Pool Creek Petroglyphs site and are tallied with that location. On four occasions during the former

study we netted under trees in the yard and over Pool Creek west of the house. A total of 11 bats were captured, representing five species as follows: 1 Myev, 3 Myth, 3 Myvo, 3 Myyu, and 1 Lano. Since that time, the creek has rearranged itself and there are no longer nettable pools at the former locations. On 12 August 2008, nets in the yard under trees and a bright moon, produced only a young-of-the-year (read inexperienced) Myth. Whenever we were working any of the Pool Creek sites, we sought the daytime shade and breezes of the ranch yard to escape the heat and raging mosquitoes along lower Pool Creek and in the Echo Park Campground.

Pot Creek (N 40.63197 x 108.94005, elev. 5202 ft.). The bat specimens taken at this locality during the former study are labeled River mi 235, rt. bank Green R., Pot Creek. Three bats of two species (1 Lano, 2 Epfu) were shot there on 12 June 1982. In 2009, on a virtually perfect night for netting (temperature hovering near 70 degrees, no wind, no moon, plenty of insects), we captured only a single Epfu in one of two nets set near the beach and under the trees. Very few bats were seen foraging. We also set nets just north of camp in some small clearings but caught no bats. The site was dominated by boxelder.

Rippling Brook (N 40. 58629 x W 108.98327, elev. 5155 ft.). The specimen taken at this locality in the former study bear is labeled River mi 230.5, rt. bank Green R., Rippling Brook. The site is a sand bar dominated by boxelder. Despite the poetic name, the brook is dry. Only a single Epfu was collected (shot) at this locality in the former study. We never saw a bat flying at dusk on the evening of 13 July 2009. And, our nets, set both up the creek from camp and in camp in flyways produced only singles of Anpa and Myyu, the latter a female bearing a newborn pup attached to a nipple. The brief, morning float from Pot Creek put us ashore here at 1230h, in time to witness an afternoon-long drama across the river from camp. A bighorn ewe was leading her lamb across the cliff face to forage at the river's edge. The path included a jump of perhaps seven feet to a ledge above, which the lamb failed to reach after several attempts. With the ewe bleating from above the lamb tried to find alternate routes, including jumping in the river and swimming a short distance. Failing to scramble ashore between some large boulders, it turned back. Reaching the shore again, it was mightily troubled by the water in its ears and nose. Another attempt up the path produced a fall, and the lamb lay down. It later moved into the shade. The ewe seemed then to just abandon the young, moving off to forage and rest on a sandbar 40 yds downriver. At 1600h she worked her way back to the lamb over a period of 45 minutes. They foraged together until 1750h when the ewe started back along the same route. From above the jump the lamb failed to make, the ewe bleated. The lamb tried and made the jump this time. Just above the jump, the pair seemingly bedded down for the night. They were shortly joined by another ewe. All were gone the following morning.

River mi 10.2, rt. bank Yampa R., Laddie Park. See Laddie Park.

River mi 20, lt. bank Yampa R., Harding Hole. See Harding Hole.

River mi 24, rt. bank Yampa R., Big Joe CG . See Big Joe Campground.

River mi 34, rt. bank Yampa R., Haystack Rock [CG]. See Haystack Rock Campground.

River mi 228.5, lt. bank Green R., Alcove Brook. See Alcove Brook.

River mi 230.5, rt. bank Green R., Rippling Brook. See Rippling Brook.

River mi 235, rt. bank Green R., Pot Creek. See Pot Creek.

Sand Creek. On our first trip to the monument, two Myvo erroneously reported in field notes as being taken here on 10 June 1982 were actually captured at Pool Creek at Echo Park.

Snow Reservoir (N 40.5157203 x W 109.0588456, elev. 7369 ft.). This reservoir is so labeled because of the proximity to the Snow Cabin shown on our quad map. It may have another local name. Access is from Chew/Snow turnoff from the Harpers Corner Road. We scouted the reservoir on 7 August 2008 with the intention of netting it the following night. We found the water surface shaped like an hourglass, paralleling the length of the dam, approximately 40 x 60 ft in dimensions. However, at that time there was a recently-dead cow on the margin of the water. We subsequently reported this occurrence and made another visit to the location on 11 August when the water level was down a little, suggesting that without rain the water might not last out the month. The decomposing cow had been dragged from the water's edge but was still present so we elected not to work the site until the following summer. On 9 July 2009 the water surface was paced off at 75 x 150 ft. That evening we captured 27 bats of seven species as follows: 2 Myca, 2 Myci, 2 Myev, 9 Myvo, 1 Myyu, 3 Lano and 7 Coto. This site was perhaps the most unpleasant place we worked in the monument. We coughed and sneezed for days after inhaling what we assumed were particulates from the soil and dry cow feces.

Split Mountain. (N 40.4467281 x W 109.2533534, elev. 4788 ft.). This site is on the Green River near the Split Mountain Campground, under cottonwoods and over eddies just upstream of the takeout ramp. We debarked here after our 2009 float down the Green River from Lodore. Like the Morris Ranch it could be accessed over an all-weather road, and on short notice, when weather or time limited going elsewhere. We netted here three nights during the present study, capturing five bats of four species as follows: 1 Myev, 2 Myyu, 1 Epfu and 1 Coto.

Vermillion Creek. (N 40.7565777 x W 108.8318895, elev. 5464 ft.). The Laci taken here during the former study is labeled Vermillion Creek, ca. 3.5 mi N[E] Lodore Campground. This site is 3.5 straight-line miles NE (055 deg) from the position of the Lodore Ranger Station marked on the quad map. The distance by road is approximately 6.5 miles. The netting location is at one of the sites marked "falls" on Vermillion Creek on the quad map. The shallow pools in the bedrock along a 200 ft reach just above the bridge were netted. The habitat is riparian, dominated by a few cottonwoods. There is spikerush, salt cedar and clover on the stream margins. Sage occupies the bench above the stream and there is juniper on the hillsides. The water may be permanent here, but the abundance of water and bat forage habitat downstream to the Green River precludes effective netting at this locality. Five bats including 3 Myci, 1 Myev and 1 Laci were captured on one night during the present survey.

Warm Springs Rapids. At Yampa River mile 4.3, this Class 4 rapid flipped one of our rafts during both the present and former studies.

Zenobia Basin. Access to the basin is WNW from Maybell on blacktop Highway 318 to the intersection with graveled Road 12 (N 40.6600324 x W 108.5916586), WSW to the intersection of Road 10 (N 40.6381010 x W 108.6836411), S to the intersection of Road 116 (N 40.5857601 x W 108.6726521), also known as Douglas Mountain Boulevard (it is anything but a boulevard). Road 116 eventually goes all the way to the fire lookout on Zenobia Peak, but there are two turnoffs germane to both the former and present surveys. The first is the trail to Five Springs and the Maddox Place that were visited in the earlier study. This turnoff goes to the right (north) at N 40.5976157 x W 108.8298277. The second junction of importance (N 40.5980015 x W 108.8494097) is the two-track that leaves Road 116 to the left (west) for

Zenobia Basin. The distance from this point to Zenobia Basin is at least eight miles over a road that only a high-clearance, 4WD vehicle can pass. Permission must be obtained through the Park Service to cross private land along the way. The round-trip distance from Highway 318 to Zenobia Basin and back is no less than 56 miles. The nearest fuel and provisions are at the Browns Hole store to the northwest on 318 or Maybell to the southeast on 318.

Appendix 2. Species accounts for bats known to occur in Dinosaur National Monument.

These comments provide short overviews of the distribution of the species, general habitat preferences, as well as more specific information on distribution and abundance at DINO in both the earlier and more recent study. The comments on reproduction are in the context of the annual reproductive cycle for most North American bats and are reported by day and month, regardless of year. The sequence for females in the north temperate summer is gravid (enlarged abdomen, young often detected by palpation, female seemingly about to give birth), lactating (having given birth and actively suckling young; milk can be easily expressed from the nipple) and post-lactating (having nursed young recently as shown by enlarged nipple, no hair around nipple). Young-of the-year bats were weaned recently (phalangeal epiphyses not fully fused). Any one of these events is evidence that the species is reproducing in the region. Scrotal males are evidence that another reproductive cycle is about to start or is under way.

Myotis californicus (California myotis)

The California myotis occurs throughout most of Utah, except some areas in northern and central parts of the state (Oliver 2000), and much of western Colorado (Fitzgerald et al. 1994). In the Southwest and Intermountain West, the California myotis is common from lower elevations in deserts and riparian habitats to higher elevations generally below ponderosa pine woodlands. Between 1982 and 1990 the California myotis was documented from 8 of 26 localities in DINO, ranging from 5155ft to 7697ft. It was most common below 6478ft (22 of 24 captures). It made up 5.1% of total captures and occurred in 20% of netting events in the earlier study. In 2008-2009 we captured it at 10 of 23 sites, ranging in elevation from 5124ft to 7363ft. It was most common below 5351ft elevation (15 of 21 captures) and comprised 2.3% of total captures and occurred at 25% of netting events. Its abundance ranking was sixth in the early work and eleventh in 2008-2009. A young-of-the-year was taken on 1 August.

Myotis ciliolabrum (Western small-footed myotis)

The Western small-footed myotis likely occurs statewide in Utah and over most of Colorado, and in montane areas is typically found at higher elevations forested by ponderosa pine or mixed coniferous forest. In the earlier study we took only 17 individuals from 6 of 26 localities ranging in elevation from 5138ft to 7697ft. It represented 3.6% of total bats and occurred at about 18% of net events. In 2008-2009 we took 64 individuals (7% of all captures) at 10 of 23 sites (prevalence = 35%). Fifty-nine of 64 captures came from above 5364ft. The reason for its seeming abundance in the recent study is unknown. Its abundance ranking was seventh in both studies. A lactating female was netted on 17 July. We observed young-of-the-year on 3 and 4 August.

Myotis evotis (Long-eared myotis)

The Long-eared myotis is known throughout Utah (Oliver 2000) and montane areas of Colorado (Fitzgerald et al. 1994). It is known from a wide range of habitats, including lowland riparian habitats, sagebrush, piñon-juniper woodlands, ponderosa pine forests, and mixed coniferous forests. Between 1982-1990 we took 41 individuals from 11 of 26 localities with 38 of those from elevations above 6478ft. It represented almost 9% of total captures and occurred

at nearly 27% of netting events. In 2008-2009 we captured 121 (13%) and 101 of those came from sites above 6478ft. Long-eared myotis occurred at 16 of 23 sites and 53% of net events. Its abundance ranking was fifth (1982-1990) and third (2008-2009). Gravid females were netted on 6 and 7 July. Lactating females were captured in the period 14 July to 5 August. Post-lactating females were taken on 3 and 4 August. Young-of-the-year were observed on 4 and 8 August. Scrotal males were taken from 16 July to 5 August.

Myotis lucifugus (Little brown bat)

The Little brown bat occurs over much of Utah and Colorado although it appears to be absent from much of southern Utah. In southern Colorado it is apparently replaced by the Occult myotis (*M. occultus*). This species appears to have a wide habitat tolerance and is a common bat in urban environments as well in as more natural habitats, especially at upper elevations. In the earlier study we took 16 individual Little brown bats, almost exclusively from Massey Reservoir (6817ft) with only one from Canyon Overlook (7697ft). They represented 3.4% of total captures and occurred in 8% of net events. In 2008-2009 we took 10 individuals, representing barely 1% of total captures, from three localities (Massey Res., Massey Pond [6872ft], and Dry Woman Res. [6481ft]). Its abundance ranking was eighth and thirteenth. We took a scrotal male on 4 August.

Myotis thysanodes (Fringed myotis)

The Fringed myotis occurs mainly in southern and eastern Utah and is absent from northwestern Utah; it is known from montane areas of Colorado. It is listed as a species of concern in Utah although unique threats are unclear. It occurs from deserts to mixed coniferous forests but may be somewhat more common at lower elevations (Mollhagen and Bogan 1997). Between 1982-1990 we captured 7 individuals (1.5% of all captures) from 5 of 26 sites, all below 6817 ft, and in only 10% of net events. In 2008-2009 we took 24 fringed myotis, representing 2.6% of all captures and with a prevalence value of 29.4%, meaning the species was much more widespread than earlier. In the recent work we took it at 10 of 23 sites ranging from 5124ft to 7423ft. Eleven of the animals came from sites above 6481ft. and 13 below that elevation. Its abundance ranking was eleventh and tenth. This bat is very maneuverable; it may commonly elude capture in mist nets and may be more widespread in the park than the numbers indicate. Gravid females were seen on 8 July. Lactating females were taken on 11 July. Young-of-the-year were captured between 4 and 12 August. A scrotal male was taken on 4 August.

Myotis volans (Long-legged myotis)

The Long-legged myotis occurs throughout Utah and Colorado in a variety of habitats. Although it is known from low elevations in desert and riparian habitats (at least seasonally) to high elevations in ponderosa, aspen, and mixed coniferous forests, most records are from habitats in sagebrush to higher elevations in montane forests. In the Henry Mountains of southeastern Utah, Mollhagen and Bogan (1997) reported that their captures of *M. volans* were below 2,012m in May and above 2,335m in June, July, and August, suggesting that this species migrates to

upper elevations in summer. In the earlier study we took 55 individuals (almost 12% of the total) from 12 sites (prevalence = 40%). It seemed to be most common at sites from 6478ft to 6817ft. In 2008-2009 we took 84 long-legged myotis (9.2% of total) from 11 of 23 sites ranging in elevation from 5136ft to 7423ft (prevalence = 45%). Sixty-four of the individuals came from sites above 6478ft. Its abundance ranking was third and fifth. We observed gravid females in the period 4 to 17 July. Lactating females were captured from 16 July to 5 August. Three post-lactating females were netted on 3 August. A young-of-the-year was recorded on 1 August. Scrotal males were captured on 3 and 4 August.

Myotis yumanensis (Yuma myotis)

The Yuma myotis occurs across much of both Utah and Colorado in a variety of habitats from deserts to mixed coniferous forests. In Arizona and New Mexico this species commonly is associated with lower elevations along permanent watercourses (Findley et al. 1975, Hoffmeister 1986). This species forages over water and may be most abundant along the Yampa and Green rivers although at Capitol Reef NP we have seen them foraging above small tinajas and at Canyonlands NP we saw them in the late afternoon in a small plunge pool where they continued their activities until dusk, oblivious to our presence and easily avoiding our nets. At DINO we observed individuals foraging and hawking insects above the water surface at a small pool at Pool Creek at Echo Park on several occasions. In 1982-1990 we captured 52 individuals (11% of total) at 10 sites ranging from 5138ft to 7697ft (prevalence = 30%). In 2008-2009 we captured 91 Yuma myotis (10% of total) at 15 sites from 4788ft to 7423ft (prevalence = 57%). Its abundance ranking was fourth in both studies. Our numbers are biased by the large number (32) we captured one night at Pool Ck. at Echo Park; most of these animals were females, presumably gravid. Gravid females were recorded from 4 to 11 July. Lactating females were captured on 13 and 14 July 2009. The individual from the former date was caught with her new pup attached to a nipple. A post-lactating female was recorded on 8 August. We observed a scrotal male on 4 August.

Lasionycteris noctivagans (Silver-haired bat)

The Silver-haired bat occurs throughout much of Utah and Colorado, primarily in the mountains, and then as almost-exclusively populations of males. Most Utah records are of males taken in mountainous areas (Mollhagen and Bogan 1997). This species is known to migrate and hibernate (Jones et al. 1983), with both sexes inhabiting southern and eastern parts of the United States during winter. Cryan (2003) mapped migratory patterns of *L. noctivagans* at the continental scale from specimens housed in museums, and he observed that spring movements in western parts of its distribution were to the north. In the Southwest, there is no evidence that females bear and raise young in the region (Findley et al. 1975, Hoffmeister 1986, Oliver 2000, Cryan 2003). Mollhagen and Bogan (1997) captured only males in the Henry Mountains of southeastern Utah and surmised that males were regular summer residents at upper elevations in the mountain range. In 1982-1990 we captured 69 (15% of total) with 64 of those coming from sites above 6478ft elevation. They occurred at 8 sites (prevalence = 27%). In 2008-2009 we captured 187 animals (21% of the total) at nine sites, with all but 10 animals coming from sites above 6478ft (prevalence = 37%). Silver-haired bats were especially abundant at Haystack Rock Reservoir where on two occasions in different years we took over 40 individuals. Its abundance

ranking was second and first in the two studies. Scrotal males were captured between 4 July and 3 August.

Lasiurus cinereus (Hoary bat)

The Hoary bat is a summer resident in Utah and Colorado, and like the silver-haired bat, most individuals are male. Monthly distribution maps of Hoary bats at a continental scale demonstrate that most winter records are from southern California and Mexico (Cryan 2003) and that in summer females are in the eastern US. This species was a rare summer resident in the Henry Mountains (Mollhagen and Bogan 1997). In the early study we captured 41 individuals (9% of total) from 9 of 26 sites ranging in elevation from 5138ft to 7697ft with 23 of the individuals occurring above 6478ft prevalence = 33%). In 2008-2009 we captured 32 (3.5% of total), one of few species for which we caught fewer animals than in 1982-1990. Reasons for this are unclear although some studies have shown that this species may be more affected by wind farms than some other species (Cryan 2008, Cryan and Brown 2007). In our work at DINO the species occurred at 8 localities from 5226ft to 6872ft elevation (prevalence = 28%). Its abundance ranking was fifth and eighth in the two studies. Two scrotal males were netted on 5 August.

Parastrellus hesperus (Canyon bat)

The Canyon bat (formerly Western pipistrelle) occurs across lower elevations in much of Utah and western Colorado. This species has not been documented in extreme north-central and northwestern parts of Utah and it barely occurs in adjacent Wyoming. In New Mexico, Findley et al. (1975) reported 98% of specimens came from grasslands, deserts, and woodlands (piñon-juniper and oak). In Arizona, Hoffmeister (1986) reported individuals from a variety of habitats, including fir-spruce forests, but commented that western pipistrelles were never far from rocky canyon walls, cliffs, or rocky outcrops. In our work at Canyonlands NP the western pipistrelle was the most frequently captured species; we captured a total of 911 individuals, 550 in 2004 and 361 in 2005. In 1982-1990 at DINO we took only two Canyon bats, one at river level across from Haystack Rock and one at Haystack Rock Res. The species accounted for only 0.4% of total bats and had a prevalence value of 3.3%. In 2008-2009, we captured 7 individuals (0.8%) from 4 of 23 sites ranging from 5136ft to 6481ft (prevalence = 9%). Its abundance ranking was thirteenth and fourteenth in the two studies. We recorded no observations on reproduction for this species.

Eptesicus fuscus (Big brown bat)

The Big brown bat occurs across Utah and Colorado in a variety of habitats from deserts to coniferous forests and is one of the most common urban bats In the Henry Mountains of southeastern Utah, it was the most commonly captured species (Mollhagen and Bogan 1997). In 1982-1990 we captured 112 Big brown bats (24% of total bats) from 13 sites that ranged from 5096ft to 7697ft (prevalence = 53%). In 2008-2009 we took 148 individuals (16% of total) from 10 sites between 4788ft to 7160ft (prevalence = 45%). Its abundance ranking was first and second in the two studies. Scrotal males were captured between 16 July and 4 August. Gravid females were only noted on 4 July, post-lactating females on 1 and 2 August, and young-of-the-year were netted on 3 and 10 August.

Euderma maculatum (Spotted bat)

The Spotted bat occurs across much of Utah and western Colorado, but as in many western states, its distribution is patchy and abundance is uncommon (Hoffmeister 1986, Fitzgerald et al. 1994, Perry et al. 1997, Geluso 2000). It is most common at higher elevations, typically p-j forest and higher although there are some lower-elevation records, including some from cities. This species may be more abundant than capture rates in mist nets suggest because *E. maculatum* tends to forage high above the ground (Wai-Ping and Fenton 1989). In the Henry Mountains, Mollhagen and Bogan (1997) captured only a single gravid female, although the species was heard elsewhere. Navo et al. (1992) documented that spotted bats were locally common at five locations in canyons of the Green River at DINO. In our initial work at DINO we captured 5 individuals, the first to be taken since Finley and Creasy (1982) captured one from nearby Browns Park NWR. These five animals represented barely 1% of total bats and came from only two sites: Massey Reservoir and Haystack Rock Reservoir (prevalence = 6.7%). In 2008-2009 we captured 11 (1.2%) animals from 3 sites: Haystack Rock Res., Dry Woman Res., and Bear Draw Res. (prevalence = 11.8%). Its abundance ranking was twelfth in both studies. There is a salvaged specimen in MSB from Lodore Ranger Station, found dead and picked up by Virginia Smith in June 1994. Lactating females were captured on 16 and 17 July 2009. A scrotal male was netted on 17 July.

Corynorhinus townsendii (Townsend's big-eared bat)

Townsend's big-eared bats occur throughout much of Utah and Colorado from deserts to ponderosa pine forests. Throughout the Southwest, it commonly inhabits caves and mines which are used as day, night, and maternity roosts (Findley et al. 1975, Hoffmeister 1986, Oliver 2000). In the earlier study we captured 14 individuals (3% of the total) at 5 of 26 sites from 5249ft to 7697ft elevation (prevalence = 10% of events). More recently we took 29 big-eared bats (3.2% of total) at seven sites from the lowest (4788ft) to the highest (7423ft) elevations we worked (prevalence = 19.6). Its abundance ranking in the two studies was ninth. Although we captured Townsend's big-eared bats relatively infrequently, we suspect this species is more common in the region but individuals elude capture in mist nets (Findley et al. 1975, Oliver 2000) due to nimble and versatile flight (Hoffmeister 1986). Gravid females were recorded on 8 July and a lactating female was captured on 16 July; post-lactating females were taken on consecutive nights, 1-3 August, at three different locations. Young-of the year were observed between 3 and 8 August. Scrotal males were captured on 17 July and 3 August.

Antrozous pallidus (Pallid bat)

The Pallid bat occurs across most of Utah and Colorado and is fairly common in low-elevation arid regions such as deserts and sagebrush habitats. In much of the Southwest they frequently co-occur with California myotis and the Canyon bat in arid areas. In our earlier work we captured 13 (2.8%) pallid bats at eight sites ranging from 5138ft to 7160ft in elevation (prevalence = 17%). In 2008-2009 we took 78 (8.6%) bats of this species at 8 of 23 sites ranging in elevation from 5111ft to 7160ft (prevalence = 33%). We took large numbers (28 and 13) of pallid bats at Morris Ranch in August 2008 and had more modest captures of two to six captures at several other sites. It ranked tenth and sixth in the two studies. A lactating female was

observed on 17 July. Post-lactating females were captured 1 and 10 August. Young-of-the-year were taken between 1and 10 August. Scrotal males were recorded between 4 July and 10 August.

Tadarida brasiliensis (Mexican free-tailed bat)

Records for the Mexican free-tailed bat are thinly scattered across both Utah and Colorado. The species typically occurs in arid habitats below ponderosa pine forests. Males make fairly long-distance movements (Genoways et al. 2000) and in some cases occurrence of males is followed by establishment of maternity colonies, as in Colorado (Fitzgerald et al. 1994). In the Henry Mountains, Mollhagen and Bogan (1997) captured 50 individuals, 44 of which were captured on 19 May 1996 and may have been migrating individuals; eight of the bats were females, the others were males. We did not capture any bats of this species in the earlier study but acquired a salvaged specimen from the Quarry housing area in 1985. In 2008-2009 we captured two individuals (0.2% of total; abundance fifteenth), one from Cub Creek and one from Dry Woman Reservoir. It would be informative to listen for this species along the Green and Yampa rivers using ultrasonic detectors. This species may be more abundant in the park and probably drinks over larger sources of water than we netted. We recorded no observations on reproduction for this species

Nyctinomops macrotis (Big free-tailed bat)

The big free-tailed bat is known only from a relatively few captures in Utah and Colorado. Individuals have been captured in deserts, lowland riparian areas, and montane forests (Oliver 2000). Maternity colonies of big free-tailed bats are known from Arches National Park and Natural Bridges National Monument, (Haymond et al., Bogan et al., unpublished reports to NPS). There is one record of the big free-tailed bat from DINO, a salvaged animal from the Dinosaur Quarry, found dead and picked up by W. Dye on 9 Dec 1996.

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