THE ECOLOGICAL DISTRIBUTION OF MAMMALS IN COLORADO NATIONAL MONUMENT, MESA COUNTY, COLORADO

By

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I. INTRODUCTION

This study is the result of a critical analysis of the distribution of the mammalian fauna of Colorado National Monument, Mesa County, Colorado, with emphasis on habitat selection and vertical stratification.

The National Park Service, with a conservation principle based on preserving natural history areas in an undisturbed ecological status as far as possible, has much to contribute to biology. Not only can undisturbed study areas be found at present, but such areas can be studied with the assurance that they will remain in such condition allowing researchers to return much later for comparative analyses.

Colorado National Monument was chosen as the study area because of the author's association with it as Chief Park Naturalist for almost five years, and because it was situated where both altitudinal differentiation and ecological factors were logistically convenient for study purposes. A secondary objective was to provide useful information to assist Monument personnel in the administration of the area. This was a strong factor in the initiation of the study and was a determinant in the study area selection.

The importance of the study extends beyond the boundaries of Colorado National Monument and should be useful to students of the Mesa Country and western Colorado fauna because of a general lack of comprehensive mammal data from the area. Most of the useful taxonomic information on the mammals was derived from two old and incomplete works that treat of the entire state. A few restricted and abbreviated works

were very helpful but were not inclusive enough to cover the study area. Most recent studies of western Colorado deal with higher-altitude life forms. A few recent publications deal with ecological relationships of game mammal species and are excellent references.

Field work to accomplish the proposed problem was mainly a survey of the extant mammals of the Monument. Simultaneously, an analysis was made of habitats and notes recorded on basic ecological factors. The former was accomplished through a series of field collections utilizing several collection techniques, by observations, and review of Monument records and files. An extensive search through known and available literature was made to seek out additional records of both living and extinct mammal species.

Data were compiled and analysed and specimens were distributed in several logical depositories. Most field notes were retained by the author, the more formal data were sent to Colorado National Monument, and representative collections of specimens were placed in the museums of Colorado National Monument, Oklahoma State University, and the University of Colorado.

Many people and several institutions have aided with this study and the author would like to acknowledge the assistance of as many as possible. Special appreciation is extended to Dr. Bryan P. Glass, Graduate Committee Chairman and principal advisor. The Graduate Committee members, Doctors Roy W. Jones, William H. Irwin, F. M. Baumgartner, and D. E. Howell, are not the least of those to whom appreciation is expressed. The National Park Service facilitated the study and provided many of the necessary factors of the study. Specifically, the support of Superintendent F. G. Bussey and his Monument staff, and Midwest

Regional Chief of Natural History, Edwin C. Alberts, is acknowledged. Dr. Hugo G. Rodeck made the facilities and museum collections of the University of Colorado Museum available to the study and special appreciation is extended to him. The work on the Monument's herbarium by Dr. William A. Weber, Curator of the Herbarium, University of Colorado Museum, is acknowledged here because of its significance in plant identification. Appreciation is due Dr. Richard G. Beidleman, Colorado College, who made available the Edward Royal Warren mammal collection. Dr. Richard H. Manville, United States National Museum, kindly loaned specimens from the Biological Survey Collections. Special appreciation is extended to Mr. Clarence J. McCoy, Jr., for his able and untiring assistance in facilitating field work during peak visitor months in the Monument, for timely transportation of materials between the Monument and Boulder, and for simplifying many curatorial problems.

COLORADO
NATIONAL MONUMENT
COLORADO

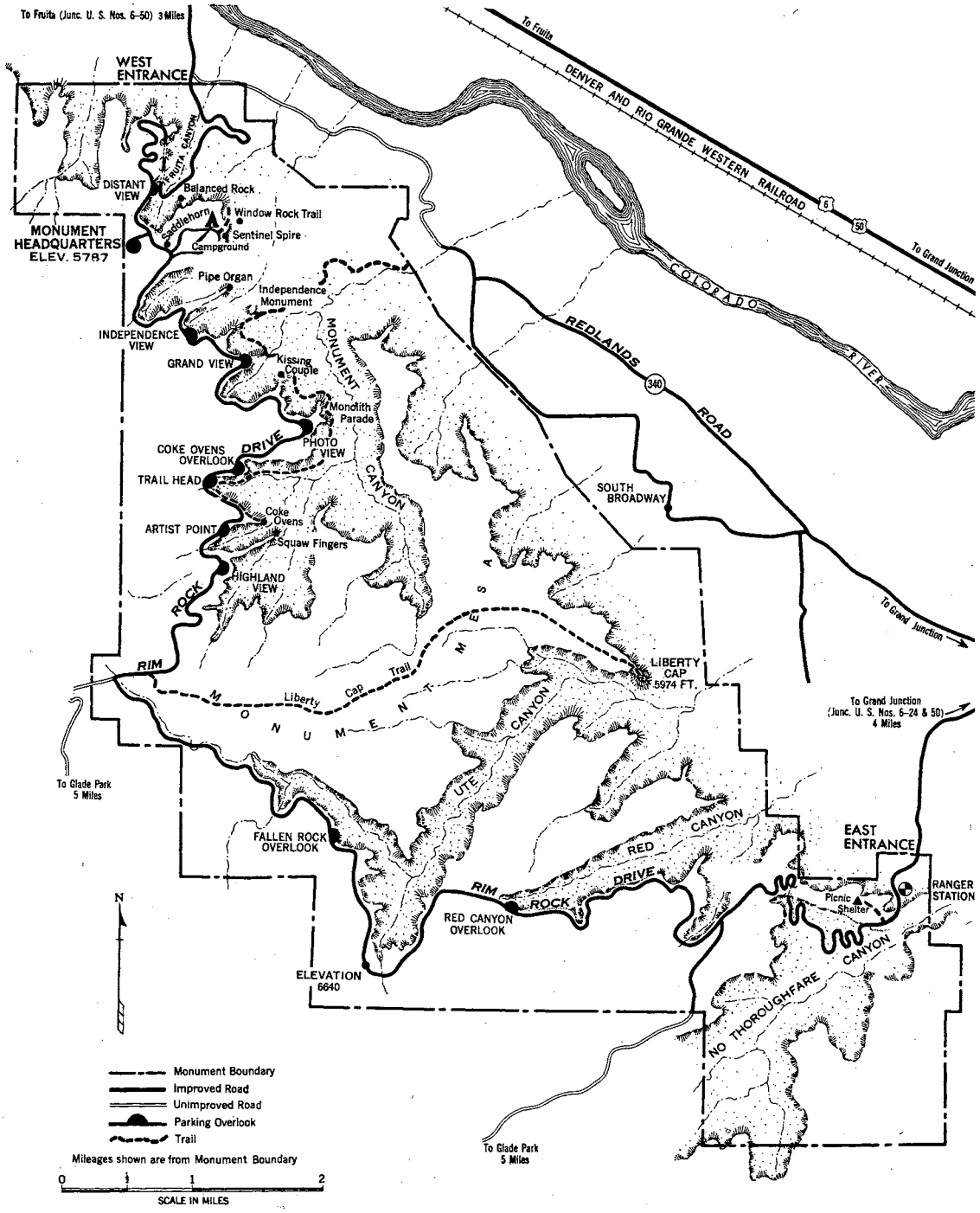

Figure 1

II. COLORADO NATIONAL MONUMENT

Colorado National Monument consists of 17,606.76 acres located in west-central Colorado, entirely within the boundaries of Mesa County. It is administered by the Federal Government with proprietary jurisdiction. The Monument contains about 23 miles of primary and about 10 miles of secondary roads. There is an administration area located on the northwest end which includes a utility area, visitor center, employee housing and campground. A ranger station is situated near the east entrance to the Monument. The present administrative staff numbers ten full-time and about twenty-five seasonal employees.

The area was proclaimed a National Monument by President William Howard Taft on May 24, 1911, under Public Law 34, Stat. 225, dated June 8, 1906, (Sullivan, 1945). The proclamation was the result of a petition made to the President, through the Secretary of the Interior, by local citizens who became interested in having the area set aside as a "National Park." An eccentric by the name of John Otto was largely responsible for initiating the movement that finally resulted in the petition.

The Monument was administratively dormant for many years after establishment, with only John Otto serving as a "dollar-a-month" custodian to care for the area and protect it according to the establishing act. Few improvements were made, but eventually some fencing was constructed and a well dug. The Colorado Game and Fish Department assisted John Otto in protecting the Monument's wildlife. Colorado National Monument

was administered by the now-defunct General Land Office prior to the establishment of the National Park Service on June 19, 1916.

The depression years of the 1930's brought the emergency relief organizations into Colorado National Monument and with them came the Monument's first full-time resident employees. Roads, trails, employee housing, utility area, campground, and administration buildings were constructed. The World War II years saw deterioration and out-dating of the same facilities.

An ever-increasing visitor-use load, combined with deteriorated existing facilities, demanded a re-evaluation of National Park Service areas with emphasis on renovation of existing facilities and construction of new ones. Part of that study was entitled MISSION 66, which was a ten-year plan to upgrade National Park facilities. Colorado National Monument, under the MISSION 66 program, has received a visitor center with space for study collections and exhibits. This allows biological specimens to be properly stored and provides for personnel to manage and curate them. Administration facilities, employee residences, campground improvements, and road reconstruction are also being provided.

Colorado National Monument suffered only minor damages prior to its establishment as a protected area in 1911. Much of the land was not injured by grazing, mining, or timbering. The National Park Service policy of the protection of all wildlife species has led to survival of some predaceous and rodent species whose existence is deemed unnecessary or competitive by the general public. The same policy precludes introduction of exotic plant and animal species and with only a few exceptions has been closely followed in Colorado National Monument. A few of the more cosmopolitan exotic species have become established in

the area but with little apparent impact on the native biota. Those exotics include starlings, house mice, Russian Thistle and Tamarisk, and possibly the bison, whose status as a native Monument species is questionable. There are occasions when feral domestic mammals such as dogs, cats and livestock cause local depredations on native biota, but diligent attention by park rangers usually eliminates these soon after detection.

Geology and Topography

The Colorado National Monument is a part of the northeast edge of the Uncompahgre Plateau overlooking the Grand Valley of the Colorado River. Across the Grand Valley, to the north, are the Book Cliff Mountains rising to about 8000 feet in elevation. The Colorado River traverses the lower Grand Valley after flowing through DeBeque Canyon, a gap between the Book Cliffs and the 10,000-foot Grand Mesa. The Colorado and Gunnison Rivers merge at Grand Junction.

The northeast edge of the Uncompahgre Plateau is partly composed of deep, red sandstones lying on crystalline Precambrian rocks. The sediments have been dissected by erosional forces so that today, deep box canyons penetrate the softer formations to their hard base rocks and in some places even into these. Three sandstone layers of varying thicknesses provide much of the spectacular rim and canyon scenery which the Monument was established to preserve. The Wingate Sandstone (Triassic) is an aeolian formation about 350 feet deep and comprises most of the sheer canyon walls. The Kayenta Sandstone (Triassic) is a highly stratified, weathering-resistant formation that composes some of the canyon rims and forms a protective cap on many of the monoliths. The Entrada Sandstone (Jurassic) is an unjointed, smooth-surfaced sandstone

of aeolian origin that forms cliffs behind the head of most of the canyons and in places joins the Kayenta and Wingate Sandstones to form the deepest canyon walls of the Monument. The highest elevations of the Monument consist of the deep-layered Morrison Formation (Jurassic) and the Dakota Formation (Cretaceous). The Morrison Formation is composed of multicolored layers of clays, bentonites, shales and sandstones and is world-famous for its fossil dinosaur remains. Grand Junction is the type locality for Brachiosaurus, one of the largest known dinosaurs.

The Uncompahgre Uplift is a part of the more extensive Colorado Plateau. During late Pliocene the ancestral Colorado River altered its route from Unaweep Canyon to a new course down what is now called the Grand Valley (Lohman, 1961). The Colorado River, enforced with heavy Pleistocene glacial runoff from the high San Juan Range, excavated the soft sedimentary formations from its new basin exposing the hard formations of the Uncompahgre Plateau, Book Cliffs and Grand Mesa. It also exposed the ten-mile Redlands Fault and the granite, gneiss and schist escarpment along the northeast side of the Plateau.

Today, the Grand Valley floor is composed mostly of soft, deep Mancos Shale which is still being excavated by the Colorado River. The Grand Valley extends from eastern Utah to near Rifle, Colorado. The Gunnison River Valley, joined by the Uncompahgre River Valley at Delta, extends eastward into Montrose and Delta Counties and is geologically very similar to the Grand Valley. The Uncompahgre Plateau extends about 80 miles east-west and about 35 miles north-south. Further south, the Plateau rises to over 9000 feet in altitude. Across the Grand Valley to the north, the Book Cliffs have also resisted the downward cutting of the river and there the Mesaverde, Green River, and Wasatch Formations

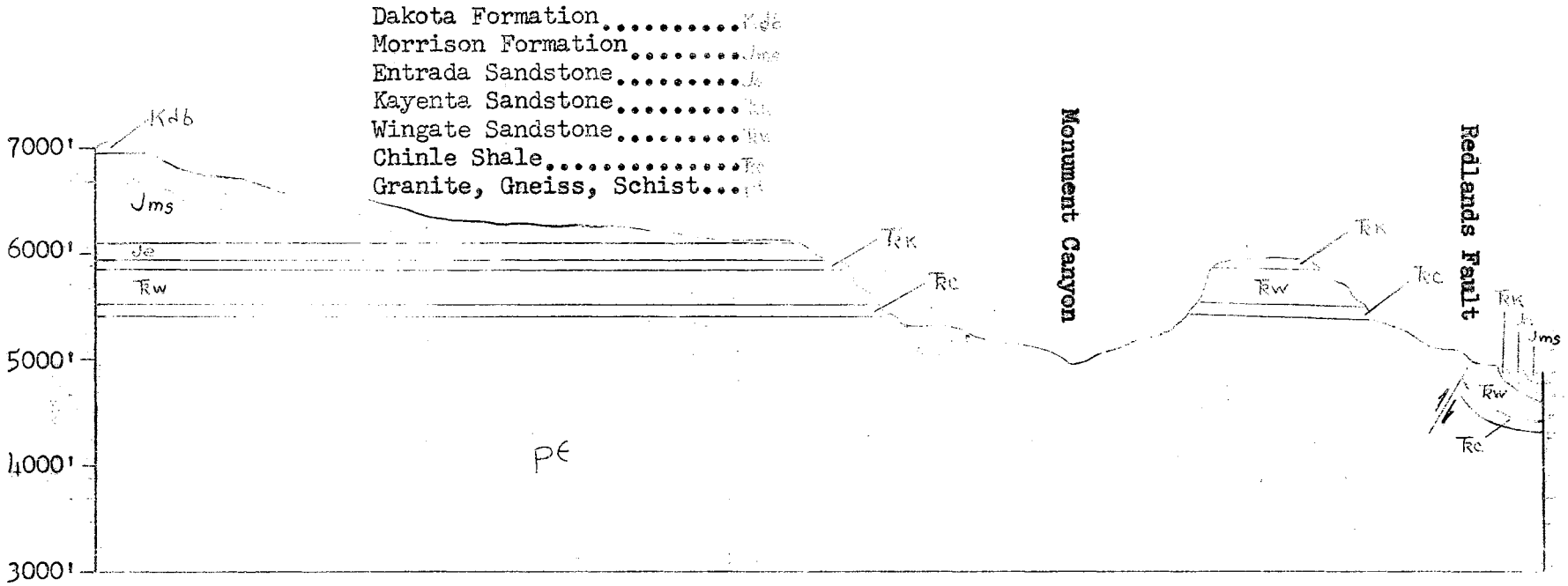

Fig. 2 Cross section of Colorado National Monument through Monument Canyon. From Lohman (1963).

provide precipitous exposures.

The altitudinal differentiation is about 2530 feet from the Colorado River near Fruita (4500 feet) to the highest point in the Monument (7030 feet). There is about an 1100-foot difference between the base of the Precambrian escarpment and the canyon rim in the vicinity of the Saddlehorn. The top 500 feet of the Precambrian rocks are exposed on the north side of the Monument, above which some 450 feet of sediments form the canyon walls, monoliths, and canyon rims. The deep Morrison and Burro Canyon Formations compose the upper elevations.

Decomposition of sediments has resulted in a shallow, sandy, and slightly alkaline soil over most of the Monument, but in the Grand Valley soils are composed mostly of decomposed shales and are deeper and more alkaline.

Ecology of Colorado National Monument

Most of the altitudinal differentiation is in abrupt steps as indicated in the previous section on geology of the Monument. Despite the variation of altitude, most of the Monument is within the Upper Sonoran Life Zone as described by Warren (1942). The Transition Life Zone is a minor component in the Monument with very restricted areas either at higher altitudes or existing as intrusions of transitional vegetation types into sheltered sections of the canyons.

Upper Sonoran vegetation grows over most of the Monument departing little from typical Great Basin forms of low precipitation. (See Figures 3 and 4). In this semi-desert situation the following associations have been chosen as representing the broader, more significant ones for the basis of this study.

Greasewood

Dominant vegetation is shrubby Sarcobatus vermiculatus indicating a high soil alkalinity and usually precipitation of 10 inches or less (Harrington, 1954). Understory plants include Atriplex canescens, Artemis tridentata, and Chrysothamnus sp. The most common grasses are Distichlis stricta, Sporobolus airoides and Bromus tectorum. Greasewood concentrations are mostly at the lower elevations and are prominent in the No Thoroughfare Canyon near the east entrance.

Sagebrush

Artemisia tridentata is one of the most abundant plants in the Monument. Not only does it grow naturally in most of the area, it has been transplanted to stabilize road cuts and fills on the Rim Rock Drive. The species A. tridentata is by far the most common one but A. frigida and A. spinescens are also found. Sagebrush grows into mature sagebrush stands where it has been left undisturbed for long periods. Mature sagebrush stands can be found near the Upper Fruita reservoir and in Upper Ute Canyon where plants may grow to heights over 10 feet. Growing in association with sagebrush are Atriplex sp., Salsola kali, Chrysothamnus sp., and occasionally Juniperus osteosperma. Grasses include Agrypyron smithii, Agropyron dasystachyum, Oryzopsis hymenoides, Sitanion hystrix, Poa fendleria, and Koeleria sp. Sagebrush in the Monument is heavily browsed by deer, bison and wapiti.

Grasses appeared to be most abundant in areas of old disturbances and in such areas as exist along the Liberty Cap Trail on Monument Mesa where overbrowsing by large winter concentrations of deer have destroyed sagebrush. Wapiti and bison are dependent upon the grasses for summer and winter range.

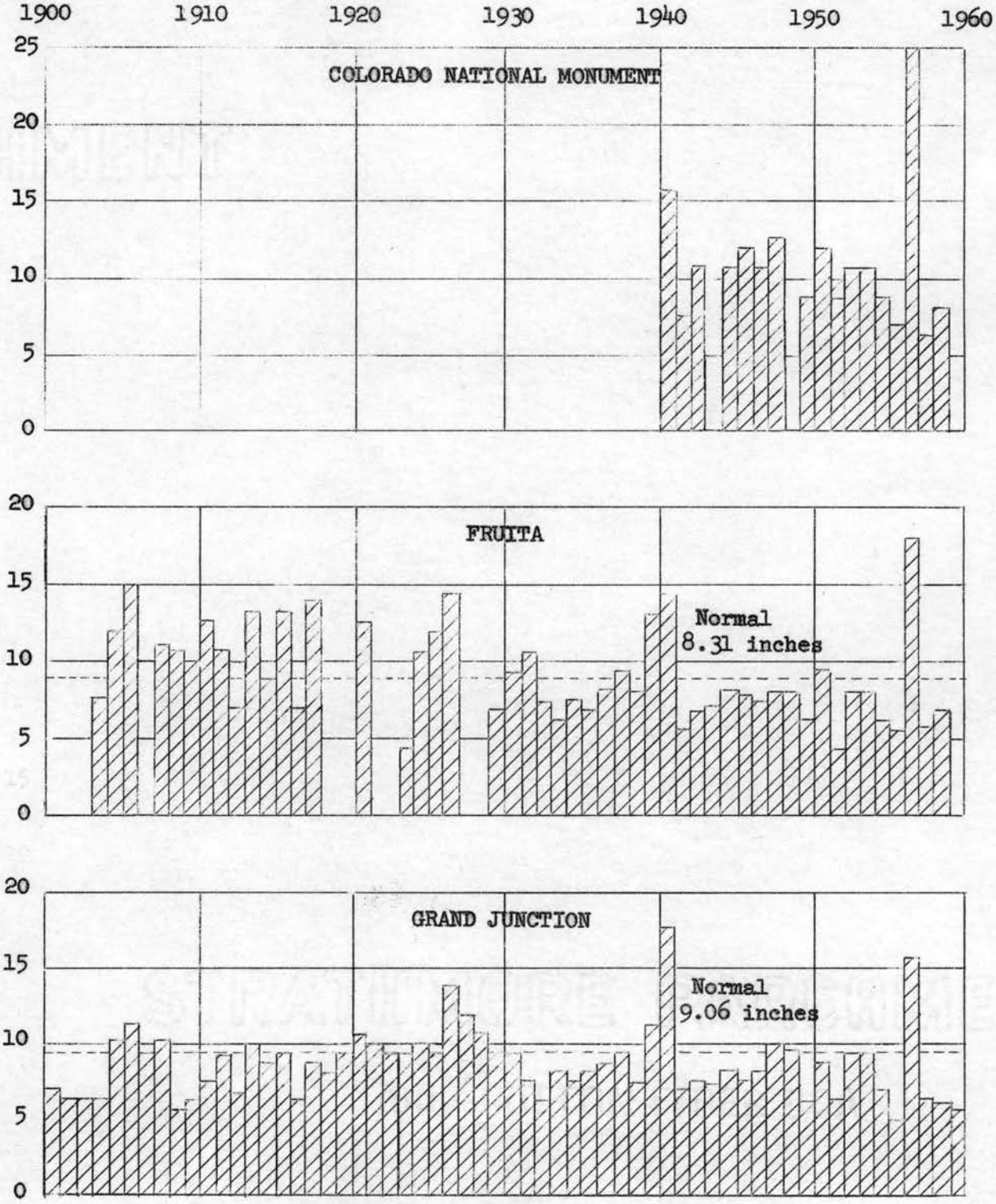

Fig. 3. Precipitation, in inches.
From U. S. Weather Bureau Records

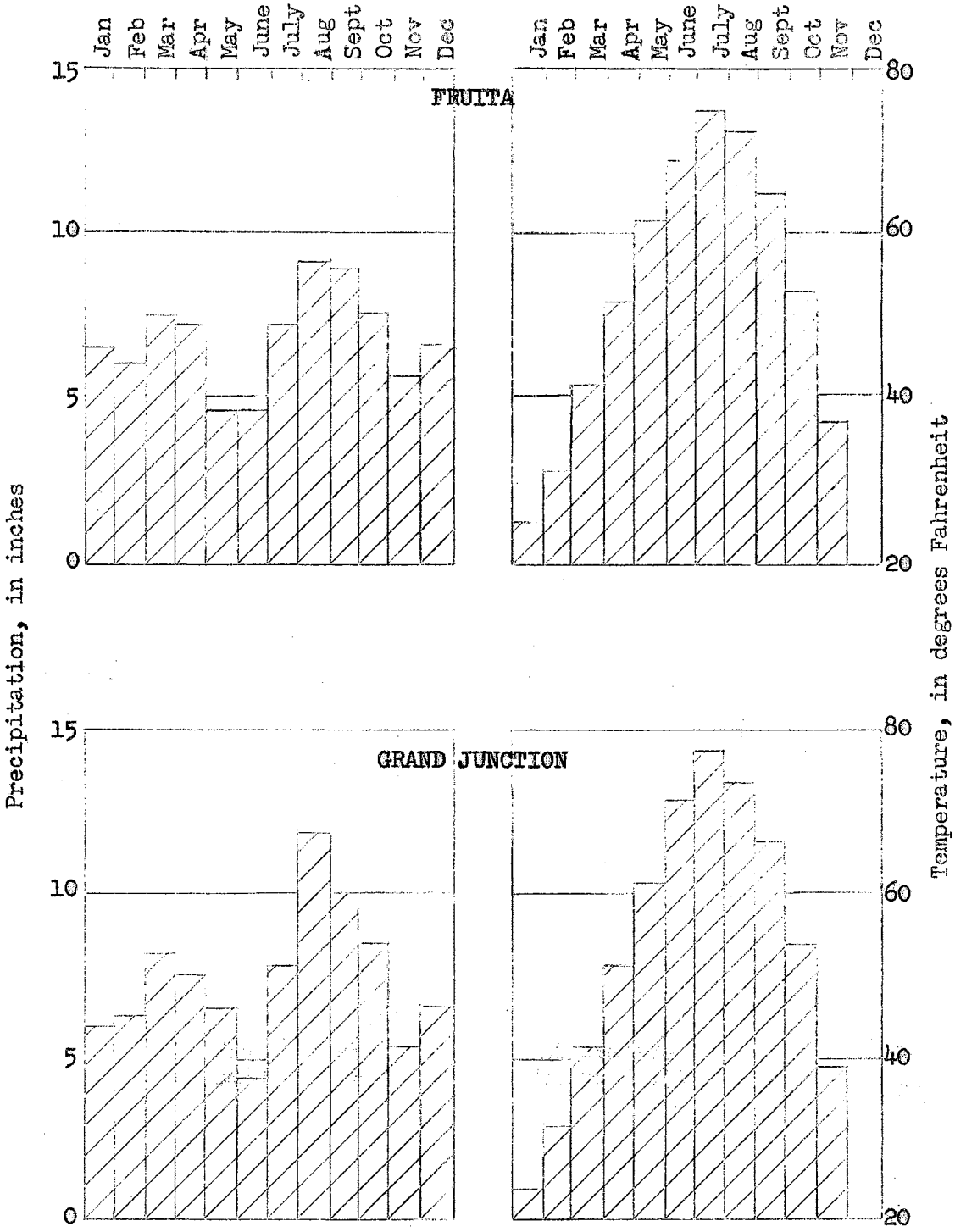

Fig. 4. Precipitation and temperature,
From U.S. Weather Bureau Records, 1900-1960.

Much of the area between the boundary fence and the base of the Precambrian escarpment along the Redlands is covered with grasses, mostly Bromus tectorum. Very limited areas of Oryzopsis hymenoides and Agropyron dasystachyum can be found along canyon rims and between Ute and Red Canyons. Low snowfall and the presence of a few grasses in meadows probably influence the winter wapiti migration into the Monument.

Pinyon-Juniper Forests

Although juniper trees are often present in association with sagebrush at lower elevations in the Monument, they do not become a major unit of the Monument's flora until, associated with Pinyon Pines, they form an open, low-growing coniferous forest. Juniperus osteosperma and Pinus edulis become dominant at about 6000 feet and continue up to over 8500 feet on Pinyon Mesa. At lower elevations juniper is more abundant than the pinyon pine, but at 6000 feet it is only slightly more abundant than the pinyons.

Growing in the pinyon-juniper forests is Artemisia tridentata, Cercocarpus sp., Purshia tridentata, Chrysothamnus nauseosus, and Gilia sp. Grass and forb elements are not usually very abundant in mature pinyon-juniper forests due to generally dry conditions, but when found are commonly composed of Chrysopsis villosa, Sphaeralcea coccinea, Salsola Kali, Erigeron sp. and Hymenoxys richardsoni (Harrington, 1954). Shrubs other than Artemisia tridentata are only locally abundant.

Oak-Serviceberry Chaparral

Oak-serviceberry stands are found at the upper edge of the pinyon-juniper association. In Colorado National Monument the two species are usually located together in sheltered box canyons or in Entrada Sandstone canyons near the heads of major canyon systems. Chaparral is

often found in north-facing pockets at higher elevations in the Monument and is especially evident along the Rim Rock Drive at the head of Ute Canyon where several small side canyons provide the necessary shelter.

Gambel Oak (Quercus gambellii) and serviceberry (Amelanchier alnifolia) are more commonly found in the Transition Zone at higher elevations on Pinyon Mesa. Artemisia tridentata is usually found with oak-serviceberry in the Monument. Both chaparral species grow quite low to the ground eliminating heavy ground cover. This chaparral-type vegetation provides excellent wildlife cover and food.

Barren Cliff Faces

These deserts are mostly found as canyon walls formed of the Wingate and Entrada sandstones and are wide spread throughout the Monument. They are almost entirely void of vascular plants and provide shelter only for volant species who use the numerous cracks and crevices for shelter.

Sandstone "Caves"

The "caves" are actually arch-like, shallow excavations in vertical canyon walls. Sometimes these ultimately form complete arches or bridges in the steep walls. They usually are no more than about 5 to 20 feet in depth.

These sheltered locations provide protected sites where moisture is often available and small pools are occasionally found. There, individuals of ponderosa pine, douglas-fir and aspen may grow. Smilacina and Cercocarpus are found in such situations in Kodels Canyon with other Transition Zone species.

Springs and Seeps

The porus sandstones are efficient aquifers and small seeps and

springs are often found near cliff bases or in canyons where ground water reaches the surface. Many artesian wells were developed in the Grand Valley by tapping the sandstones where they dip under the Grand Valley. Some of the semi-permanent and permanent water in the canyons is derived from this source.

Around seeps and springs grow sedges, rushes and Equisetum. Along the short, semi-permanent stream beds Populus fremonti, Salix sp., and Tamarix pentandra live in small gallery forests. The most notable seep is man-made and is the result of a subterranean leak in the upper Fruita Reservoir.

Reservoirs

The two Fruita reservoirs are near the West Entrance. The upper one is within the boundaries of the Monument while the lower one is only a short distance outside the boundary. Concentration of this study was on the upper reservoir. In both cases the size is about one-third acre.

Neither reservoir has much vegetation on its perimeter due to periodic cleaning by the town of Fruita. The reservoirs were used in the study to sample mammal populations, especially in an attempt to learn the dependence of desert species on free water, or if the reservoirs brought moisture-requiring species into an otherwise alien situation.

III. REVIEW OF THE LITERATURE

Undoubtedly, the first mammal collectors in the vicinity of what is now the Colorado National Monument were the prehistoric Fremont and Anasazi Indians, followed by the Ute Indians. American and French fur trappers pushed into the area in the early 1800's in search of beaver. Records of the activities of such early-day invaders into western Colorado are uncommon and pertinent mammal data is indeed rare.

The first comprehensive Colorado mammal records were published in 1910 in Mammals of Colorado (revised, 1942) by Edward Royal Warren. In his book, Warren listed the known species of mammals of the State, based mostly on records that he had found and on the extensive collections that he made. Warren did not indicate that he collected in what is now the Monument, but some of his collection sites were near the present boundary, at low elevations near Grand Junction and Mack, and on the Seiber Ranch near the Little Dolores River, all in Mesa County. Warren's works indicate Mesa County mammal distribution in the early 1900's. He listed 26 species from the Grand Valley vicinity that could be considered for inclusion in the Monument's fauna.

The next pertinent work was accomplished by Merritt Cary, United States Biological Survey, after three years of field study in Colorado. The work was published by the Department of Agriculture as North American Fauna No. 33, 1911, and titled A Biological Survey of Colorado. This work contained a section on mammals and listed 23 mammal species from Mesa County that were probably valid for Colorado National Monument.

Many of Cary's records were integrated with Warren's records and were often used as references. Cary's collections and data were dependent upon previous Biological Survey studies and his records, in turn, provided Mesa County material for subsequent works that affect this study.

A few studies have been made during recent years concerning life history and distribution of widespread and economically important mammals as they affect Colorado. They include: Guide to the Mammals of Colorado (Rodeck, 1953), a layman's guide to the more common mammals of the State; The Antelope of Colorado by Hoover, Till, and Ogilvie (1959); The Bighorn Sheep of Colorado by Moser (1962); A Systematic Review of Colorado Chipmunks (Genus Eutamias) by Sutton (1953); and The Woodrats of Colorado by Finley (1958). These works all contribute to the knowledge of Mesa County, if not Colorado National Monument mammals.

Two mammal studies of adjacent states were used as references in the study because of their physical proximity to Colorado National Monument and Mesa County. Mammals of Utah by Durrant (1952) was used extensively, especially as it applied to mammals of Grand and San Juan Counties, Utah, which are adjacent to Mesa County, Colorado. Vernon Bailey's Mammals of New Mexico (1931) was referred to in many instances where information on ecological or geographic distribution was necessary to complete detailed patterns.

Little has been written about the mammals of western Colorado or Mesa County, and nothing about the mammals of Colorado National Monument. Anderson's papers, the Mammals of Mesa Verde National Park, Colorado (1961), and the Mammals of Grand Mesa, Colorado (1959) are pertinent to this study. The latter study does help to orient local species as to vertical distribution and is applied to the somewhat ecologically similar Pinyon Mesa.

Botanically, Harrington's Manual of the Plants of Colorado (1954) provides an excellent reference and is applicable to the study area. Biological Survey of Colorado (Cary, 1911) also provides sound ecological data that is very pertinent to the Monument.

There is no good published geology of the area; however, Stanley W. Lohman's groundwater survey of the Grand Valley and adjacent areas will include the Monument, thus filling that void. Through the courtesy of Mr. Lohman the unpublished manuscript has been available for this study and is the source for the geological information.

Much of the historical data concerning mammal records and observations has been found in the Colorado National Monument Superintendent's Monthly Narrative Report, compiled into two volumes, available at the Monument's library.

In all matters of nomenclature the list of North American Recent Mammals by Miller and Kellogg (1955) has been followed unless superceded by later revisions.

IV. METHODS AND MATERIALS

Sample collections of specimens from each of seven ecological associations at various altitudes were made. A qualitative, rather than a quantitative, analysis was the objective but data that would indicate relative abundance of species are included in appropriate sections of the report.

In addition to samples collected in the Monument, specimens were examined from several museum collections, obtained from Bureau of Sport Fisheries and Wildlife (Predator and Rodent Control) personnel working in adjacent areas, and observation records were examined.

The most significant collection examined was the Edward Royal Warren Collection, Colorado College, Colorado Springs (the Warren Collection was transferred recently to the University of Colorado Museum, Boulder). The Warren Collection does not contain material from Colorado National Monument but includes collections from the Seiber Ranch on the Little Dolores River, Grand Junction, Fruita, Mack, and other sites in the Grand Valley. The University of Colorado Museum, Boulder, contains the greatest amount of material from the Monument and some specimens from adjacent areas. Small loans from the United States National Museum were most helpful. Most of the specimens collected during the study were temporarily catalogued in the author's collection or recorded by C. J. McCoy, Jr., for later transfer to the University of Colorado Museum. A few specimens were catalogued in the Colorado National Monument museum study collection.

Literature citations to other collections and the following museums are used as references in this report:

American Museum of Natural History	AMNH
C. J. McCoy, Jr., Catalogue	CJM
Carnegie Museum	CM
Colorado National Monument Museum	COLM
Edward Royal Warren Collection	ERW
Kansas University Museum of Natural History	KU
Pat H. Miller, Catalogue	PHM
University of Colorado Museum	UCM
United States National Museum	USNM

Local government trappers were most cooperative in assisting in the examination of material resulting from their work. Mr. Jack D. Peters, Fruita, permitted examination of dozens of skeletons of predatory mammals killed in his district. The material was mostly from the previous year's kills.

Records filed in the Chief Park Naturalist's office reflected observations made by Monument personnel from 1935 to the present. The records are neither complete nor detailed and they do not cover the smaller, less conspicuous species. They were not used to substantiate taxonomic detail but were used to provide an insight into historic occurrences and distribution, especially of the larger carnivores and ungulates.

Personal interviews with local residents provided some indication of early-day animal abundance and in some cases significant information on distribution patterns over the past 40 years. Colorado Game, Fish, and Parks Department personnel from the Northwest District, Grand Junction, were very cooperative and provided data regarding game mammal species.

The most important material resulted from collections made within the boundaries of the Monument during this study. Using a systematic approach, snap trap lines of varying trap numbers and sizes were placed in logically selected ecological and altitudinal sites. Vegetation types, topography, altitude, and accessibility were the most important factors considered.

Trap lines were strategically set in an attempt to sample a cross section of the study area's major habitats. Traps were placed in promising sets on the line but seldom more than 8 to 10 feet apart. Single sets were usually made rather than a multiplicity of traps at each location along the line. Composition of trap lines was about 91 percent museum special traps, 8 percent Victor rat traps and 1 percent mouse traps. Bait was mostly peanut butter but occasionally rolled oats were added to increase success in catching Dipodomys and Perognathus. In some instances, a bat shooting "stand" was considered a collection site.

Live traps of various sizes were placed in individual sets at likely locations or in known habitats in order to collect small carnivores and were especially effective in collecting skunks. Live traps were not set in conjunction with snap traps and were not included in the trap site data. Mist nets were occasionally used and were placed near small ponds and near the entrance of sheer-walled, granite inner canyons and the mouths of larger, sandstone-walled canyons.

Systematic night patrols were made along the Rim Rock Drive and over Colorado Highway 340. An estimated 1700 miles of driving was done during the summer of 1962 in an effort to pick up road kills and make collections along the Rim Rock Drive and Highway 340. Accurate observation records were kept.

CATALOGUE NUMBER	NAME	SEX	AGE	MEASUREMENTS

DATE	LOCALITY	BAIT	ELEVATION	GEOLOGY AND SOIL	WEATHER

FLORA	NOTES

MANNER PRESERVED	PRESENT LOCATION	METHOD DISPOSED	DATE

Fig. 5. Specimen Data Card

COLLECTION SITE DATA			
SITE NUMBER	LOCATION	COLLECTION METHODS	DATE

MAJOR PLANT ASSOCIATION	PRINCIPAL GEOLOGICAL FEATURES	WEATHER	COLLECTORS

LIST OF SPECIMENS

Fig. 6. Collection Site Data Card

Data for each trap line, and for each specimen collected, were placed on six by eight inch cards (see Figs. 5 and 6), then filed. Trapline cards were filed numerically after specimens from the site were processed. Specimen cards were filed in phylogenetic sequence. Cards of different colors were used to distinguish museum specimens from collections made in the Monument during the study.

Most specimens of sizes smaller than Citellus variegatus were placed in a preservative solution (FPG) described by Sutton (1962) for later processing. Larger specimens were usually skinned soon after collection or diagnostic parts were retained. In this manner about 85 percent of all specimens collected will eventually be made into study specimens. Nearly 100 percent of skeletal material obtained was retained as study specimens.

A total of 30 sites were sampled by trapping or shooting during the study. Each site was assigned a collection site number. The following list is arranged numerically, by collection site, with its description, location, and number of trap nights:

Site 1. Saddlehorn Area; sagebrush association; June 15-16, 1961; elevation 5780 feet; 14 trap nights.

Site 2. Saddlehorn Area; sagebrush association; July 26-29, 1961; elevation 5780 feet; 150 trap nights.

Site 3. Headquarters Area; sagebrush association; Aug. 1-2, Aug. 6, Sept. 20, 1961; elevation 5780 feet; shooting site.

Site 4. Rim Rock Drive; 0.7 mile east of West Glade Park Road junction; oak-serviceberry association; Oct. 6-7, 1961; elevation 6415 feet; 84 trap nights.

Site 5. West Entrance; seep area; Sept. 18-21, 1961, June 16-27, 1962; elevation 4700 feet; 511 trap nights.

Site 6. Rim Rock Drive; 1.0 mile east of West Glade Park Road junction; oak-serviceberry association; Oct. 4-5, 1961; elevation 6400 feet; 84 trap nights.

Site 7. Headquarters Area; grass flat; Nov. 11-14, 1961; elevation 5780 feet; 168 trap nights.

Site 8. Coke Ovens View; sagebrush association; Jan. 19-20, 1962; elevation 6070 feet; 80 trap nights.

Site 9. Saddlehorn Area; grass flat; Feb. 2, 1962; elevation 5780 feet; 94 trap nights.

Site 10. Headquarters Dump Area; sagebrush association; Feb. 3-5, 1962; elevation 5589 feet; 141 trap nights.

Site 11. Lower Fruita Reservoir; April 23-24, 1962; elevation 4670 feet; shooting site.

Site 12. Monument Mesa; 2.0 miles east of Rim Rock Drive; pinyon-juniper association; June 9, 11, 12, 15, and 18, 1962; elevation 6620 feet; shooting site.

Site 13. Upper Fruita Reservoir Area; sagebrush association; June 10-15, 1962; elevation 4737 feet; 132 trap nights.

Site 14. West Entrance Area; sagebrush association; June 6-11, 1962; elevation 4674 feet; 500 trap nights.

Site 15. Fruita Canyon, west end; streambed; serviceberry; June 22-27, 1962; elevation 5140 feet; 250 trap nights.

Site 16. North Monument Canyon mouth; grass flat; July 3-10, 1962; elevation 4900 feet; 350 trap nights.

Site 17. East Monument Canyon mouth; sagebrush association; July 9-12, 1962; elevation 4900 feet; 150 trap nights.

Site 18. North Monument Canyon head (above Rim Rock Drive); grass, juniper, dry wash; July 17-22, 1962; elevation 5780 feet; 120 trap nights.

Site 19. Monument Mesa, about 2.0 miles east of Rim Rock Drive; sagebrush association; July 27-Aug 2, 1962; elevation 6480 feet; 200 trap nights.

Site 20. Monument Mesa, 2.3 miles east of Rim Rock Drive; Pinyon-juniper association; July 29-Aug. 4, 1962; elevation 6500 feet; 300 trap nights.

Site 21. Monument Mesa, 1.5 miles east of Rim Rock Drive; grass flat; Aug. 3-4, 1962; elevation 6520 feet; 50 trap nights.

Site 22. Borrow Pit, near head of Red Canyon; sagebrush association; Aug. 4-9, 1962; elevation 6400 feet; 500 trap nights.

Site 23. Saddlehorn Area; pinyon-juniper association; Aug. 9-14, 1962; elevation 5780 feet; 100 trap nights.

Site 24. Rim Rock Drive, 1.0 mile east of West Glade Park Road junction; oak-serviceberry association; Oct. 4-5, 1961; elevation 6400 feet; 200 trap nights.

Site 25. No Thoroughfare Canyon mouth, near East Entrance Ranger Station; greasewood association; Aug. 19-21, 21-24, Sept. 12-16, 1962; elevation 4913 feet; 900 trap nights.

Site 26. Rim Rock Drive, 0.3 mile west of Coke Ovens View; pinyon-juniper association; July 18-25, 1962; elevation 6073 feet; 50 trap nights.

Site 27. Monument Mesa, 0.3 mile east of Rim Rock Drive; pinyon-juniper association; July 27-28, 1962; elevation 6510 feet; 200 trap nights.

Site 28. West Boundary Patrol Road, 0.3 mile west of Rim Rock Drive (road mix area); sagebrush association; July 19-22, 1962; elevation 6610 feet; 200 trap nights.

Site 29. West Boundary Patrol Road, 1.0 mile south of Monument boundary; pinyon-juniper association; July 19-21, 1962; elevation 6520 feet; 150 trap nights.

Site 30. Rim Rock Drive, West Glade Park Road junction; pinyon-juniper association; June 10, 1961; elevation 6479 feet; 50 trap nights.

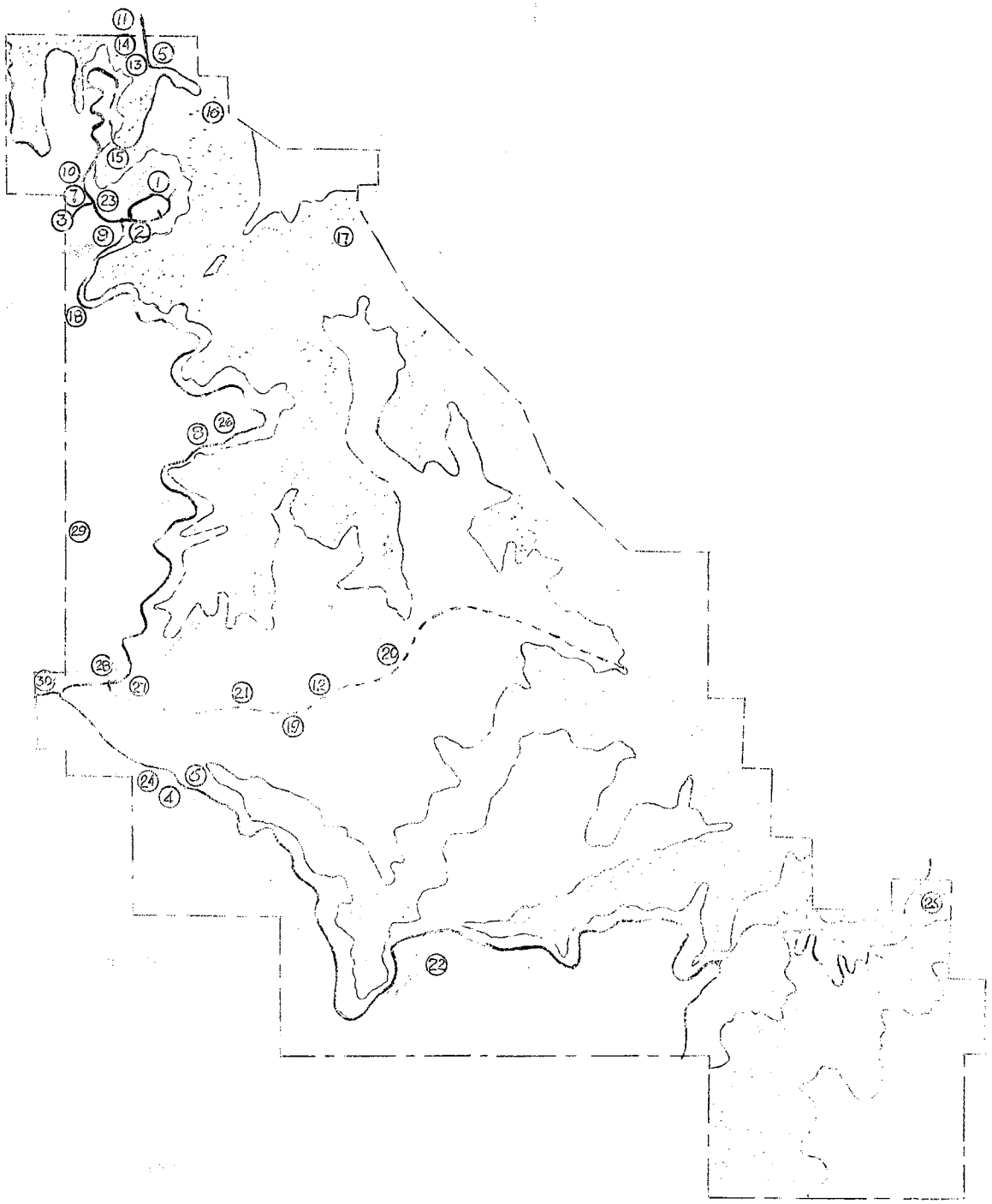

Fig. 7. Collection Site Locations

V. ACCOUNT OF THE SPECIES

The following annotated list represents 38 mammal species included in the existing fauna of Colorado National Monument. A supplemental account of historic and hypothetical mammals will be found at the end of this section. Nomenclature follows Recent Mammals of North America, Miller and Kellogg (1955), except that in a few instances substitutions have been made when current literature indicates more recent taxonomy. Common names follow Vernacular Names For North American Mammals North of Mexico (Hall, 1957), but more descriptive common names have sometimes been used in reference to sub-species. Other common names were included to assist Colorado National Monument personnel to interpret vernaculars in relation to scientific names and other colloquialisms. Additional common names were derived from various non-technical and technical sources.

Myotis lucifugus carissima Thomas

Little Brown Myotis

Myotis /Leuconoe/ carissima Thomas. 1904. Ann. Mag. Nat. Hist., ser. 7, vol. 13, p. 383, May, 1904.

Myotis yumanensis altipetens, H. W. Grinnell. 1916. Univ. California Pub. Zool., vol. 17, No. 2, p. 9, Aug. 23, 1916.

Myotis lucifugus carissima, Cary. 1917. North American Fauna No. 42, p. 43, Oct. 3, 1917.

Myotis albicinctus, G. M. Allen. 1919. Jour. Mamm., vol. 1, No. 1, p. 2, Nov. 28, 1919.

Type Locality -- Lake Hotel, Yellowstone Park, Wyo. (information from collector through O. Thomas).

Other Common Names -- Yellowstone Bat, Big Myotis.

Comments -- Two specimens of this bat were collected in the Monument, both shot at about dusk. One specimen was taken from the Monument Mesa Patrol Road at Site 12. This specimen was flying about in an open pinyon-juniper forest at about 6500 feet. The other specimen was flying over the open compound area near Entrada Sandstone Cliffs at 5780 feet. It appeared to be feeding on high-flying insects.

Measurements -- Two adult males measured: 90.5 (97-84), 41.5 (48-35), 10.0 (11-9), 14.0 (14-14), tragus 7.3 (8.5-6).

Specimens Examined -- Total 2, distributed as follows: Monument Mesa (Site 12), 6500 feet, CJM (1); headquarters utility area, 5780 feet, PHM (1).

Myotis volans interior Miller

Long-legged Myotis

Myotis longicrus interior Miller. 1914. Proc. Biol. Soc. Washington, vol. 27, p. 211, Oct. 31, 1914.

Myotis volans interior, Miller and G. M. Allen. 1928. U. S. National Mus. Bull., 144, p. 142, May 25, 1928.

Type Locality -- Five miles south of Twining, Taos County, N. Mex. Altitude 11,300 feet.

Other Common Names -- Western Little Brown Bat, Hairy-winged Myotis, Interior Long-legged Bat.

Comments -- Only one specimen of this bat was collected in the Monument during the study, but this may not be a true indication of its abundance in the Monument. Eptesicus and Pipistrellus were collected at the same site. Cary (1911) reported a specimen in the Biological Survey collection from Grand Junction taken by Mr. J. Alden Loring, June 23, 1893. The species is represented by a specimen in the Colorado National Monument collection from DeBeque Canyon near Plateau Creek, Mesa County. Anderson (1959) reported a female shot on Grand Mesa 28 miles east of Grand Junction, Mesa County.

Little was learned about the habitat of Myotis volans interior in the Monument. It appears to be quite tolerant to altitudes, being locally reported from 4600 feet in Grand Junction to near 10,000 feet on Grand Mesa. Hall (1946) found it ranging from 5600 feet to 10,500 feet in White Pine County, Nevada. This bat probably roosts either in rock cracks or in trees, perhaps using canyon floor cottonwood groves.

Measurements -- Two adult females: 92.5 (97-88), 41.5 (41-42), 8.5 (8-9), 8 (8-8).

Specimens Examined -- Total 2, distributed as follows: Mouth of North Monument Canyon (Site 16), PHM (1); DeBeque Canyon, PHM (1).

Other Records -- Total 2, distributed as follows: (Cary, 1911) Grand Junction, USNM (1); (Anderson, 1959) Grand Mesa, KU (1).

Myotis subulatus melanorhinus (Merriman)

Small-footed Myotis

Vespertilio melanorhinus Merriam. 1890. North Amer. Fauna No. 3, p. 46, Sept. 11, 1890.

V/espertilio/nitidus henshawii, H. Allen. 1894. U. S. Nat. Mus. Bull.

43, p, 103, (1893), Mar. 14, 1894. (Near Wingate, McKinley Co., N. Mex.)

Myotis orinomus, Elliot. 1903. Field Colum. Mus. Publ. 79, Zool. Ser., vol. 3, p. 228, (June) August 15, 1903. (La Grulla, Sierra San Pedro Martir, Baja Calif., Mex. Altitude, 8000 feet.)

Myotis subulatus melanorhinus, Miller and G. M. Allen. 1928. U. S. Nat. Mus. Bull. 144, p. 169, May 25, 1928.

Type Locality -- Little Spring, north base of San Francisco Mountain, Coconino Co., Ariz., 8500 feet.

Other Common Names -- Small-footed Myotis, Black-nosed Bat, Say Bat.

Comments - - One specimen of M. s. melanorhinus was shot over the Monument Mesa Patrol Road about two miles east of the Rim Rock Drive at 6620 feet (Site 12). The location was a small sagebrush opening in a mature stand of pinyon-juniper trees.

Relative abundance of this bat in the Monument was unknown and equally little was learned about its habitat or life history. It is apparently a late evening flyer.

Anderson (1961) collected five specimens of this bat at 7400 feet in Mesa Verde National Park. Durrant (1952) reported one specimen from the Colorado River, five miles east of Moab, Grand County, Utah, at 5000 feet.

Measurements -- Adult male: 97, 48, 9, 14, tragus 8.5.

Specimens Examined -- Total 1, distributed as follows: Monument Mesa, 6620 feet, CJM (1).

Other Records -- Total 6, distributed as follows: (Anderson, 1961) Mesa Verde National Park, Colorado (5). (Durrant, 1952) Moab, Grand County, Utah (1).

Pipistrellus hesperus hesperus (H. Allen)

Canyon Bat

Scotophilus hesperus H. Allen. 1864. Smithsonian Misc. Coll., vol. 7, publ. 165, p. 43, June, 1864.

Vesperugo herperus, True. 1884. Proc. U. S. Nat. Mus., vol. 7. (App., Circ. 29), p. 602, Nov. 29, 1884.

Pipistrellus hesperus, Miller. North Amer. Fauna No. 13, p. 88, Oct. 16, 1897.

Pipistrellus hesperus hesperus, Hatfield. 1936. Jour. Mamm., vol. 17, No. 3, p. 257, August, 1936.

Type Locality -- Old Fort Yuma, Imperial County, Calif., on right bank of Colorado River, opposite present town of Yuma, Ariz.

Other Common Names -- Western Pipistrelle, Santa Rosa Bat, Western Bat, Little Canyon Bat.

Comments -- The canyon bat is the smallest and most common bat in the Colorado National Monument.

Specimens taken in the Monument bear out Hall's (1946) observations regarding a disproportionate female to male population ratio. Out of 24 specimens examined, 9 were males.

This bat appeared to be numerous at all elevations in the Monument but they seem to be more numerous near canyon rims, especially along the Rim Rock Drive, than elsewhere in the Monument. This early flyer was also the most easily-observed bat in the Monument, often initiating its flight well prior to darkness and sometimes as early as 4:30 P. M. in summer. The necessary flight stimulus may be the shadows created by the western elevations in the Monument obscuring the sun in late afternoon.

This bat was observed in the Monument during each month of the year except December, January, and February.

Little natural history information was gathered about this bat during the course of the study. Some evidence was found to support the conclusion that the canyon bat uses cracks and fallen rocks as diurnal resting shelters. Two were collected in mid-morning on the ground under a slab of sandstone near the mouth of North Monument Canyon at 4674 feet.

Most of the specimens collected in the Monument were shot, but three were caught (with three Antrozous) in a mist net stretched across a Precambrian rock cut in East Monument Canyon. Attempts to shoot this species over the Fruita Reservoirs were mostly unsuccessful as was the stretched wire method described by Borell (1937). Evidently, this species does not depend upon permanent bodies of water and did not appear to concentrate anywhere in the Monument. Late evening, down-canyon migrations toward the Colorado River were observed in Pipistrellus and several were shot in the North Monument Canyon "migration route" with other bat species.

Measurements -- For 6 adult males: 66 (75-63), 26 (28-23), 3.7 (8-4), 11.2 (14-7), tragus 5.2 (7-3); for 5 adult females: 68.2 (75-65), 27.8 (32-23), 5.4 (6-5), 10.2 (13-8), tragus 4.8 (6-3).

Specimens Examined -- Total 19, distributed as follows: Mouth of North Monument Canyon, 4674 feet, PHM (6), CJM (3); East Monument Canyon, 4900 feet, CJM (3); Monument boundary behind utility area, 5780 feet, COLM (3), CJM (2); Colorado Highway 340, one-half mile south of Fruita Bridge, 4485 feet, CJM (2).

Other Records -- Total 4, distributed as follows: (Miller, 1897) Grand Junction, USNM (4).

Eptesicus fuscus pallidus Young

Big Brown Bat

Eptesicus pallidus Young. 1908. Proc. Acad. Nat. Sci. Phila., vol. 60, p. 408, Oct. 14, 1908.

Eptesicus fuscus pallidus, Miller. U. S. Nat. Mus. Bull. 79, p. 62, Dec. 31, 1912.

Type Locality -- Boulder, Boulder Co., Colorado.

Other Common Names -- Brown Bat, Common Brown Bat, Colorado Brown Bat, House Bat.

Comments -- The big brown bat in Colorado National Monument was first collected on Monument Mesa where it was observed making early evening flights away from the pinyon-juniper forest and Morrison sandstone cliffs toward Glade Park. At lower elevations the migrations were observed at the mouth of North Monument Canyon where flights were toward the Colorado River. In both instances flights were in the direction of water sources, perhaps for the purposes of drinking or feeding on the insects found near such bodies of water.

Little was learned about habits of Eptesicus in the Monument but since this bat is known to be a cave dweller, the absence of caves in the vicinity leads to the conclusion that this bat, like most others found in the Monument, probably uses deep clefts in the sheer sandstone cliffs for daytime resting.

Anderson (1961) collected Eptesicus at 7400 feet in Mesa Verde National Park and Warren (1942) collected 21 specimens at Newcastle, Colorado, (5375 feet) in 1907. It was observed in several sections of the Monument at varying elevations indicating wide-spread distributions without regard to vegetation or elevation.

Measurements -- Two adult males measured: 112 (116-108), 42 (44-40), 10 (11-9), 16.5 (16-17), tragus 8.5 (9-8); three adult females measured: 107.7 (113-100), 43.7 (50-37), 9.8 (11.5-8.5), 18 (20-16), tragus 8.5 (9-8).

Specimens Examined -- Total 6, distributed as follows: Mouth of North Monument Canyon, 4674 feet, PHM (2), CJM (1); Rim Rock Drive, One-quarter mile west of West Glade Park Road junction, CJM (1); Newcastle, Garfield County, Colorado, 5375 feet, ERW (1); Little Dolores River, Mesa County, Colorado, UCM (1).

Other Records -- Total 20, distributed as follows: (Warren, 1942), Newcastle, Garfield County, ERW (20).

Plecotus townsendii pallescens Miller

Big-eared Bat

Corynorhinus macrotis pallescens Miller. 1897. North Amer. Fauna No. 13, p. 52, October 16, 1897.

Corynorhinus megalotis pallescens, G. M. Allen. 1916. Bull. Comp. Zool., vol. 60, p. 341, April, 1916.

Plecotus rafinesquii pallescens, Blair. 1952. Texas Jour. Sci., vol. 4, No. 1, p. 96, 1952.

Corynorhinus [townsendii] pallescens, Handley. 1955. Jour. Wash. Acad. Sci., vol. 45, No. 5, p. 147, 1955.

Type Locality -- Keam Canyon, Navajo County, Arizona.

Other Common Names -- Townsend's Big-eared Bat, Pale Big-eared Bat, Pallid Big-eared Bat, Western Big-eared Bat.

Comments -- This bat was not collected in the Monument, but at least one reliable observation record was made to substantiate placement of this

species in the Monument's fauna. Nearby collections indicate this bat is not uncommon in the area. Although the species is cave-dwelling, it roosts in buildings upon occasion (Handley, 1959) and may eventually be found in Monument buildings. Two specimens obtained in the Grand Valley were found in buildings and one from a mine tunnel in Unaweep Canyon. The observation record was made over the water trough near the mouth of the Gold Star Canyon.

Measurements -- Two adult females measured: 101.5 (112-91), 47.5 (59-46), 5.3 (6.5-4), 36 (36-36), tragus 16.3 (16.5-16).

Specimens Examined -- Total 3, distributed as follows: 4 miles north of Loma, Mesa County, Colo., 4659 feet, PHM (1); about 2 miles northeast of Fruita, Mesa County, Colo., 4500 feet, PHM (1); Unaweep Canyon, Mesa County, Colorado PHM (1).

Other Records -- Total 2, distributed as follows: (Handley, 1959) 4 miles north of Thompsons, Grand County, Utah, (1); Post Canyon, Book Cliffs, Grand County, Utah, 8200 feet (1).

Observation Records -- Buffalo Spring, mouth of Gold Star Canyon, Colorado National Monument, Pat H. Miller and R. L. Hoover, August 17, 1960 (1).

Antrozous pallidus pallidus (Le Conte)

Desert Pallid Bat

V/espertilo/ pallidus Le Conte. 1856. Proc. Acad. Nat. Sci. Phila., vol. 7 (1854-5), p. 437.

Antrozous pallidus, H. Allen. 1864. Smithsonian Misc. Coll., vol. 7, publ. 165, p. 68. June, 1864.

Anthrozous /sic/ pallidus, True. 1884. Proc. U. S. Nat. Mus., vol. 7,

(App., Circ. 29), p. 602.

Type Locality -- El Paso, El Paso County, Texas.

Other Common Names -- Pallid Bat, Pale Bat, Big-eared Bat.

Comments -- Three lactating females were collected in Colorado National Monument during the course of this study and on two occasions flight identifications of Antrozous were made near the mouth of North Monument Canyon. Subspecies were determined by geographic distribution.

Antrozous, with other species of bats, were observed making crepuscular migrations down Monument Canyon toward the Colorado River about a mile distant. Cary (1911) stated, "These bats were rarely observed about the ranch buildings, and invariably appeared first over the cliffs in the early twilight. Although none were seen actually emerging from the cliffs, the numerous cracks and crevices doubtless formed their retreat during the day."

This bat is a mammal of the Upper Sonoran valleys of southwestern Colorado. Durrant (1952) reported that Antrozous was frequently found in company with Eptesicus fuscus flying around the crowns of cottonwood trees. A similar observation was made near Monument Canyon where Populus fremonti grows in gallery forests along the Colorado River.

Measurements -- Three females measured: 117.3 (119-116), 51.7 (53-50), 10.3 (11-10), 36 (36-36), tragus 18.3 (19-17.5).

Specimens Examined -- Total 4, distributed as follows: Attic, Redlands Club House, South Broadway, Grand Junction, Mesa County, 4800 feet, COLM (1); Mouth of East Monument Canyon, 4900 feet, CJM (3).

Other Records -- Total 2, distributed as follows: (Cary, 1911) Ashbaugh's Ranch, McElmo Canyon, 20 miles west of Cortez, Montezuma County, June 21, 1907 (2).

Observation Records -- Monument boundary near mouth of North Monument Canyon, August 23, 1962, 4800 feet, Pat H. Miller and C. J. McCoy, Jr. (1); one mile northwest of Fruita Bridge on Colorado River, 4468 feet, several flying, July 6, 1962, Pat H. Miller and C. J. McCoy, Jr.; Plateau Creek, 5 miles west of Tunnel, Mesa County, Colo., Sept. 20, 1906, Cary (1911).

Lepus townsendii townsendii Bachman

White-tailed Jackrabbit

Lepus townsendii Bachman. 1839. Journ. Acad. Nat. Sci. Phila., vol. 8, pt. 1, p. 90, pl. 2.

Lepus campestris sierrae, Merriam. 1904. Proc. Biol. Soc. Washington, vol. 28, p. 70, Mar. 12, 1915. (Hope Valley, Alpine County, Calif.; altitude, 7800 feet. Regarded as identical with townsendii by Orr, Occ. Pap. California Acad. Sci. No. 19, p. 42, May 25, 1940.)

Lepus campestris townsendii, Merriam. 1904. Proc. Bio. Soc. Washington, vol. 28, p. 70, May 14, 1904.

Lepus townsendii townsendii, Hollister. 1915. Proc. Biol. Soc. Washington, vol. 28, p. 70, Mar. 12, 1915.

Type Locality -- Fort Walla Walla, near present town of Wallula, Walla Walla County, Wash.

Other Common Names -- Western White-tailed Jackrabbit.

Comments -- Although this hare is distributed at all elevations in the Monument where suitable habitat is found, there is a correlation between white-tailed jackrabbit population density and altitude, with much greater abundance above 6500 feet. White-tailed and black-tailed jackrabbits were observed feeding together in grassy meadows near the

upper exit of the West Boundary Patrol Road at 6500 feet. Below 6500 feet black-tailed jackrabbits outnumber white-tails in most situations. Observations of white-tails were made along State Highway 340 (4600 feet) and up through the Monument into Glade Park and Pinyon Mesa (8500 feet). Warren (1942) recorded them as high as 12,000 feet in Gunnison County.

The white-tailed jackrabbit undergoes two annual molts, from white in winter to light grayish-brown in summer and reverse. Observations in the Monument indicated that summer pelage is rather palid. This is the largest lagomorph in the Monument and Warren (op. cit.) recorded one female killed in the North Park section of Colorado that weighed 10½ pounds. White-tailed jackrabbits are easily distinguished from black-tailed jackrabbits by tail color and their coloration of pelage.

Measurements -- One adult female: 558, 75, 146, 133; one adult male: 515, 78, 155, 125.

Specimens Examined -- Total 2, distributed as follows: State Highway 340, one-half mile west of Fruita Entrance, 4600 feet, PHM (1); Rim Rock drive, one-quarter mile west of West Glade Park Road junction, 6470 feet, CJM (1).

Observation Records -- Monument boundary at West Boundary Patrol Road exit, 6500 feet, several seen by Pat H. Miller and C. J. McCoy, Jr.; Glade Park, 7038 feet, one adult male killed (specimen destroyed); One-half mile east of East Entrance (dead-on-road), C. J. McCoy, Jr.

Lepus californicus texianus Waterhouse

Black-tailed Jackrabbit

Lepus texianus Waterhouse. 1848. A natural history of the Mammalia, vol. 2, p. 136

Lepus texianus griseus, Mearns. 1896. Proc. U. S. Nat. Mus. Nat. Hist., vol. 18, p. 563, June 24, 1896. (Fort Hancock, Hudspeth County, Texas).

Lepus texianus micropus, J. A. Allen. 1903. Bull. Amer. Mus. Nat. Hist., vol. 19, p. 605, Nov. 12, 1903. (Rio de las Bocas, north-west Durango, Mexico).

Lepus californicus texianus, Nelson. 1909. North Amer. Fauna No. 29, p. 142, Aug. 31, 1909.

/Macrotolagus/ texianus, Shamel. 1942. Proc. Biol. Soc. Washington, vol. 55, p. 25, May 12, 1942.

Type Locality -- Unknown, but probably in western Texas.

Other Common Names -- Texas Jackrabbit.

Comments -- The black-tailed jackrabbit appears to inhabit the lower elevations of the Monument area mostly in the Upper Sonoran Life Zone, especially near cultivated areas of the Grand Valley. It is gradually replaced by the white-tailed jackrabbit at higher elevations. The latter became more numerous in the Transition Life Zone of the area near 6500 feet. Both species were found over most of the Monument.

The black-tail is a smaller animal than the white-tail with 23 adult males from Arizona averaging 5.1 pounds (Hall, 1951). Other external differentiating characters were discussed in the section of L. t. townsendii.

A pair of black-tails lived near Quarters Number 1 in the Saddlehorn area for about three years. They usually became active in the evening at dusk and were often feeding until well after sunrise. That behavior pattern was true throughout the entire year although they were observed less frequently in the winter months when snow covered the

ground. The jackrabbits did not use the lawn grass (Poa) as much as did the cottontails which appeared in numbers each evening on the lawn during the entire year. The jackrabbits did not appear to be antagonistic toward the cottontails, neither were they frightened by small carnivores such as skunks. In one instance a jackrabbit chased a young doe mule deer from the corner of the lawn where he was feeding. Jackrabbits evidently utilize native vegetation for food as much as the lawn grasses, but prefer the succulent lawn grasses as an excellent source of water. Black-tails were found in a variety of habitats including open pinyon-juniper forests.

Measurements -- Two adult females measured: 442 (452-432), 79.5 (81-78), 120.5 (124-117), 130.5 (135-126).

Specimens Examined -- Total 2, distributed as follows: Rim Rock Drive one-half mile west of Red Canyon Overlook, 6393 feet, PHM (1); Monument Mesa Patrol Road about two miles east of Rim Rock Drive junction, 6450 feet, PHM (1).

Other Records -- Total 1, distributed as follows: (Anderson, 1961) Mesa Verde National Park, Colorado, (Observations only); (Durrant, 1952) 19 miles south of Moab, Grand County, Utah (1).

Observation Records-- East mouth of Monument Canyon, July 31, 1961, 4750 feet, C. J. McCoy, Jr.; Rim Rock Drive at Historic Trails Overlook, 5400 feet, November 8, 1961, Pat H. Miller; Rim Rock Drive, one-half mile east of Red Canyon Overlook, 6420 feet, June 23, 1962, Pat H. Miller.

Sylvilagus audubonii warreni Nelson

Desert Cottontail

Sylvilagus audubonii warreni Nelson. 1907. Proc. Biol. Soc. Washington,

vol. 20, p. 83, July 22, 1907.

Type Locality -- Coventry, Montrose County, Colorado.

Other Common Names -- Colorado Cottontail, Audubon Cottontail.

Comments -- Cary (1911) described this as "the cottontail of the warm Upper Sonoran valleys and lowest mesas of southwestern Colorado south of Grand River Valley." Durrant (1962) restricted its Utah range to the southeastern part of that state. It was the ubiquitous species of cottontail in Colorado National Monument. The desert cottontail is replaced at higher altitudes in southwestern Colorado by Nuttall's Cottontail (S. nuttallii pinetis). In Black Canyon of the Gunnison National Monument, about 60 air miles from Colorado National Monument, only S. n. pinetis was taken (8200 feet). No collections were made between the Monument and Pinyon Mesa; therefore, it was not determined at what altitude on Pinyon Mesa the replacement of species took place. Durrant (1962) collected S. n. pinetis as low as 5400 feet in the La Sal Mountains of San Juan County, Utah. Durrant also collected S. a. warreni in Block Canyon (5400 feet), San Juan County, Utah. Anderson (1961) reported that both species occupied Mesa Verde National Park but conceded that S. nuttallii was most often found on top of the Mesa while S. audubonii was found closer to the foot of the Mesa. Although there appear to be altitudinal overlaps between the two species, they are quite sharply separated ecologically by differentiation in vegetative types with S. audubonii occupying the more arid mesas and valleys, and S. nuttallii occupying the transition types that contain more dense cover.

Field separation of the two species can best be based on relative ear length and pelage, although ear length is not always dependable. Durrant (op. cit.) gave ear measurements for an adult S. audubonii male

and female from San Juan County, Utah, as 101 and 89, respectively. The same author assigned ear measurements for one male and three female specimens of S. nuttallii from San Juan County as 91, 89, 91, and 100 respectively. The cinnamon nape is characteristic of S. audubonii and the black-tipped ears characteristic of S. nuttallii. Identification from skulls is easier. Hall (1951) distinguished between the two by the smaller tympanic bullae of S. nuttallii.

Population density was rather uniform throughout the Monument. Cottontails preferred the grassy meadows for feeding and there was no evidence of habitat preference between canyon floors and rim communities. There was a definite concentration around the residential areas where lawn grasses (Poa) attracted cottontails in large numbers. Former Park Superintendent, Russell Mahan, stated he counted as many as 30 individuals on the lawn of Quarters No. 1 at one time. In winter, the cottontails spent a great deal of time feeding upon the dry grasses while at other seasons they fed upon green grass. One very young specimen was caught in a museum special trap baited with peanut butter and rolled oats.

Specimens Examined -- Total 4, distributed as follows: Sagebrush flat about two miles east of Rim Rock Drive on Monument Mesa Patrol Road, 6450 feet, PHM (1); Rim Rock Drive at West Boundary Patrol Road junction, 6593 feet, CJM (1); Rim Rock Drive at 6640 elevation sign, CJM (1); Grand Junction, Mesa County, Colorado, 4600 feet, UCM (1).

Other Records -- Total 6, distributed as follows: (Durrant, 1952) Grand County, Utah, near Casleton, (1); Moab, (1); Block Canyon, San Juan County, Utah, (2); (Anderson, 1961) Mesa Verde National Park, Colorado, (2).

Cynomys leucurus Merriam

White-tailed Prairie Dog

Cynomys leucurus Merriam. 1890. North Amer. Fauna No. 3, p. 59, Sept. 11, 1890.

Cynomys lewsii, J. A. Allen. 1898. Bull. Amer. Mus. Nat. Hist., vol. 10, p. 455, Nov. 10, 1898. (Not Arctomys lewsii Audubon and Bachman, a Marmota from the "shores of the Columbia River," see Hollister, North Amer. Fauna No. 40, p. 26, June 20, 1916).

Type Locality -- Fort Bridger, Uinta County, Wyoming.

Other Common Names -- Barking Squirrel, Burrowing Squirrel, Prairie Squirrel, "Dog," Wishtonwish, Petit Chien.

Comments -- The white-tailed prairie dog inhabits many of the western Colorado valleys where their small towns inflict relatively little agricultural damage, although Cary (1911) reported that they do considerable damage to crops where they are found. Several small towns survive in the Grand Valley mostly on the north side of the Colorado River. There have been noticeable increases in the population since 1958 in the Grand Valley. There have also been increases in C. gunnisoni zuniensis during recent years, a species more commonly found in the Gunnison River vicinity of Montrose and Delta Counties.

Cary (op. cit.) reported C. leucurus in the Uncompahgre Valley, the North Fork of the Gunnison River Valley, and in the Grand Valley between Grand Junction and the Utah State Line, but not in the Grand Valley between Grand Junction and Glenwood Springs.

Interview with former Colorado National Monument employees revealed that during the 1940's small white-tailed prairie dog colonies existed in the Monument near the West Entrance and also near the "White Rocks"

on the Redlands Road (South Broadway). An old abandoned colony was found near the East Entrance about one-quarter mile south of the present ranger station. This site appeared to have been abandoned for several years. All three of these sites are between 4600 and 4900 feet. No active towns were found during the 1958-1962 period.

One specimen was collected in the Monument, a road kill found near the Fruita Canyon rim on the Rim Rock Drive. This animal was observed by park personnel a few days prior to its death. Other specimens were collected near Fruita on the north side of the Colorado River.

It appeared that this mammal resided in the Grand Valley in small towns and sometimes included the lower sections of the Monument in its local range. Limiting factors in the Monument probably are soil depth, and possibly rainfall.

Specimens Examined -- Total 5, distributed as follows: one-quarter mile above upper Fruita Canyon tunnel, 5300 feet, PHM (1); one-half mile south Fruita, State Highway 340, 4500 feet, CJM (1); South of Grand (Colorado) River bridge near Grand Junction, 4600 feet, ERW (2); Grand Junction, 4600 feet, UCM (1).

Other Records -- Total 7, distributed as follows: (Durrant, 1952) Grand County, Utah, between Moab and Green River, (4); 11 miles south Valley City on Utah Highway 160, (1); 8 miles northwest Moab, (1); north side Colorado River, (1).

Observation Records -- East Entrance to Monument, April 21, 1957, Loren Lane, (2); one-quarter mile above upper Fruita Canyon tunnel, June 25, 1962, James A. Richardson, (1); One-half mile west of Glade Park P. O., July, 1963, C. J. McCoy, Jr., (1).

Citellus variegatus grammurus (Say)

Rock Squirrel

S /ciurus/ grammurus Say. 1823. In Long, Account of an expedition from Pittsburgh to the Rocky Mountains, . . . , vol. 2, p. 72.

Spermophilus grammurus grammurus, True. 1884. Proc. U. S. Nat. Mus., vol. 7 (App., Circ. 29), p. 594, Nov. 29, 1884.

/Citellus variegatus/ grammurus, Elliot. 1904. Field Columbian Mus. Publ. 95, Zool. Ser., vol. 4, pt. 1, p. 149, Aug. 2, 1904.

Citellus variegatus juglans, V. Bailey, 1913. Proc. Biol. Soc. Washington, vol. 26, p. 131, May 21, 1913. (Glenwood, on Rio San Francisco, southwest base of Mogollon Mountains, Catron County, New Mexico.)

Type Locality -- Purgatory (Pugatoire) River, near mouth of Chacuaco Creek, Las Animas County, Colorado (See Cary, North Amer. Fauna 33, p. 87, Aug. 17, 1911.)

Other Common Names -- Cinnamon Ground Squirrel, Colorado Rock Squirrel, Canyon Squirrel, Gray Squirrel, Digger Squirrel, Fox Squirrel, Say's Rock Squirrel.

Comments -- This rodent was the most commonly observed diurnal mammal in the Monument. During spring, summer, and fall it was seen during most daylight hours. Cold weather sends it into its burrows for extended periods of time but it ventures out on nearly any sunny day for short periods of time.

The rock squirrel was found in nearly all habitats in the Monument. There was little altitudinal differentiation in range or population densities in the Monument. It appeared to be slightly more abundant in

the rim and valley communities than in the canyons. The rock squirrel nests in underground burrows but frequents pinyon pines and junipers, especially in late summer when the pinyon nuts and juniper berries are ripe. It is not surprising that this ground squirrel climbs like a true tree squirrel, which it resembles with its large, bushy tail, and it is characteristic for the rock squirrel to climb a tall pinyon or perch on top of a high rock and "whistle" for extended periods of time. This usually occurs during mid-summer to early fall (July to October).

Cary (1911) restricted the rock squirrel in vertical range to below 6500 feet in the Grand River Valley, but it has been observed at well over 7000 feet on Pinyon Mesa. It was found on the South Rim of Black Canyon of the Gunnison National Monument at 8200 feet and there C. v. grammurus and C. lateralis populations were equiponderant. On Pinyon Mesa C. v. grammurus eventually is replaced by C. lateralis, but no data were accumulated to interpret distribution. Citellus lateralis was not found in the monument during the study nor was any evidence uncovered that might warrant placing it on the Monument list.

The rock squirrel is rather omnivorous in food habits. In addition to the previously mentioned pinyon nuts and juniper berries, a variety of other vegetative plants and seeds are consumed. Cary (1911) indicated they have a fondness for young chicks which may indicate they are predaceous on bird hatchlings and eggs. Former Superintendent Aiton and Park Ranger Byrd watched an adult rock squirrel chase and capture an adult cottontail on April 20, 1943. Mr. Aiton stated the squirrel killed the rabbit by biting it on the nape of the neck, ate the ears, and beginning with the nose consumed the entire head before abandoning it (Supt. Report, April, 1943). It was found during this study that the

rock squirrel was sometimes cannibalistic, and rock squirrels caught in traps during daylight hours were often mutilated or almost completely eaten by other rock squirrels. Warren (1942) removed fifteen apricot pits from the cheek pouches of a rock squirrel in Montezuma County, Colorado, in April. Anderson (1961) found 234 pinyon nuts in the cheek pouches of a specimen collected in Mesa Verde National Park.

This species appears to intergrade with C. v. utah in eastern Utah, but Howell (1938) did not believe western Colorado specimens were intergrades. No evidence was found during this study to indicate that the Colorado National Monument specimens intergraded with C. v. utah.

Measurements -- Three adult females measured: 494 (507-485); 214 (227-204); 61.7 (62-61); 26.3 (27-26); one adult male measured: 476, 196, 88, 26.

Specimens Examined -- Total 12, distributed as follows: junction of Rim Rock Drive and park utility area road, 5780 feet, PHM (1); Rim Rock Drive (D.O.R.), PHM (1); Rim Rock Drive and Saddlehorn Road junction, 5780 feet, PHM (1); Rim Rock Drive, one-quarter mile east Fruita Canyon Overlook, 5700 feet, CJM (1); Rim Rock Drive, one-quarter mile west of Highland View, 6530 feet, COLM (1); Grand Junction, Mesa County, Colorado, 4600 feet, ERW (2); Sieber Ranch, Little Dolores River, Mesa County, Colorado, 5675 feet, ERW (5).

Other Records -- Total 18, distributed as follows: (Anderson, 1959) three miles east, four miles south Collbran, Mesa County, 6800 feet, KU (3); (Anderson, 1959) Mesa Verde National Park, Colo. MVNP (6); (Durrant, 1952) Grand County, Utah, (7); (Howell, 1938) Grand Junction, (1); 12 miles east of Tunnel, Mesa County, Colo., (1).

Observation Records -- Monument utility area, April 20, 1943, Superin-

tendent Aiton and Park Ranger Byrd. Fruita Canyon, March 7, 1959, Park Ranger J. M. Morehead. Monument Utility area, Feb. 13, 1962, Park Ranger J. V. Court.

Citellus leucurus cinnamomeus (Merriam)

White-tailed Antelope Squirrel

Tamias leucurus cinnamomeus Merriam. 1890. North Amer. Fauna No. 3, p. 52, Sept. 11, 1890.

Citellus leucurus cinnamomeus, Elliot. 1905. Field Columb. Mus. Publ. 105, Zool. Ser., vol. 6, p. 299, Dec. 6, 1905.

Type Locality -- Echo Cliff, Painted Desert, Coconino County, Arizona.

Other Common Names -- Rusty Antelope Squirrel, Antelope Ground Squirrel, Cinnamon Ground Squirrel, Antelope Chipmunk, White-tailed Chipmunk.

Comments -- In his review of the mammals of Colorado, Warren (1942) cited both C. l. cinnamomeus and C. l. pennipes from Grand Junction, the type location of pennipes. Hall and Kelson (1959) in their range map (p. 333) indicated Grand Junction as a marginal locality for both forms. In view of that situation, a close examination of the species from the Monument was made.

Skull measurements and coloration were used to separate the two subspecies, but the former was especially difficult because there are few series of comparative measurements in the literature. Specimens examined included topotypes of pennipes, specimens from the Grand Valley, Colorado National Monument, and the Uncompahgre Plateau. Color appeared to be a more reliable character to distinguish between the two forms. Color in cinnamomeus is decidedly more rusty or vinaceous than pennipes.

Altitudinal stratification was evident in the species as it relates

to the Monument. Citellus leucurus pennipes inhabits the lower elevations of the Monument including the Grand Valley. This form is replaced by cinnamomeus at about 5500 feet and upwards on Pinyon Mesa. This species exhibited the best evidence of vertical stratification found in the Monument.

Ecologically, the two forms occupy somewhat different habitats. At the lower elevations, pennipes occupies areas of sandy soils, sparse precipitation, and vegetative types such as Sarcobatus, Atriplex, Artemisia, and gallery forests of Populus along streams. Above 5500 feet cinnamomeus inhabits open, less sandy situations with vegetative types of more transitional influence such as Quercus, Amelanchier, Cercocarpus, and sometimes pinyon-juniper situations.

Measurements -- Measurements of two adult females were: 218.5 (222-215), 61.0 (63-59), 38.0 (39-37), 10.5 (11-10); one adult male measured: 229, 68, 40, 11.

Specimens Examined -- Total 8, distributed as follows: one-quarter mile West of Coke Ovens, Rim Rock Drive, 6073 feet, PHM (1), CJM (1); Sieber Ranch, Little Dolores River, Mesa County, Colorado, 5675 feet, ERW (1), UCM (2); Coventry, Montrose County, Colorado, 6800 feet, ERW (1); Ashbaugh's Ranch, Montezuma County, Colorado, 5350 feet, ERW (2).

Other Records -- Total 1, distributed as follows: (Durrant, 1952) Little Castle Valley, Grand County, Utah, (1).

Citellus leucurus pennipes (A. H. Howell)

White-tailed Antelope Squirrel

Ammospermophilus leucurus pennipes A. H. Howell. 1931. Jour. Mamm., vol. 12, No. 2, p. 162, May 14, 1931.

Citellus leucurus pennipes, A. H. Howell. 1938. North Amer. Fauna No. 56 (April), p. 175, May 18, 1938.

Type Locality -- Grand Junction, Mesa County, Colorado.

Other Common Names -- Colorado Antelope Ground Squirrel, Colorado Antelope Squirrel, Antelope Chipmunk, White-tailed Chipmunk.

Comments -- A more complete discussion of the species was made under the diagnosis of C. l. cinnamomeus. As indicated there, vertical stratification was evident between the two subspecies found in the Monument. The differential altitude is about 5500 feet with pennipes occupying the lower sections.

Ecologically, pennipes prefers the warmer sections of the Monument living mostly in the greasewood-saltbrush-sagebrush flats or rocky exposed Morrison Formation outcrops in the lowest elevations, and near the Colorado River outside the Monument.

Measurements -- Measurements from 11 adult females: 214.8 (226-187), 62.2 (67-57), 38.8 (47-37), 10.7 (13-8); from 4 adult males: 214.5 (222-206), 57.3 (60-48), 40.8 (43-39), no ear measurements available.

Specimens Examined -- Total 35, distributed as follows: Mouth of North Monument Canyon, 4700 feet, PHM (1), CJM (1); Upper Fruita Reservoir, West Entrance to Monument, 4737 feet, PHM (1), CJM (1); three-quarter mile above West Entrance Station on Rim Rock Drive, 4790 feet, COLM (2); Grand Junction, 4600 feet, ERW (7), USNM (10), UCM (4); north of Mack, Mesa County, 4670 feet, ERW (3); 7 miles south of Carbonera, Mesa County, UCM (1); Cameo, Mesa County, UCM (1); 10 miles north of Grand Junction, UCM (1); Bedrock, Montrose County, ERW (2).

Other Records -- Total 19, distributed as follows: (Howell, 1938) Fruita, 4504 feet, USNM (1); Grand Junction, 4600 feet, USNM (10); Hotchkiss,

Montrose County, USNM (2); Rangeley, Rio Blanco County, USNM (1); 20 miles east of Rangeley, USNM (2); (Durrant, 1952) 1 mile east of Highway 160, 6 miles south of Valley City, Grand County, Utah, 4500 feet, (3).

Eutamias minimus operarius Merriam

Least Chipmunk

Eutamias amoenus operarius Merriam. 1905. Proc. Biol. Soc. Washington, vol. 18, p. 164, June 29, 1905.

Eutamias minimum operarius, A. H. Howell. 1922. Jour. Mamm., vol. 3, No. 3, p. 183, Aug. 4, 1922.

Type Locality -- Gold Hill, Boulder County, Colorado, Altitude 7400 feet.

Other Common Names -- Lesser Colorado Chipmunk, Busy Chipmunk, Colorado Chipmunk.

Comments -- Sutton (1953) reported the range of E. minimus operarius in western Colorado as occupying all of the area south of the Colorado River, but explained that the lack of suitable habitat in the Grand Valley precluded its occurrence in that area. A specimen examined from near Colorado National Monument was collected by Sutton on the abandoned Serpent's Trail Road at 6600 feet just outside the boundary. Sutton also collected three other specimens between that location and Pinyon Mesa with the lowest subsequent site being at 8600 feet near the Fruita water reserve road. The other two specimens came from 9000 feet on Pinyon Mesa.

The single Monument specimen was collected in a sparse Pinyon Pine-Utah Juniper forest on the rim area of No Thoroughfare Canyon. That habitat does not appear to be optimum for minimus which seems to prefer

the scrub oak habitat of slightly higher altitudes. This was borne out by the fact that minimus was collected in abundance on both rims of Black Canyon of the Gunnison National Monument at slightly over 8000 feet in such habitat. The majority of Sutton's collections in Mesa County were made at altitudes above 7500 feet in chaparral or medium-altitude coniferous forests. This subspecies shows the widest altitudinal distribution of any Colorado Chipmunk, being recorded from 6500 feet to 12,500 feet.

The slight overlap with E. q. hopiensis was only at the higher elevations of the Monument and the two species are easily distinguished by the bright tawny general color and large size of hopiensis.

Measurements -- One adult male: 199, 90, 33, 19.

Specimens Examined -- Total 10, distributed as follows: Uncompahgre Plateau, Whitewater, Mesa County, 7500 feet, UCM (3); Land's End Road, Whitewater, Mesa County, UCM (4); Hightower Ranger Station Road, Collbran Mesa County, 8400 feet, UCM (1); 25 miles northeast Collbran, Mesa County, Colorado, 7300 feet, UCM (1); Serpent's Trail, Colorado National Monument, 6600 feet, UCM (1).

Eutamias quadrivittatus hopiensis Merriam

Colorado Chipmunk

Eutamias hopiensis Merriam. 1905. Proc. Biol. Soc. Washington, col. 18, p. 165, June 29, 1905.

Eutamias quadrivittatus hopiensis, A. H. Howell. 1922. Jour. Mamm., vol. 3, No. 3, p. 184, Aug. 4, 1922.

Type Locality -- Keams Canyon, Painted Desert, Navajo County, Arizona.

Other Common Names -- Hopi Chipmunk, Say Chipmunk.

Comments -- The Colorado Chipmunk is an ubiquitous species in Colorado

National Monument. It was collected at 14 of the trapping sites, in nearly all habitats examined, and was common at all altitudes in the Monument. It was the only common chipmunk in the Monument.

Howell (1929) stated that the purest form of E. q. hopiensis, for diagnostic characters, was in western Colorado and southeastern Utah. The Colorado National Monument specimens bear out Howell's observations concerning coloration. The dorsal stripes are tawny with some black. The grayish-colored rump is another distinguishing character which aids in separating hopiensis from E. minimus in the Monument.

Food habits of this chipmunk appear to be extremely varied depending largely upon development of seeds of the various shrub species. They have been observed feeding upon the seeds of Cercocarpus, Juniperus, Pinus edulis, Atriplex, Chrysothamus nauseosus, Amelanchier, and Cowania. The blossoms of Yucca harrimanae also are eaten. The yucca is harvested by cutting the flowering stalk off just below the blossoms and then dragging off the entire stalk or else removing the flowers one at a time for the cache. A captive specimen kept by Sutton readily ate flies and beetles.

Sutton (1953) stated that all records for hopiensis were from very rocky places in scattered pinyon-juniper associations. He further stated that he thought sage to be important to them as food. Sutton's placement of this subspecies in rocky, pinyon-juniper situations fits the Monument in a general sense, but it was not found that hopiensis always occupied such locations. Although sagebrush is important to most mammals in the Monument, mature sagebrush (Artemisia tridentata) stands were conspicuously void of hopiensis.

Sutton (1953) found seven embryos (26 mm) in a specimen collected

as early as March 21, and embryos in a specimen collected April 1. Lactating females were found on May 13 and 14 and on June 22. One post-lactating female was collected on June 22.

Altitudinal records of specimens collected in the Monument and adjacent areas indicated that hopiensis was common from 4485 feet near the Fruita bridge to 6800 feet one mile west of Serpent's Trail Road. Sutton (op. cit.) listed collection records from 4600 feet to 8050 feet. Sutton's records were distributed with 28 percent in the upper Sonoran Zone, 71 percent in the Transition Zone, and only 1 percent from the Canadian Zone above 8000 feet.

Measurements -- 15 adult females: 210.7 (225-200), 90.1 (95-76), 32.3 (34-29), 16.6 (21-11); measurements of 21 adult males: 208.2 (221-195), 90.4 (98-83), 32.1 (34-30), 17.0 (22-12).

Specimens Examined -- Total 68, distributed as follows: (Colorado National Monument unless otherwise indicated). Site 1, 5787 feet, COLM (1); Site 2, 5780 feet, COLM (2), PHM (2), CJM (2); Site 3, 5780 feet, CJM (2); Site 7, 5800 feet, UCM (1); Site 15, 5140 feet, UCM (1); CJM (10); Site 16, 4700 feet, PHM (1); Site 19, 6400 feet, PHM (2); Site 21, 6520 feet, PHM (1); Site 22, 6400 feet, PHM (5); Site 23, 5780 feet, PHM (5); Site 25, 4913 feet, PHM (6); Site 29, 5520 feet, CJM (1); 100 yards west of Coke Ovens Trail head, 6070 feet, COLM (1); Fruita bridge, 4485 feet, CJM (1); Grand Junction, Mesa County, Colo., 4600 feet, ERW (8); Luster Ranch, Glade Park, Mesa County, Colo., UCM (2); Serpent's Trail, 5750 feet, UCM (1); Serpent's Trail, 6400 feet UCM (1); Serpent's Trail, 6750 feet, UCM (4); Serpent's Trail, 6800 feet, UCM (1); Campground, Colorado National Monument, 5800 feet, UCM (1).

Other Records -- Total 5, distributed as follows: (Sutton, 1953) Grand

Junction, Mesa County, 4600 feet, AMNH (3), UCM (2); 9 miles south Glade Park store, AMNH (1); 1½ miles south Loma, Mesa County, Colo., 4600 feet, KU (1).

Observation Records -- Quarters No. 1, Saddlehorn area, Colorado National Monument, 5800 feet, February 18, 1962, by Pat H. Miller.

Perognathus apache caryi Goldman

Apache Pocket Mouse

Perognathus apache caryi Goldman. 1918. Proc. Biol. Soc. Washington, vol. 31, p. 24, May 16, 1918.

Type Locality -- Eight miles west of Rifle, Garfield County, Colorado.

Other Common Names -- Colorado Pocket Mouse.

Comments -- The factors influencing distribution of Perognathus in Colorado National Monument appear to be primarily soil type, and secondarily, vegetation type. There was no evidence found of altitudinal stratification within the Monument. Most successful collections in the Monument were made in areas of sparse vegetation and loose, sandy soils. Vegetation was composed of mixed Artemisia and Atriplex growing near the edge of a sparse pinyon-juniper woods at site 22, near the head of Red Canyon (6400 feet). The area was a road maintenance borrow-pit for dirt fill. The sparse grass was mostly Bromus.

Site 25, (4913 feet) was even more successful than Site 22 for collection of Perognathus. This site, in No Thoroughfare Canyon, was in deep sandy soil with predominant vegetative types being Sarcobatus, Atriplex, and Artemisia with a ground covering of Bromus and Salsodia. Cary (1911) collected this medium-size pocket mouse among prickly pears on the sandy desert north of Frutia. He further stated that distribution

in the Grand Valley appeared to be local. Prickly pear cactus was not common at site 22, but was very common at site 25, and there did appear to be an association between Perognathus and Opuntia.

Other than general habitat requirements and some little information concerning food habits during August, little was learned about the life history of Perognathus. Hunting this nocturnal pocket mouse at night utilizing gasoline lanterns and flashlights failed to produce any specimens in known habitats of Perognathus.

Measurements -- 5 adult females: 136.8 (142-131), 66.6 (69-64), 18.0 (20-16), 7.3 (8-7).

Specimens Examined -- Total 6, distributed as follows: Red Canyon borrow pit, one-quarter mile west of Red Canyon Overlook, elevation 6400 feet, PHM (1); brushy flat near borrow pit, one-quarter mile southeast East Entrance Ranger Station, elevation 4913 feet, PHM (4); Sieber Ranch, Little Dolores River, Mesa County, 5675 feet, ERW (1).

Other Records -- Total 2, distributed as follows: (Cary, 1911) Grand River valley near Rifle, (1); north of Fruita, "several"; (Durrant, 1952) 18 miles northeast Moab, Grand County, Utah, elevation 6000 feet, (1).

Dipodomys ordii sanrafaeli Durrant and Setzer

Ord's Kangaroo Rat

Dipodomys ordii sanrafaeli Durrant and Setzer. 1945. Bul. Univ. Utah, vol. 35, No. 26, June 30, 1945.

Type Locality -- One and one-half miles north of Price, Carbon County, Utah. Altitude 5567 feet.

Other Common Names -- San Rafael Kangaroo Rat, Pocket Rat.

Comments -- The kangaroo rat in Colorado National Monument was most often collected in deep, sandy soil away from the canyon rims. The most successful collecting site was in the Saddlehorn vicinity where observations were common in the picnic area and in the older section of the campground. Probably wherever there is suitable soil conditions, kangaroo rats can be found. It was coinhabitant with Perognathus in the Red Canyon borrow pit (Site 22).

Subspecies determination of Dipodomys in the Monument was based on Setzer's (1949) analysis that included Dipodomys ordii collections from three localities in Colorado: State Line, Fruita, and Grand Junction. Setzer noted intergradation between D. o. nexilis and sanrafaeli but stated that the Mesa County specimens were all referrable to D. o. sanrafaeli. Typical sanrafaeli from the type locality near Price, Utah, differ from nexilis in being smaller in size, lighter in color, narrower across the zygomatic processes, wider across the occipital condyles, and the pterygoid fossae are ovoid rather than round. Specimens collected in Colorado National Monument and those examined from the University of Colorado Museum collected at Grand Junction are therefore possibly intergrades between nexilis and sanrafaeli, but are herein referred to as sanrafaeli.

Kangaroo rats in the Monument were observed most often during August after evening rains. The cool moist nights were also best for trapping. Rolled oatmeal was successful in attracting Dipodomys to snap traps. Sutton collected one in January.

Little association with vegetative types was noted, but examination of cheek pouches revealed a high percentage of grass seeds. Soil type and depth is probably the most limiting factor in Monument distribution.

Measurements -- One adult female: 249, 150, 43, 14; nine adult males: 263.9 (291-237), 143.2 (156-126), 42.6 (44-37), 12.7 (16-7).

Specimens Examined -- Total 14, distributed as follows: Saddlehorn picnic area, 5780 feet, PHM (1); Saddlehorn area near quarters No. 1, 5780 feet, PHM (3), CJM (2); Red Canyon borrow pit, 6400 feet, PHM (1); Rim Rock Drive near Fallen Rock Overlook, dead on road, 6412 feet, PHM (2); Utility area, 5800 feet, UCM (1); Airport, Grand Junction, Mesa County, 4800 feet, UCM (3); Book Cliffs Road, Mesa County, UCM (1).

Other Records -- Total 17, distributed as follows: (Setzer, 1949) One mile east of Green River, (1); 16 miles northwest of Moab, (2); Grand County, Utah, State Line, (11); Fruita, (1); Grand Junction, (2); Mesa County.

Observation Records -- one-quarter mile west of Highland View, Rim Rock Drive, dead-on-road, 6355 feet, June, 1958, (1), Pat H. Miller; Saddlehorn Road, 5780 feet, June 19, 1959, (1), Pat H. Miller; Highland View on Rim Rock Drive, 6355 feet, June 26, 1959, (1), Pat H. Miller; Rim Rock Drive, several seen, October 8, 1960, Pat H. Miller.

Reithrodontomys megalotis aztecus J. A. Allen

Western Harvest Mouse

Reithrodontomys megalotis aztecus J. A. Allen. 1893. Bull. Amer. Mus. Nat. Hist., vol. 5, p. 79, April 28, 1893.

Reithrodontomys megalotis aztecus, A. H. Howell. 1914. North Amer. Fauna No. 36, p. 30, June 5, 1914.

Type Locality -- La Plata, San Juan County, New Mexico. (See J. A. Allen, Bull. Amer. Mus. Nat. Hist., vol. 7, p. 125, May 21, 1895).

Other Common Names -- Aztec Harvest Mouse, Big-eared Harvest Mouse.

Comments -- There appeared to be very little differentiation in altitudinal distribution of R. m. aztecus in the Monument area. A specimen examined from site 25 at 4913 feet represents the lowest elevation. Ten specimens collected near the Monument's Rim Rock Drive (site 29) at 6500 feet represent the highest elevations. A range of intermediate elevations is represented by other specimens.

Habitats, on the other hand, showed extremes in variation with specimens taken from well-drained, arid areas of sparse vegetation, and wet, marshy, well-vegetated areas. The largest single collection was made at site 24 in a brushy Quercus - Amelanchier area. Cary (1911) collected two specimens near Morris, Garfield County, in beds of Opuntia. Bailey (1931) stated that Loring captured 12 specimens among weeds and small willows in the center of a large field near Laplata, New Mexico. Three specimens were trapped under a large Sarcobatus bush in a sandy, dry area of North Monument Canyon, and three were collected in mixed bunches of grasses and Juncus under a Populus fremonti stand in the marshy area below the upper Fruita Reservoir.

No pregnant females were taken during the study, but three lactating females were captured on August 12 and 13. Four males in breeding condition were trapped on June 18, August 13, and August 21. Anderson (1961) indicated that females are pregnant from August to November and that there is an autumnal peak in breeding activities. Cary (1911) reported that one specimen examined by him August 13, 1906, contained six fetuses.

Identification to subspecies was based upon the larger ear size and generally more robust skull. Eleven adult specimens averaged 15.5 mm. in ear size (14-18). R. m. megalotis from the type locality averaged

12.5 mm. from the notch (12-13.2) according to Howell (1914). The skull of R. m. aztecus is considerably larger than that of megalotis.

Anderson (op. cit.) reported finding one specimen in the stomach of a small rattlesnake (Crotalis viridis) that was trapped in a snap trap on a dry, sparsely-vegetated hillside in Mesa Verde National Park.

Measurements -- Measurements of 8 adult females: 132.8 (145-115), 62.3 (68-51), 17.3 (19-16), 15.8 (18-14); measurements of 9 adult males: 126.1 (141-100), 60.6 (67-56), 16.9 (19-16), 15.4 (18-14).

Specimens Examined -- Total 22, distributed as follows: Marsh below Fruita reservoir, 4700 feet, PHM (1), CJM (2); Utility area, 5787 feet, UCM (1); Mouth of North Monument Canyon, 4700 feet, PHM (1), CJM (2); Head of Ute Canyon near Rim Rock Drive, 6500 feet, PHM (10); East Entrance Ranger Station, 4913 feet, PHM (1); Upper Fruita Canyon Tunnel, 5250 feet, PHM (1); Seiber Ranch, Little Dolores River, Mesa County, 5675 feet, UCM (3).

Other Records -- Total 66, distributed as follows: (Howell, 1914) Grand Junction, Mesa County, 4600 feet, (26); Rifle, Garfield County, (2); (Anderson, 1961) Mesa Verde National Park, (38).

Peromyscus crinitus auripectus (J. A. Allen)

Canyon Mouse

Sitomys auripectus J. A. Allen. 1893. Bull. Amer. Mus. Nat. Hist., vol. 5, p. 75, April 28, 1893.

Peromyscus crinitus auripectus, Osgood. 1909. North Amer. Fauna No. 28, p. 23, April 17, 1909.

Peromyscus crinitus peridoneus, Goldman. 1937. Journ. Mamm., vol. 18, No. 1, p. 92, Feb. 11, 1937. (Bright Angel Trail, south side of

Grand Canyon, Coconino County, Arizona. Altitude 4800 feet. Regarded as identical with auripectus by Hall and Hoffmeister, Jour. Mamm., vol. 23, No. 1, p. 64, Feb. 14, 1942.)

Type Locality -- Bluff City, San Juan County, Utah.

Other Common Names -- Buff-breasted Canyon Mouse, Golden-breasted Canyon Mouse.

Comments -- This beautiful, large-eared mouse is nearly always found in rocky situations. Specimens collected in the Monument were all found in either the rim areas just above the deep canyons, in the canyons, or in the shallow intrusions of the Entrada sandstone above the deep canyons. Only two specimens were not collected in the rocks.

The canyon mouse is characterized by large ears, long and heavy tail that is heavily haired, and by a buff spot on the white breast. The ear size (average 20.7 mm. in 17 specimens) is considerably smaller than in Peromyscus truei truei, the other large-eared mouse in the Monument (average ear size for 87 truei was 24.0 mm.).

The canyon mouse is evidently most abundant in the Upper Sonoran Zone in western Colorado but there appeared to be some doubt as to restrictions in stratification. Cary (1911) stated that it was only found below 6500 feet. Warren (1942) raised the elevational limits to 7000 feet and expressed some doubt as to that elevation. It was collected on the North Rim of Black Canyon of the Gunnison National Monument, Montrose County, at 8000 feet by the author. Hall (1946) collected P. c. crinitus at 10,000 feet in Nevada at the edge of the Transition Zone. Monument records indicate that it is found in rocky situations at all altitudes in the Monument.

Bailey (1931) stated that the average number of embryos found in

New Mexico specimens was 4 with extremes of 3 and 5. The two pregnant specimens collected in the Monument contained 4 fetuses each.

Measurements -- Measurements from 8 adult females: 171.1 (182-162), 90.3 (94-83), 20.9 (21-20), 20.9 (22-20); from 6 adult males: 169.7 (181-160), 89.2 (94-82), 21.0 (23-20), 20.8 (26-18).

Specimens Examined -- Total 18, distributed as follows: Saddlehorn Area, 5780 feet, COLM (2), CJM (1), UCM (1); Head of North Monument Canyon above Rim Rock Drive about 1 mile east of visitor center, 5780 feet, PHM (2), CJM (2); Rim Rock Drive at Distant View, PHM (1); Fruita Canyon, 5140 feet, UCM (4); above Rim Rock Drive near Coke Ovens View, 6100 feet, UCM (2); Rim Rock Drive, one-quarter mile west of Coke Ovens View, 6070 feet, CJM (2); Grand Junction near Gunnison River, 4600 feet, ERW (1).

Other Records -- Total 14, distributed as follows: (Durrant, 1952), Grand County, Utah (14).

Peromyscus maniculatus osgoodi Mearns

Deer Mouse

Hesperomys leucopus nebrascensis Mearns. 1890. Bull. Amer. Mus. Nat. Hist., vol. 2, p. 285 (described on p. 287), Feb. 21, 1890. (Not *Hesperomys sonoriensis* var. *nebrascensis* Coues, 1877.)

Peromyscus maniculatus osgoodi, Mearns. 1911. Proc. Biol. Soc. Washington, vol. 24, p. 102, May 15, 1911. (Substitute for *nebrascensis* Mearns.)

Type Locality -- Calf Creek, Custer County, Montana.

Other Common Names -- Black-eared Deer Mouse, Osgood's White-footed Mouse, Vesper Mouse, Wood Mouse.

Comments -- This nocturnal rodent was the most abundant mammal collected in the Monument. It appears to be tolerant of altitudinal variations over much of its range. Lechleitner (1955) stated that in Glacier National Park it ranged from forests and meadows to barren, rocky mountain peaks and cirques. In western Colorado P. m. osgoodi appeared to inhabit the Upper Sonoran zone and P. m. rufinus replaces it at higher elevations. Anderson (1961) examined 396 specimens of rufinus from Mesa Verde National Park at elevations ranging from 7000 feet to over 8525 feet and did not record osgoodi at any elevation in the Park. Earlier (1959) he had examined 36 specimens of Peromyscus maniculatus from seven sites on Grand Mesa with an altitudinal range of 6800 to 10,200 feet and assigned all specimens to rufinus. Hall and Kelson (1959) indicated from marginal records for the two subspecies that osgoodi and rufinus are primarily separated along the Colorado River. Specimens of osgoodi were listed from south of the Colorado River and northwest of the Gunnison River, whereas rufinus was listed from north of the Colorado River. Anderson's interpretations do not agree with those of Hall and Kelson.

Warren (1942) collected osgoodi from Grand Junction, but there was no indication as to the side of the Colorado on which he collected the specimens. Warren (op. cit.) also collected osgoodi near Fruita and Mack, both north of the river. Rufinus was taken from both sides of the Gunnison River in the Black Canyon, Montrose County. Warren (1942) also took osgoodi at the Seiber Ranch on the Little Dolores River at 5675 feet. University of Colorado specimens were collected on Pinyon Mesa at 9000 feet elevation and along the Little Dolores. All specimens collected in Colorado National Monument have been assigned to osgoodi.

P. m. osgoodi differs from rufinus in being slightly larger in size and having a little less rufus color on the sides. The skull of osgoodi is slightly larger than of rufinus. Durrant (1952) stated that the skull of osgoodi has the nasals longer, narrower, and more convex; the zygomatic breadth greater; and, the length of diastema greater. Measurements of maniculatus trapped in the Monument have substantiated the greater measurements.

Peromyscus maniculatus was found in most situations with P. truei in the Monument and sometimes with P. crinitus. It was collected in every trapping site in the Monument except Sites 4, 7, 10, 11, 12, and 17. It was collected with truei at every site except Nos. 6, 10, 14, 24, and 30. It was collected with crinitus at Sites 2, 7, 18, and 26 (truei was also collected at those sites). Only at Site 15 were truei and crinitus found together without maniculatus.

The species thus appears to be ubiquitous in the Monument at all elevations and in nearly all habitats.

Measurements -- Measurements from 42 adult females: 156.5 (181-136), 68.5 (80-46), 17.8 (21-17), 17.5 (20-13); from 45 adult males: 153.2 (167-137), 67.3 (81-58), 19.5 (22-17), 17.6 (21-13).

Specimens Examined -- Total 164, distributed as follows: Site 1, CJM (1); Site 2, PHM (1), CJM (1); Site 5, PHM (3); Site 6, PHM (1); Site 7, COLM (1), UCM (1), CJM (1); Site 13, CJM(4); Site 14, CJM (5); Site 15, PHM (1); Site 16, PHM (5), CJM (1); Site 18, CJM (2); Site 19, PHM (4); Site 20, PHM (8); Site 21, PHM (1); Site 22, PHM (14); Site 23, PHM (4); Site 24, PHM (19); Site 25, PHM (26); Site 26, PHM (3), COLM (1); Site 27, PHM (1); CJM (3); Site 28, PHM (8); CJM (10); Site 29, PHM (6), CJM (6); Site 30, CJM (4); Little Dolores River, Mesa County, Colorado, ERW

(9); North of Mack, Mesa County, Colorado, ERW (1); Grand Junction, Mesa County, Colorado, ERW (2); 7 miles south of Glade Park Store, Mesa County, Colorado, UCM (3); Rim Rock Drive one-half mile west of Distant View, PHM (1); Mesa top above Coke Ovens Overlook, UCM (2).

Peromyscus truei truei (Shufeldt)

Pinyon Mouse

Hesperomys megalotis Shufeldt. 1885. Proc. U. S. Nat. Mus., vol. 8, p. 407, Sept. 14, 1885.

Hesperomys megalotis, Merriam. 1890. North Amer. Fauna No. 3, p. 63, Sept. 11, 1890.

P/eromyscus/ truei, Thomas. 1894. Ann. Mag. Nat. Hist., ser. 6, vol. 14, p. 365, Nov. 1894.

Peromyscus lasius, Elliot. 1904. Field Columb. Mus. Publ. 90, Zool. Ser., vol. 3, p. 265, Mar. 7, 1904. (Hannopee Canyon, Panamint Mountains, Inyo County, California).

Type Locality -- Fort Wingate, McKinley County, New Mexico.

Other Common Names -- True's Deer Mouse, True Cliff Mouse, True White-footed Mouse, Large-eared Deer Mouse.

Comments -- Throughout its range Peromyscus truei truei appears to be coexistent with Pinyon Pine forests. The pinyon is often replaced by juniper, and Hall (1946), stated that truei was found in Nevada in situations where rocks and pinyons are found together. In Colorado National Monument truei was not restricted to pinyon-juniper vegetative types and was taken both in moist locations dominated by Populus and in mixed sagebrush-oak stands. The largest populations were found in pinyon-juniper areas. As might be expected, mature pinyon-juniper

forests did not yield the greatest trapping success. Open juniper-grass-sagebrush growing near rock outcrops produced the most specimens.

The vertical range of truei in the Monument showed no variation in either habitat selection or population densities from the lowest site (4700 feet) to the highest (6610 feet). Hoffmeister (1951) stated that the altitudinal range varied from 3150 feet at Camp Verde, Arizona, to 11,000 feet in the Charleston Mountains, Nevada. Cary (1911) indicated that truei invariably inhabited the Upper Sonoran life zone, but he once took a specimen in the Canadian Zone. Hoffmeister (op. cit.) listed the zonal range as Upper Sonoran and rarely inhabiting the Lower Sonoran or Transition Zones. No collections were made in the Transition Zone outside the boundaries of Colorado National Monument but it was collected in Transition Zone vegetative types (Quercus) at 6410 feet in the Monument and in chaparral associations on both rims of the Black Canyon of the Gunnison, Montrose County.

The pinyon mouse has relatively the largest ears of any native mice (Bailey, 1931). The long ears (average, 24 mm. in 86 animals from the Monument) distinguish truei from maniculatus (average 17.8 mm. in 126 animals) and crinitus (average 20.8 mm. in 16 animals). It is further differentiated from crinitus in having a relatively shorter tail (83.7 mm. versus 88.8 in crinitus).

This nocturnal cricetid mouse was the second most numerous mammal collected in Colorado National Monument. It makes its home in rocks or in hollow juniper trees. Large caches of pinyon nuts and juniper seeds indicate that they provide a large part of the diet of truei. The 4-6 young are born in late spring or early summer.

Measurements -- Measurements from 23 adult females were: 181.5 (217-141),

90.9 (98-72), 22.7 (24-20), 25.5 (28-20); measurements from 21 adult males were: 175.7 (196-153), 88.0 (100-77), 22.0 (25-19), 24.3 (28-19).

Specimens Examined -- Total 92, distributed as follows: Site 1, COLM (1); Site 2, COLM (1), CJM (2); Site 4, PHM (2); Site 5, PHM (2); Site 7, COLM (1); CJM (1); UCM (5); Site 9, PHM (5); Site 13, PHM (3); CJM (5); Site 15, CJM (1); Site 16, PHM (7); CJM (1); Site 18, CJM (2); Site 19, PHM (2); Site 20, PHM (8); Site 21, PHM (1); Site 22, PHM (6); Site 23, PHM (2); Site 25, PHM (17); Site 26, COLM (3), PHM (5), CJM (3); Site 27, PHM (1); CJM (1); Site 28, PHM (1); Site 29, PHM (3).

Other Records -- Total 54, distributed as follows: (Anderson, 1961) Mesa Verde National Park, (42). (Durrant, 1952) Grand County, Utah, (12).

Neotoma mexicana inopinata Goldman

Mexican Wood Rat

Neotoma mexicana inopinata Goldman. 1933. Jour. Washington Acad. Sci., vol. 23, No. 10, p. 471, Oct. 15, 1933.

Type Locality -- Chuska Mountains, San Juan County, New Mexico. Altitude 8800 feet.

Other Common Names -- Colorado Wood Rat, Gale's Wood Rat, Pack Rat, Trade Rat, Mountain Rat, Brush Rat.

Comments -- The Mexican Wood Rat was found at most elevations in the Monument and in a variety of habitats. Finley (1958) placed their upper elevation limit between 7000 and 8500 feet, depending upon exposure. They inhabit the Upper Sonoran Life Zone mostly below 7500 feet, rarely getting into the Lower Sonoran but do extend their range into the Transition Zone.

Finley (1958) found mexicana did not go north of the Colorado or

Gunnison Rivers in Colorado. Rivers evidently act as effective barriers to wood rats and they are reluctant to cross them even via such structures as bridges. Hall and Kelson (1959) indicated a marginal record for inopinata from Grand Junction collected by Warren in 1913. Warren's collection records do not specify on which side of the Grand (Colorado) River he made his collections, but Finley in his collecting did not find them on the north side of the river at Grand Junction, but did collect Neotoma lepida which has not been recorded on the south side of the Colorado and Gunnison Rivers.

N. m. inopinata can be distinguished from N. l. lepida which ranges on the north side of the Grand Valley, by less inflated bullae and in more curved lateral margins of the interpterygoid fossa and the generally larger skull. The Mexican Wood Rat has a dark ring around the mouth. N. m. inopinata is distinguishable from N. cinerea in that it has a smaller rostrum and more curved lateral margins of the interpterygoid fossa. Usually the heavily haired tail of cinera will distinguish it from mexicana. (Finley, op. cit.)

The Mexican Wood Rat was most widespread in the pinyon-juniper forest but was by no means restricted to that community. It was also common in the juniper-sagebrush association. Nests are commonly constructed in and under rock crevices. They are composed of sticks, bones, and other debris and are sometimes lined with juniper bark. N. m. inopinata has a weak collecting instinct according to Finley (op. cit.).

Food of mexicana consists of many types of shrubs and forbs but they show a marked dislike for cactus, eating only areoles of certain species, including Echinocereus coccineus. Finley (1958) found that a nest two and one-half miles south of Fruita, Mesa County, and very near

the Monument, contained Juniperus osteosperma, Atriplex, Salsola kali, Stanleya, Ephedra viridis, Artemisia tridentata, Pinus edulis, Chrysothamnus and Echinocereus.

Measurements -- Three adult females measured: 276.3 (303-245), 131.7 (141-125), 30.0 (31-29), 24.3 (25-23); two adult males measured: 277.0 (307-247), 130.0 (143-117), 30.5 (31-30), 24.5 (25-24).

Specimens Examined -- Total 7, distributed as follows: Site 7, UCM (1); Site 15, UCM (1); Site 24, PHM (1); Site 27, CJM (1); Site 28, CJM (1); Site 31, UCM (1); one-quarter mile east of Grand View on Rim Rock Drive, COLM (1).

Other Records -- Total 29, distributed as follows: (Finley, 1958) two and one-half miles south Fruita, 4600 feet, south side Colorado River, (1); Sieber Ranch, Little Dolores River, 5675 feet (six miles east of Utah State Line [Warren, 1913:97; Grand Junction, 4600 feet, South Side Colorado River, ERW (3), MVZ (1); (Anderson, 1961) MVNP (10); (Durrant, 1952), (5), Grand County, Utah.

Neotoma cinerea arizonae Merriam

Bushy-tailed Wood Rat

Neotoma arizonae Merriam. 1893. Proc. Biol. Soc. Washington, vol 8, p. 110, July 31, 1893.

Neotoma cinerea arizonae, Goldman. 1910. North Amer. Fauna No. 31, p. 56, Oct. 19, 1910.

Type Locality -- Keams Canyon, Navajo County, Arizona.

Other Common Names -- Arizona Wood Rat, Pack Rat, Trade Rat, Mountain Rat, Brush Rat.

Comments -- The bushy-tailed and Mexican wood rats were found in the

Monument with equal frequency. Finley (1958) found no altitudinal limits for cinerea in Colorado. No other species occurs higher than 9000 feet in the upper part of the Transition Life Zone, however, N. c. arizonae occurs only below 7500 feet in the Upper Sonoran Life Zone. This makes the altitudinal range of arizonae coextensive with that of N. m. inopinata.

All specimens examined from the Monument area have been assigned to arizonae but the specimens may be intergrades with N. c. orolestes. Both Finley (1958) and Hall and Kelson (1959) included the study area in the range of arizonae. Finley (op. cit.) referred specimens from one and one-half miles southwest of Fruita and specimens from Grand Junction to arizonae but indicated intergrades for all specimens of both locations.

N. c. arizonae differs from N. c. orolestes by having lighter color, shorter hind foot, shorter rostrum, less spatulate nasals, and more inflated bullae, less widely separated temporal ridges, and usually smaller size (Finley, op. cit.).

Neotoma cinerea arizonae prefers to nest and take shelter in vertical crevices and clefts in cliffs. Horizontal clefts under rocks and boulders are less desired (Finley, op. cit.). Such situations are usually identifiable by large deposits of fecal and urine deposits that have stained or varnished the cliff walls black or dark brown, sometimes over large areas.

Food preferences of cinerea are less specialized than other species in Colorado with the majority of food items being derived from shrubs. Finley (op. cit.) in an analysis of food habits of arizonae taken two and one-half miles south of Fruita, Mesa County, (about one-half mile

north of the Monument) revealed the following genera made up the largest portion of arizonae's food in that vicinity: Eriogonum, Stanleya, Juniperus, Atriplex, Salsola, Opuntia, Artemisia, Ephedra, Chrysothamnus, and Echinocactus.

Measurements -- Measurements from 3 adult females were: 301.3 (316-284), 132.0 (140-117), 35.0 (38-33), 30.3 (32-29); from 3 adult males: 321.7 (347-290), 139.7 (148-132), 37.0 (41-35), 31.0 (31).

Specimens Examined -- Total 8, distributed as follows: Site 5, 4700 feet, PHM (1); Site 7, 5780 feet, COLM (1); Site 10, 5690 feet, CJM (1); Site 18, 5780 feet, CJM (1); Site 20, 6500 feet, PHM (1); Seiber Ranch, Little Dolores River, 5675 feet, UCM (1); one-half mile west of Distant View, Rim Rock Drive, 5680 feet, CJM (1); Grand Junction, Mesa County , 4600 feet, ERW (1).

Other Records -- Total 17, distributed as follows: (Finley, 1958), one mile southwest of Fruita, (3); two and one-half miles south of Fruita, 4600 feet, (1); Grand Junction, 4600 feet, ERW (6), AMNH (2), MVZ (1); (Anderson, 1959) 3 miles east, 4 miles south of Collbran, Mesa County, 7000 feet, KU (2); (Anderson, 1961) Mesa Verde National Park, (1); (Durrant, 1952) Grand County, Utah, (1).

Mus musculus domesticus Rutty

House Mouse

Mus domesticus Rutty. 1772. Essay Nat. Hist. County Dublin, vol. 1, p. 281.

H/esperomys/ indianus, Wied-Neuwied. 1862. Arch. Naturg., Jahrg. 28, vol. 1, p. 111. (New Harmony, Posey County, Ind. See Hatt, Jour. Mamm., vol. 11, No. 3, p. 317, Aug. 9, 1930.)

Mus musculus domesticus, Schwarz and Schwarz. 1943. Journ. Mamm., vol. 24, No. 1, p. 65, Feb. 20, 1943.

Type Locality -- Dublin, Ireland.

Comments -- This exotic species was not found abundantly anywhere in the Monument. Most observations and trapped specimens were in employee residences in the headquarters area. Trapping in the housing area did not reveal a "wild" population, and most of the mice were transported in by residents and exterminated shortly thereafter. Trapping efforts in the warehouse, however, were continually successful, indicating that a permanent population existed there.

Two skeletal specimens were found in a narrow-necked soft drink bottle that had been discarded near the Rim Rock Drive in the vicinity of Red Canyon View. One specimen was trapped near the mouth of North Monument Canyon in loose, sandy soil. This was under a Sarcobatus shrub where Reithrodontomys had previously been caught.

Measurements -- Three adult males measured 148.7 (159-135), 79.0 (83-74), 18.3 (19-17), 9.3 (11-7).

Specimens Examined -- Total 5, distributed as follows: Site 16, 4700 feet, PHM (1); Warehouse, Utility Area, 5780 feet, PHM (2); one-quarter mile east Red Canyon View, COLM (2).

Erethizon dorsatum couesi Mearns

Porcupine

Erethizon epixanthus couesi Mearns. 1897. Proc. U. S. Nat. Mus., vol. 19, p. 723, July 30, 1897.

Erethizon dorsatum couesi, Hall. 1946. Mammals of Nevada, p. 649, July 1, 1946.

Type Locality -- Fort Whipple, Yavapi County, Arizona.

Other Common Names -- Arizona Porcupine, Coues Porcupine, Yellow-haired Porcupine, Quill-pig, "Porky".

Comments -- There was little, if any, vertical stratification of the porcupine range in Colorado National Monument. Frequency of sight records and porcupine sign placed heavier populations in the canyon floors and rim communities due to the presence of more dense coniferous forest. Damage to Pinyon Pines has been extensive in many localities within the Monument.

Annual population fluctuations were noticed and climatic conditions may influence vertical stratification during severe winters. The Protection Division in the Monument has been authorized to control porcupines in certain areas of the Monument and during the last five years has killed about 80 animals along the Rim Rock Drive. The porcupine reduction policy should be re-evaluated periodically to determine the validity of decimating a porcupine population on the basis that the porcupine is not compatible with the Pinyon Pine. The two have survived centuries of coexistence, and perhaps a more correct exercise of porcupine control would be elimination of those individuals in the immediate vicinity of developments such as the residential and visitor center areas. Indiscriminate killing of porcupines over the entire length of the Rim Rock Drive does not presently appear to be necessary or desirable as a continuous practice.

The determination of subspecies was based almost entirely upon geographic distribution. Insufficient collections of adult specimens made a careful analysis of cranial measurements impossible. Skull characters were used to differentiate between couesi and epixanthum.

In couesi the infraorbital foramina average larger than in epixanthum; the tympanic bullae are more inflated ventrally; the jugals are narrower dorsoventrally and nearly straight rather than moderately bowed out; the external nares are larger; the molariform teeth smaller; the pterygoid hamulae are narrower and more nearly perpendicular; and the space between the ptergoid hamulae and the anterior face of the tympanic bullae is narrower (Durrant, 1952).

Hall and Kelson (1959) showed the breaking point of distribution between couesi and epixanthum in the vicinity of the Grand Valley. Anderson (1959) indicated epixanthum was found on Grand Mesa in Delta County at 10,000 feet. This was based on one skull found in a wood rat nest. One albino specimen (skin only) was obtained from Mr. Glen Hickman, Colorado National Monument, from near Collbran on Grand Mesa. Anderson (1961) reported couesi from Mesa Verde and Warren (1942) recorded couesi from Chromo, Colorado. Monument specimens were referred to couesi on the basis of the Monument's closer geographic relationship with the southern part of the state and its proximity to the Uncompahgre Plateau. Additional studies may reveal that Monument specimens are intergrades. Durrant (op. cit.) placed the area west of the Colorado River in Utah in the range of couesi. He obtained couesi from Grand County, Utah.

Specimens Examined -- Total 4, distributed as follows: One-quarter mile east of Independence View, Rim Rock Drive, 5827 feet, COLM (1); one-quarter mile west of Red Canyon View, Rim Rock Drive near Site 22, 6400 feet, PHM (1); Pinyon Mesa, 1 mile east, 4 miles south of Glade Park Store, 7000 feet, COLM (1); 10 miles east of Collbran, Grand Mesa, Mesa County, 8400 feet, PHM (1).

Other Records -- Total 7, distributed as follows: (Anderson, 1959) Grand Mesa, 10,000 feet, (1). (Anderson, 1961) Mesa Verde National Park, 6200 feet, (2). (Durrant, 1952) Grand County, Utah, 3995 feet, (1); LaSal Mountains, (2). (Warren, 1942), Chromo, 8500 feet, (1).

Canis latrans lestes Merriam

Coyote

Canis lestes Merriam. 1897. Proc. Biol. Soc. Washington, vol. 11, p. 25, Mar. 15, 1897.

Canis latrans lestes, Grinnell. 1913. Proc. California Acad. Sci., ser. 4, vol. 3, p. 285, Aug. 28, 1913.

Type Locality -- Toyabe Mountains, near Cloverdale, Nye County, Nevada.

Other Common Names -- Mountain Coyote, Robber Coyote, Brush Wolf, Prairie Wolf, Great Basin Coyote, Heul Wolf, Steppen Wolf.

Comments -- Coyotes were not common in Colorado National Monument but were common in adjacent areas, as attested by the fact that government predator trappers destroy several each year in areas adjoining the Monument. Coyote sign was seldom observed during the course of this study and no dependable sight records were submitted. There was no good explanation for the lack of coyotes in the Monument unless food procurement was easier in the ranching country or farmlands and orchards nearby. Local livestock growers lodge their perennial complaints that it is impossible to rid the area of the "pests" as long as the National Park Service protects them in the Monument. This complaint is largely unfounded because there are very few coyotes in the Monument. Undoubtedly, a few coyotes do den in the Monument and forage out into the ranchlands for food.

As described in the National Park Service policy in the Introductory Chapter of this report, predators enjoy protection in the Monument, and additional protection is afforded the wider-ranging predators such as coyotes by agreement with the Bureau of Sport Fisheries and Wildlife that their trappers will not place 1080 poison stations within three miles of a park or monument boundary without consent of the National Park Service (Cottam and DeMaray, 1951).

Since there was no occasion to collect specimens or make observations within the Monument and little opportunity appeared to make live-animal observations outside the Monument, little knowledge of the coyote's life history was obtained.

Classification was primarily based on distribution according to Jackson (1951) and relative cranial size. Jackson examined 8 specimens from Glade Park and assigned them to lestes. Two skulls from Glade Park fit Jackson's descriptions. Durrant (1952), found that 2 animals from Grand County, Utah, (Harley Dome) were intergrades between lestes and estor but referable to lestes.

Specimens Examined -- Total 21, distributed as follows: Pinyon Mesa, Mesa County, 7500 feet, COLM (1); Glade Park (Black Ridge), Sec. 16, T12S, R102W, 6800 feet, COLM (1); Book Cliffs, Mesa and Garfield Counties, PHM (19).

Other Records -- Total 30, distributed as follows: (Jackson, 1951) Mesa County, Crevasse (1); Glade Park (8); Grand Mesa (2); Unaweep Canyon (1); Garfield County, East Salt Creek (6), Salt Creek (2), Rifle (1); Rio Blanco County, Piceance (1), 15 miles west Rangeley, (1); Grand County, Utah, Book Cliffs, (75 miles south Ouray), (1); (Durrant, 1952), Grand County, Utah, "near" Thompson, (3); Salt Valley

"near" Thompson, (1); Harley Dome, (2).

Vulpes macrotis arsipus Elliot

Kit Fox

Vulpes arsipus Elliot. 1904. Field Columbian Mus. Publ. 87. Zool. Ser., vol. 3, No. 14 (December 1903), p. 256, Jan. 7, 1904.

Vulpes macrotis arsipus, Grinnell. 1913. Proc. California Acad., Sci., ser. 4, vol. 3, p. 287, Aug. 28, 1913. -- Benson, Proc. Biol. Soc. Washington, vol. 51, pp. 18, 22, Feb. 18, 1938.

Vulpes macrotis arizonensis, Goldman. 1931. Journ. Washington Acad. Sci., vol. 21, p. 249, June 4, 1931. (Two miles south of Tule Tanks, near Mexican boundary, Yuma County, Arizona. For status see Benson, Proc. Biol. Soc. Washington, vol. 51, pp. 18-20, Feb. 18, 1938.)

Type Locality -- Daggett, Mojave Desert, San Bernardino County, California.

Other Common Names -- Swift Fox, Desert Kit Fox, Arizona Kit Fox.

Comments -- The inclusion of Vulpes macrotis here represents an addition to the known fauna of Colorado. It was suspected that macrotis inhabited the area but substantiated observations were not forthcoming until October 20, 1960, when a sick individual was brought to the author. It was found at the junction of the Rim Rock Drive and the West Glade Park Road (6479 feet elevation). The fox was discoordinated and salivating. Autopsy examination by Dr. Louie Pavetti, D.V.M. of Grand Junction, who retained the animal until death, revealed an enlarged liver, and he attributed death to encephalitis. The specimen was destroyed. Additional sight records were made by Pat H. Miller

(June 23, 1962) one and one-quarter miles west of Red Canyon View on the Rim Rock Drive and by Robert L. Hoover, Colorado Game and Fish Department, in mid-July, 1962, on U. S. Highway 6-50 near Stateline.

Two specimens were given to the author by Mr. Jack Peters, Government Trapper, who obtained them from a rancher who in turn shot them by mistake for young coyotes. They were collected in juniper-sagebrush vegetation in sandstone "cliff" country about three miles south of the Stateline Store (about 12 miles southwest of Mack) Mesa County, Colorado.

Entry into the State apparently has been from the west by way of the Colorado River system. The source of immigration is difficult to determine and is dependent upon accurate taxonomic classification. Northern marginal records as listed by Hall and Kelson (1959) for neomexicana are the San Juan Valley near Shiprock, and near Fruitland, San Juan County, New Mexico. The confluence of the San Juan and Colorado Rivers is in eastern San Juan County, Utah. V. m. arsipus reaches its eastern limit in eastern Lincoln County, Nevada (Hall, 1946). V. m. nevadensis is recorded by Durrant (Hardy) from the Virgin River drainage of Washington County, Utah.

The Colorado specimens were tentatively assigned to arsipus on the basis of size and coloration although the collection site was geographically closer to neomexicana. Specimens of neomexicana represented in the Spencer Collection of the University of Colorado Museum from near Tucson, Arizona, and records stated in Hall (op. cit.) revealed the following external measurements, male and female specimens listed in that order: total length 828.5 and 821.3, tail length 315.5 and 312.7, hind foot 132.0 and 132.3, ear 83.0 and 81.0. External

dimensions from arsipus as listed in Hall (op. cit.) were: total length 741 and 715, tail 286 and 284, hind foot 120 and 111. External measurements from nevadensis as listed in Hall (op. cit.) were: total length 699 and 768, tail 230 and 284, hind foot 132 and 122, and ear 93 and 86. External measurements for the male and female specimens obtained in Colorado were: total length 759 and 790, tail 250 and 258, hind foot 126 and 122, ear 84 (no ear measurements from female specimen). External measurements more closely resemble those of the nevadensis - arsipus group than those of neomexicana. Cranial measurements are more diminutive that those of neomexicana, falling more closely in the nevadensis and arsipus range of averages.

Hall (1946) stated that the one constant difference detected to separate nevadensis from arsipus is the black sides of the muzzle in nevadensis as contrasted with the brownish or dark grayish color of those areas in arsipus. Another color characteristic used, although somewhat inconsistent, was the color of the tail tip which is consistently brown in arsipus and usually black in nevadensis. The Colorado specimens have the brownish muzzle and brown tail tip.

Little information was learned concerning the life history or habitat of the kit fox in the Monument area except that gained from the collection site. They probably inhabit the rim and open sagebrush-juniper areas rather than the canyons or forests. Five fetuses were removed from the female.

Specimens Examined -- Total 2, distributed as follows: three miles south of Stateline Store (about 12 miles southwest of Mack) Mesa County, about 4500 feet, PHM (2).

Observation Records -- Total 3, distributed as follows: Junction of

Rim Rock Drive and West Glade Park Road by Pat H. Miller, October 20, 1960, (1); one and one-quarter miles west of Red Canyon View on Rim Rock Drive by Pat H. Miller, June 23, 1962, (1); near Stateline on Highway 6-50 by Robert L. Hoover, mid-July 1962, (1).

Urocyon cinereoargenteus scottii Mearns

Grey Fox

Urocyon virginianus scotti Mearns. 1891. Bull. Amer. Mus. Nat. Hist., vol. 3, p. 236, June 5, 1891.

Urocyon cinereo-argenteus scottii, J. A. Allen. 1895. Bull. Amer. Mus. Nat. Hist., vol. 7, p. 253, June 29, 1895.

Urocyon cinereoargenteus texensis, Mearns. 1897. Preliminary diagnoses of new mammals of the genera Lynx, Urocyon, Spilogale, and Mephitis, from the Mexican boundary line, p. 2, Jan. 12, 1897 (Preprint of Proc. U. S. Nat. Mus., vol. 20, p. 459, Dec. 24, 1897). (San Pedro, near Eagle Pass, Maverick County, Texas. Regarded by Goldman, Journ. Washington Acad. Sci., vol. 28, No. 11, p. 495, Nov. 15, 1938, as identical with scottii.)

Urocyon cinero-argenteus invoensis, Elliot. 1904. Field Columb. Mus. Publ. 90, Zool. Ser., vol. 3, p. 268, Mar. 7, 1904. (Beveridge Canyon, Inyo Mountains, Inyo County, California. Regarded by Grinnell, Dixon and Linsdale, The fur-bearing mammals of California, vol. 2, p. 436, Aug. 10, 1937, as identical with scottii.)

Type Locality -- Pinal County, Arizona.

Other Common Names -- Desert Gray Fox, Scott's Gray Fox, Pinyon Fox, Arizona Gray Fox, Colishe, Tree Fox, (locally called "swift fox").

Comments -- The gray fox was one of the most common small predators

in Colorado National Monument. It was found at all elevations in the Monument and frequented most habitats at least for purposes of hunting. It was found that gray foxes traveled up out of the deep canyons onto the rims to hunt, usually at night, and returned into the canyons to den. They frequently were reported from the Saddlehorn campground where they scavenge for discarded food during the summer. They were also commonly observed near employee residences both diurnally and nocturnally.

The gray fox has been observed frequently along the Rim Rock Drive and one of the most common observation points was near the mouth of Fruita Canyon about one-half mile up from the West Entrance Station.

Collection of scats revealed that the Gray Fox is an omnivorous mammal. Many insect remains and an occasional rodent or rabbit bone was found. One of the most interesting food habits found in scat analyses was near the mouth of East Monument Canyon where an adult vixen left the Monument each night and foraged in nearby orchards. Evidence of seasonally mature fruit was consistently found in the scats evolving through harvests from cherries and apricots through the season to peaches.

Little was learned concerning breeding habits but on three consecutive years five young puppies were observed near the West Entrance Station at the mouth of Fruita Canyon. On one occasion they were seen feeding on insects in front of the headlights of a halted vehicle. Measurements -- One adult female measured 860, 360, 120, and 65. Specimens Examined -- Total 4, distributed as follows: Site 7, 5820 feet, COLM (1); one and one-quarter miles west of East Entrance Station, No Thoroughfare Canyon, 5000 feet, PHM (1); ledge below Coke

Ovens View, 5700 feet, COLM (1); Pinyon Mesa, 1W, 4S Glade Park Store, 7000 feet, COLM (1). In addition, 39 skulls were examined from animals trapped in the desert and in the Book Cliffs north of the Grand Valley.

Other Records -- Total 4, distributed as follows: (Anderson, 1961), Mesa Verde National Park, (3). (Cary, 1911), Grand Junction, 4600 feet (1).

Observation Records-- Rim Rock Drive at Distant View, by Seasonal Naturalist Murl Messersmith, July 26, 1956, carrying cottontail. (Note: there are numerous sight records of Gray Foxes on file in the Chief Park Naturalist's Office in the Monument.)

Euarctos americanus amblyceps (Baird)

Black Bear

Urusus amblyceps Baird. 1895. Mammals of the boundary, in Emory, Rep. United States and Mexican boundary survey, . . ., vol. 2, pt. 2, p. 29, January, 1859.

Ursus americanus amblyceps, V. Bailey. North Amer. Fauna No. 25, p. 187, October 24, 1905.

Type Locality -- Old copper mines near present town of Santa Rita, Grant County, New Mexico. (See V. Bailey, North Amer. Fauna No. 53 (1931) p. 357, Mar. 1, 1932).

Other Common Names -- American Black Bear, Brown Bear, New Mexico Black Bear, Cinnamon Bear.

Comments -- Bears were uncommon in the Monument and observations and sign have not been often reported, but when observations are made they usually are considered important enough to include in the naturalist's observation records file. An open hunting season on bear in

adjacent areas to the Monument and the amount of range required by bears are probably the two factors limiting the population in Colorado National Monument. A total of 25 black bears were reported killed by hunters in the Pinyon Mesa game management area between 1951 and 1961.

Observation records indicate that distribution was heavier in the vicinity of Red Canyon than elsewhere in the Monument. This may be due to the presence of well-used deer and elk game trails in that area. Observations were mostly restricted to pinyon-juniper forests and canyon rims rather than in the canyons, but one observation was recorded from Fruita Canyon at an elevation of about 5140 feet, the lowest altitude recorded within the Monument.

Classification was based on distribution (due to a lack of specimens) but cranial measurements from one skull substantiated identification. Hall and Kelson (1959) indicated that amblyceps was the species occupying the Monument area. That species is replaced by cinnamomum north of the Book Cliffs in Garfield County. Durrant (1952) recorded amblyceps from Castle Creek, Grand County, Utah, and Anderson (1961) indicated that it was common in Mesa Verde National Park.

Specimens Examined -- Total 1, distributed as follows: Alkali Creek, one mile south of DeBeque, Mesa County, PHM (1).

Other Records -- Total 2, distributed as follows: (Durrant, 1952) Castle Creek, Grand County, Utah, (1); Indian Creek, Abajo Mountains, ten miles west of Monticello, San Juan County, Utah, (1).

Observation Records -- Red Canyon View, October 10, 21, 27, 1944, observer unknown; Red Canyon View, November 6, 1944, observer unknown; Ute Canyon near Rim Rock Drive, January, 1950, Ranger Ray Dobbins;

"above" Ute Canyon, tracks seen by Seasonal Ranger Ray Spruill, 1956; Fruita Canyon, June 1938, observer unknown; Ute Canyon, November 1938, observer unknown.

Bassariscus astutus flavus Rhoades

Ringtail

Bassariscus astutus flavus Rhoades. 1894. Proc. Acad. Nat. Sci. Philadelphia, vol. 45, 1893, p. 417, January 30, 1894.

Type Locality -- Texas, exact locality unknown.

Other Common Names -- Ringtail "Cat," Miners' "Cat," Bassaris, Civet "Cat," Cacomistle.

Comments -- The ringtail prefers the rocky canyons and canyon rims and its cry has been heard in the canyons during winter nights. A highly nocturnal mammal, it is not uncommonly seen along the Rim Rock Drive at night, hence observation records are numerous.

Most authors have assigned the southwestern Colorado species to B. a. flavus but on the basis of few specimens. Durrant (1952) recorded three specimens from eastern Utah as B. a. arizonensis. Hall and Kelson (1959), in their distribution map (p. 881), listed marginal records for flavus as four miles east of Rangeley, Rio Blanco County; Delta, Delta County; Mancos Canyon, Montezuma County; West Paradox Valley, Montrose County; and two and one-half miles southwest of Mack, Mesa County. Hall and Kelson (op. cit.) listed marginal records for arizonensis as the three listed in Durrant.

This close proximity of subspecies marginal records that does not follow any natural barriers, with the possible exception of the Colorado-Green River systems, appears somewhat incongruous. Undoubt-

edly, this group is in need of additional study in western Colorado and eastern Utah. The Colorado National Monument and Grand Valley specimens are referred to flavus based on distribution and previous work by Cary (1911) and Warren (1942). A lack of available comparative material prevented a more accurate diagnosis of classification.

Specimens Examined -- Total 5, distributed as follows: one-quarter mile east of Grand View, 5915 feet, COLM (1); one-half mile north of Balanced Rock parking area, Rim Rock Drive, 5200 feet, COLM (1); twelve miles north of Loma, Mesa County, PHM (1); DeBeque Canyon, five miles east of Cameo, Mesa County, CJM (1); Westwater Canyon, three miles west, ten miles north of state line, Grand County, Utah, PHM (1).

Other Records -- Total 12, distributed as follows: (Hall and Kelson, 1959), four miles east, one mile north of Rangeley, Rio Blanco County, 5500 feet, KU (1); Delta, Delta County, ERW (1); Mancos Canyon, USNM (1); West Paradox Valley, Montrose County, USNM (1); two and one-half miles southwest of Mack, Mesa County, 4400 feet, KU (1); (Anderson, 1961) Mesa Verde National Park, MVNP (4); (Cary, 1911) Mesa County, (3).

Observation Records -- Fruita Canyon, dead on road, R. E. Hugenot, Sept. 3, 1952; Grand View, Rim Rock Drive, Ranger Monte Fitch and Wildlife Conservation Officer Dudley Jerome, 10:30 p.m., Oct. 8, 1953; Quarters No. 1, headquarters area, Chief Ranger Loren Lane, 8:30 p.m., Feb. 5, 1957; Cold Shivers Point, Rim Rock Drive, in garbage can, Ranger Harry Foster and Park Naturalist Pat H. Miller, 10:15 p.m., July 3, 1958; lower tunnel, Fruita Canyon, Rim Rock Drive, Park Naturalist D. L. Hamilton, 9:30 p.m., Dec. 7, 1960; Grand View, Rim Rock Drive, carrying rabbit, Seasonal Ranger M. R.

Cathey, 10:30 p.m., July 16, 1961; dump entrance, Rim Rock Drive, James V. Court, 7:30 p.m., Oct. 1, 1961; lower tunnel, Fruita Canyon, Rim Rock Drive, Seasonal Ranger M. R. Cathey, carrying small rabbit, 10:30 p.m., June 23, 1962; tunnel, No Thoroughfare Canyon, Rim Rock Drive, 2 young, Ranger John O'Brien, Sept., 1962.

Taxidea taxus taxus (Schreber)

Badger

Ursus taxus Schreber. 1778. Die Saugthiere . . ., vol. 3, p. 520.

Taxidea americana americana, True. 1884. Proc. U. S. Nat. Mus., vol. 7 (App., Circ. 29), p. 609, Nov. 29, 1884.

Type Locality -- Labrador and Hudson Bay (probably southwest of Hudson Bay).

Other Common Names -- Common Badger, Colorado Badger, American Badger, Blaireau.

Comments -- Badgers were not common anywhere in Colorado National Monument, but during the past four years observations have been more frequently reported. Those observations have been of animals in canyon rim areas above 5500 feet. Evidently there is bias in the recording of badgers, attributable to the frequency with which park employees travel the Rim Rock Drive. *Taxidea* would be expected to be more numerous at lower elevations where soils are deeper, thus affording better conditions for this burrowing carnivore. Shallow, sandy soils of the rim country are not suitable for a large badger population.

Identification was based on relative cranial sizes. An average of eight adult badgers revealed that zygomatic and mastoidal breadth was in excess of 66 percent of the basilar length of the skull. The

relative wideness and massiveness of the skulls examined matched more nearly those described as berlandieri by Durrant (1952). Schantz (1950) placed the area in the geographic range of her species described as Taxidea montana. Specimens recorded by Schantz included those from Piceance, Rio Blanco County, and Salt Creek, Garfield County. Anderson (1961) speculated that the Mesa Verde National Park badgers were berlandieri, but he (1959) assigned Grand Mesa specimens to taxus. It is quite possible that there is intergradation between berlandieri and taxus on the Uncompahgre Plateau. Cranial characters and length of the dorsal stripe were the bases for referring Colorado National Monument badgers to taxus. Intergrades may be common and there may be some altitudinal stratification with taxus occupying higher and berlandieri lower elevations.

Measurements -- Measurements of one adult female were: 695, 119, 100, 54.

Specimens Examined -- Total 14, distributed as follows: Fruita Canyon near Site 15, 5140 feet, CJM (1); Black Ridge (near west boundary of the Monument), COLM (1); Pinyon Mesa, COLM (3); Little Dolores River, 20 miles west of Glade Park Store, Grand County, Utah, UCM (1); Westwater Canyon, ten miles north of U. S. Highway 6-50, three miles west of Colorado-Utah line, Grand County, Utah, PHM (1); Book Cliffs, Garfield and Mesa Counties, Douglas Pass Road, PHM (7).

Other Records -- Total 5, distributed as follows; (Schantz, 1950) Piceance, Rio Blanco County, (3); Salt Creek, Garfield County, (1). (Anderson, 1959) Grand Mesa, Mesa County, (1). (Cary, 1911) Grand Valley of Grand (Colorado) River.

Observation Records -- Rim Rock Drive near junction of utility area

road, 5780 feet, August 31, 1959, Pat H. Miller, (1). Rim Rock Drive near junction of West Glade Park Road, 6479 feet, Robert Tufley (Park Caretaker), (1).

Spilogale putorius gracilis Merriam

Spotted Skunk

Spilogale gracilis, Merriam. 1890. North Amer. Fauna, No. 3, p. 83, September 11, 1890.

Spilogale saxatalis, Merriam. 1890. North Amer. Fauna, No. 4, p. 13, October 8, 1890.

Spilogale tenuis, Howell. 1902. Proc. Biol. Soc. Washington, vol. 15, p. 241, December 16, 1902.

Type Locality -- Old Hance Trail, South Rim, Grand Canyon of the Colorado River, north of San Francisco Mountain, Coconino County, Arizona, altitude 3500 feet.

Other Common Names -- Rocky Mountain Spotted Skunk, Great Basin Spotted Skunk, Western Spotted Skunk, Civet Cat, Little Spotted Skunk, Little Striped Skunk, Polecat.

Comments -- Spilogale was uncommon in the Monument but appeared to be most frequently reported in the Saddlehorn Campground area. In that location, they were quite oblivious to humans and foraged for scraps of food, much to the concern of campers.

Most records for the Monument are observations. A female with six young was frequently seen in the spring and summer of 1961. Not enough data was gathered to provide a very complete life history for this species in Colorado National Monument.

Vertical distribution was not accurately determined but based

on the data obtained in the Monument, it appeared they were found most frequently near canyon rims.

Nomenclature of the spotted skunk in the Monument was based on Van Gelder (1959) rather than on Miller and Kellogg (1955). Van Gelder referred the species to putorius and relegated gracilis to the rank of subspecies. Van Gelder (op. cit.) stated that cranial differentiation between the various subspecies of western forms of putorius is inconsistent and that reliance upon color pattern is the more accurate. S. p. gracilis can be distinguished from S. p. leucoparia in that the lateral white stripe is narrower or the same width as the first vertical stripe and may be reduced in length. It was found that the lateral stripe was more narrow in the Monument animals. S. p. gracilis is most easily recognized from S. p. interrupta by the presence of the white tail tip in gracilis.

Specimens Examined -- Total 2, distributed as follows: Quarters No. 42, headquarters residential area, 5780 feet, PHM (1); two miles east of Visitor Center on Rim Rock Drive, dead on road, 5950 feet, PHM (1).

Other Records -- Total 6, distributed as follows: (Van Gelder, 1959) Grand Junction, 4600 feet, USNM (1); thirty miles south of Grand Junction, CM (1); three miles south of Mack, Mesa County, (Anderson, 1961), MVNP (1); (Cary, 1911) Glenwood Springs, Garfield County, (1); New Castle, Garfield County, (1); (Cary, 1911) Ashbaugh's Ranch, Coventry, Montrose County, (1).

Observation Records -- West Entrance to Monument, 4700 feet, Chief Ranger Loren Lane, February 27, 1957; Head of Ute Canyon, dead on road, Seasonal Ranger Ed Hodgson, July 18, 1958; Head of Fruita Canyon, Rim Rock Drive, Carol J. Miller, June 16, 1960; Saddlehorn

Campground, Seasonal Ranger M. R. Cathey, July 1, 1961; Junction of Rim Rock Drive and Saddlehorn Road, Pat H. Miller, July-August, 1961 (family group of female and six young); Artists Point, Rim Rock Drive, Pat H. Miller and Seasonal Ranger Bill Noxon, July 24, 1962.

Mephitis mephitis estor Merriam

Striped Skunk

Mephitis estor Merriam. 1890. North Amer. Fauna, No. 3, p. 81, September 11, 1890.

Mephitis mephitis estor, Grinnell. 1933. Univ. California Publ. Zool., vol. 40, No. 2, p. 108, Sept. 26, 1933. -- Hall, Carnegie Inst. Washington Publ. 473, p. 66, Nov. 20, 1936.

Type Locality -- San Francisco Mountain (Little Spring at north base), Coconino County, Arizona, Altitude 8200 feet.

Other Common Names -- Arizona Skunk, Large Striped Skunk, Big Skunk, Line-backed Skunk, Common Skunk, Polecat.

Comments -- The striped skunks of Colorado are in need of additional study and revision to determine status and distribution. Three subspecies of *Mephitis mephitis* were indicated for the State in Hall and Kelson (1959). Western Colorado forms of *Mephitis* in the lower valleys of the Upper Sonoran Life Zone including Colorado National Monument were generally referable to *estor*. The other two subspecies were *hudsonicus* which, according to Cary (1911), is restricted to the mountainous areas of Colorado, and *varians* which generally inhabits the high plains of eastern Colorado. Some confusion has resulted and Hall and Kelson (op. cit.) listed the towns of Arkins, Larimer County, and Colorado Springs, El Paso County, as marginal for both *hudsonicus* and *varians*.

Colorado National Monument is well within the vertical and geographic distribution of estor and specimens from the Monument were retained in that classification. Nowhere were striped skunks numerous in the Monument, but there have been population increases each year since 1958 at which time observations of the striped skunk were rare. Mephitis, like Spilogale, frequented the Saddlehorn Campground and headquarters residential areas and often became pests by turning over trash receptacles or becoming trapped in large metal refuse cans. The presence of numerous campers does not seem to disturb the animals.

Food habits were little different than those generally described for the genus and their omnivorous diet included garbage, insects, rodents and various vegetative matter such as juniper "berries." A large female was observed in the Saddlehorn area with five young.

Specimens Examined -- Total 2, distributed as follows: headquarters utility area, 5780 feet, COLM (1), CJM (1).

Other Records -- Total 4, distributed as follows: (Cary, 1911) Coventry, Montrose County, (1). (Anderson, 1959) cabin, eight miles east and one and one-half miles south of Skyway, Grand Mesa, Delta County, 10,200 feet, KU (1). (Durrant IN Woodbury, 1962) Gunnison County, (2).

Observation Records -- Ute Canyon Trail, Chief Ranger Loren Lane, September 22, 1956; Distant View, Rim Rock Drive, Seasonal Naturalist J. A. Richardson, July 17, 1959; Residence 15, Saddlehorn Area, Park Ranger J. M. Morehead, July 27, 1959; Residence 1, Saddlehorn Area, Pat H. Miller, summers of 1960 and 1961; Utility and residential area road, Superintendent F. G. Bussey, October 19, 1960; Junction of Rim Rock Drive and West Glade Park Road, Seasonal Ranger H. D. Paulus, May 21, 1961; West entrance to Monument, Rim Rock Drive, Park

Ranger J. V. Court, July 6, 1961; Quarters 1, Saddlehorn Area, Pat H. Miller, summer of 1962.

Felis concolor hippolestes Merriam

Mountain Lion

Felis hippolestes Merriam. 1897. Proc. Biol. Soc. Washington, vol. 11, p. 219, July 15, 1897.

Felis concolor hippolestes, Nelson and Goldman. 1929. Jour. Mamm., vol. 10, No. 4, p. 347, Nov. 11, 1929.

Type Locality -- Wind River Mountains, near head of Big Wind River, Fremont County, Wyoming.

Other Common Names -- Rocky Mountain Cougar, Painter, Panther, Catamount, Puma, Catawauler.

Comments -- Mountain lion observations have not been frequently recorded in Colorado National Monument although the animal is not considered rare in the general area. Most mountain lion hunting is done in the Book Cliffs north of the Grand Valley and several have been killed for sport or bounty each winter. Few have been killed on the south side of the Colorado River. Colorado, slow to recognize the value of preserving large predators, still pays a $50 bounty for mountain lions.

Patterns in frequency and distribution of observations in the Monument have not indicated population trends or density in the area, but they do indicate that mountain lions frequent the Monument as part of individual ranges. It is unlikely that lions den in the Monument very often.

Identification of western Colorado mountain lions has been based

primarily on distribution, and there is little doubt that the Monument species is Felis concolor hippolestes. No Monument specimens were obtained; most of the specimens examined were from the Book Cliffs of Mesa and Garfield Counties, and all were skulls. Durrant (1952) assigned animals occupying the northern part of Grand County, Utah, to hippolestes and placed those of the southern part of the county in kaibabensis. Cranial measurements from 22 skulls collected in Mesa and Garfield Counties appeared to be within the range of measurements of hippolestes.

Specimens Examined -- Total 22, distributed as follows: Book Cliffs, between DeBeque and Utah state line, Garfield County, PHM (8); Douglas Pass, Book Cliffs, Garfield County, PHM (1); twelve miles from Rifle near power plant, Garfield County, UCM (1); South Canyon near Atchee, Book Cliffs, Garfield County, UCM (2); north of Fruita, Book Cliffs, Mesa County, UCM (3); south side of Kimball Creek, Mesa County, UCM (1); near Gateway, Mesa County, UCM; (1) near Whitewater, Mesa County, UCM (1); north of Mack, Mesa County, UCM (1); near Clifton, Mesa County, UCM (1);North of Loma, Garfield County, UCM (1); Coal Gulch, Delta County, UCM (1).

Observation Records -- Mouth of Fruita Canyon, May 25, 1938, James Luther; East Glade Park Road, chasing two fawns, September 9, 1942, Ranger Homer Carson; Black Ridge, October 31, 1942, Project Supervisor Cross; near Red Canyon November 9, 1944, Superintendent Hopper; Fruita Canyon, October, 1949, park visitor; near Artists Point, tracks in snow, February 16, 1953, Rangers Fitch and Dobbins; near Red Canyon, August 22, 1954, Seasonal Ranger Tucker; Kodels Canyon, tracks and deer carcass, October 8, 1959, Ranger John M. Morehead; Lower

end of Kodels Canyon, tracks, October 22, 1959, Chief Ranger McIntyre; 50 yards north of Artists Point, tracks in snow, November 26, 1958, Ranger John M. Morehead; three-quarters mile west of West Glade Park Road on Rim Rock Drive, July 14, 1962, Contractor Foreman Erickson; Rim Rock Drive at West Glade Park Road junction, lying alongside road, August 2, 1962, Seasonal Ranger M. R. Cathey.

Lynx rufus pallescens Merriam.

Bobcat

Lynx fasciatus pallescens Merriam. 1899. North Amer. Fauna No. 16, p. 104, Oct. 28, 1899.

/Lynx rufa/ pallescens, Elliot. 1901. Field Colmb. Mus. Publ. 45, Zool. Ser., vol. 2, p. 297, Mar. 6, 1901.

Felis rufa pallescens, Elliot. 1905. Field Colmb. Mus. Publ. 105, Zool. Ser. vol. 6, p. 371, Dec. 6, 1905.

Lynx ruffus pallescens, Grinnell. 1924. Univ. California Publ. Zool. vol. 21, No. 13, p. 350, Jan. 24, 1924.

Lynx rufus pallescens, Merriam. 1933. Univ. California Publ. Zool., vol. 40, No. 2, p. 116, Sept. 26, 1933.

Type Locality -- South side of Mount Adams, near Trout Lake, Skamania County, Washington.

Other Common Names -- Pale Bobcat, Wildcat, Pallid Barred Bobcat, Bay Lynx, Mountain Bobcat, Lynx Cat.

Comments -- The bobcat was a common predator in the Monument and observation records indicated that it was ubiquitous in the area. There was no indication that population density depended upon elevation in the Monument. As would be expected, the most frequent observa-

tions were along the Rim Rock Drive where potential reporters most frequently travel.

The Grand Valley of the Colorado River forms a natural boundary often separating subspecies in western Colorado and eastern Utah. Where subspecies meet intergradation is the rule and distinction between forms becomes difficult. Such was the case with the bobcat in the study area.

Durrant (1952) found that five specimens from Harley Dome, Grand County, Utah, were intergrades between L. r. pallescens and L. r. baileyi but closer to baileyi. Harley Dome is about twenty airline miles west of Colorado National Monument at an elevation of about 4500 feet. Other Grand County, Utah records from Salt Wash and Moab were also referred to baileyi by Durrant (op. cit.). Specimens from Gunnison County, Colorado, along the Gunnison River were listed by Durrant (1962) as intergrades between the two above-mentioned subspecies but in this case all were nearer to pallescens, mostly on the basis of cranial characteristics. Hall and Kelson (1959) listed the marginal record of pallescens as fourteen miles north, five miles west of Mack, 5600 feet, and the marginal locality for baileyi was Durrant's above-mentioned Harley Dome specimens.

Two series of specimens were examined from the Grand Valley area. Both series, consisting mostly of skulls and skins (sex unknown), were obtained from or examined with federal predator control trappers. A series of fifteen adult skulls and non-related skins came from the Book Cliffs and adjacent desert north of the Grand Valley (north of Fruita, Loma, Mack, Harley Dome) in Mesa and Garfield Counties, Colorado, and Grand County, Utah. The other series consisted of 7 adult

skulls from the Pinyon Mesa area near the Monument on the south side of the Grand Valley on the Uncompahgre Plateau in Mesa County. Elevations were comparable, ranging from about 5500 feet to about 8000 feet.

Diagnosis of cranial measurements indicated that the bobcats examined approached the average size of pallescens as given in Hall (1946) for animals from Nevada. The auditory bullae of 22 examined specimens averaged 29.3 mm. considerably larger than described in baileyi. Otherwise, carnial measurements, external size and coloration appeared to be intergradations. Careful examination of specimens from the perimeter of the Grand Valley and of specimens from the lower sections of the Valley may reveal that there is some vertical stratification with animals of pallescens derivation occupying the higher elevations and bobcats referrable to baileyi occupying lower elevations.

Measurements -- From animals collected in the Book Cliffs, ten miles north of Loma, Garfield County, 5500 - 6000 feet. Two females averaged: 831.8 (863.6-800.00); 158.7 (165.0-152.4); 174.7 (177.8-171.5); 77.8 (79.4-76.2). Three males averaged: 787.4 (863.6-743.0); 151.3 (152.4-149.2); 179.9 (190.5-171.5); 74.1 (82.6-83.5).

Specimens Examined -- Total 139, distributed as follows: Black Ridge near Monument Boundary, 6800 feet, COLM (4); Pinyon Mesa, COLM (1); Westwater Canyon, ten miles north, three miles west of Harley Dome, Grand County, Utah, PHM (35); Book Cliffs, fourteen miles north of Fruita, PHM (45); Book Cliffs, fourteen miles north of Fruita, 49 skins, no numbers; Salt Wash, three miles south of Baxter Pass, Garfield County, PHM (5).

Other Records -- Total 8, distributed as follows: (Durrant, 1952) Harley Dome, Grand County, Utah (5). (Durrant IN Woodbury, 1962) Gunnison County, (3).

Observation Records -- (Selected records since 1957). West Entrance to the Monument, 2 animals, Ranger Raymond Dobbins, March 30, 1957; South Branch, Ute Canyon, Chief Ranger Loren Lane, May 10, 1957; Fruita Canyon, Naturalist D. L. Hamilton, July 29, 1957; Highland View, Rim Rock Drive, Chief Ranger Raymond McIntyre, December 8, 1958; one mile east of West Glade Park Road, Rim Rock Drive, Ranger David Bogart, January 4, 1961.

Cervus canadensis nelsoni V. Bailey

Wapiti

Cervus canadensis nelsoni V. Bailey. 1935. Proc. Biol. Soc. Wash., vol. 38, p. 188, Nov. 15, 1935.

Type Locality -- Yellowstone National Park, Wyoming.

Other Common Names -- Nelson's Elk, Elk, American Wapiti, American Elk, American Stag.

Comments -- Interviews with early citizens of the area revealed that wapiti were not present in the Monument or on the northern part of the Uncompahgre Plateau west of Unaweep Canyon during early settlement years. John Hart, former Assistant Game and Fish Director for Colorado, stated in a personal interview that there were no wapiti in the Monument during its formative years.

The first introduced wapiti were released in Monument Canyon on May 21, 1924, with expenses being borne by the Colorado Game and Fish Department and the Grand Junction Elks Club (Otto, 1924). Prior

to release, permission had been obtained from the National Park Service to construct a fence for a "game preserve" in the Monument (Wood, 1923).

The transplanted animals were shipped to the Monument from the Denver Mountain Parks (Otto, 1927), that herd having originated from Yellowstone National Park. Two more animals were released in the Monument in 1927 (Otto, op. cit.) and, so far as can be determined, constituted the only additional releases until 1956 when three animals were removed from the Grand Junction city zoo and released in the Monument. The last three animals did not contribute to the growth and present status of the herd.

Early growth of the Monument herd was carefully watched by Monument personnel as well as State Game and Fish personnel. The first report of wapiti leaving the confines of the Monument came in 1933 when Madsen (1933) observed that three or four head had "escaped." The population census for that year was estimated at 23 head.

Population expansion since introduction has been remarkable. Progeny of the original herd of 8 head now occupy most of the Monument, are sometimes considered a pest by Glade Park Ranchers, and are numerous enough on Pinyon Mesa to provide a limited hunting season. No attempt was made in this paper to outline the management methods employed by the State or to calculate populations on Glade Park and Pinyon Mesa.

Winter increases in the Monument herd reflect seasonal migratory movements from the Monument to Pinyon Mesa. Murie (1957) stated that the main causative factor in migration is snow and its relation to suitable forage, and this is probably the major migration stimulus

in the herd's movement into the Monument during winter. There appeared to be one major migration route into the Monument from the higher country, this being a game trail near the head of Red Canyon. Summer populations are low and only a few cows remain in the higher sections during the hot months. One rare observation of a cow and twin calves was made by Regional Biologist Walter Kittams in August, 1959, in Ute Canyon.

Food habits of the herd were not studied, but sparsity of good range grasses and succulent vegetation precludes much chance of the normal high altitude diet. It was suspected that annual grasses, a few perennial grasses, and sagebrush constituted a major part of their food. Tracks were frequently seen on Monument Mesa and between Ute and Red Canyons in sagebrush and grass meadows.

Specimens Examined — Total 2, distributed as follows: Ute Canyon, south rim, (1); Rim Rock Drive, head of Ute Canyon, (1).

Observation Records — Monument Canyon, October 20, 1927, Custodian John Otto, (16); Monument Canyon, December 28, 1932, Biologist David Madsen, (30); Cold Shivers Point, July 18, 1936, (Superintendent's Report, July 1935), (1); Ute Canyon, July 26, 1937, (Superintendent's Report, July 1937) (15); "in Monument," May 9, 1941, (Superintendent's Report, May 1941), (1); Upper Ute Canyon, August 22, 1943, Maintenance Foreman Atchison, (12); Rim Rock Drive, June 18, 1944, (Superintendent's Report, June 1944) (6); Ute Canyon rim, December, 1945, Ranger Ray Dobbins, (20); southwest boundary of Monument, January, 1946, (Superintendent's Report, January, 1946), (20); Ute Canyon, March 21, 1946, Superintendent Finch, (20); head of Red Canyon, December, 1948, (Superintendent's Report, December, 1948), (30); along boundary fence,

March 1950, (Superintendent's Report, March 1950), (17); head of Ute Canyon, May 1, 1953, park visitor, (11); head of Ute Canyon, September 28, 1955, Maintenance man Glen Hickman, (8); head of Red Canyon, November 7, 1957, Park Naturalist D. L. Hamilton, (1); Ute Canyon, June 11, 1958, Seasonal Naturalist Murl Messersmith, (1); Ute Canyon, August 14, 1959, Biologist Walter Kittams, (3); head of Red Canyon, November 2, 1959, Chief Ranger Raymond McIntyre, (8); head of Columbus Canyon, January 21, 1960, Chief Naturalist Pat H. Miller (5); head of Columbus Canyon, November 22, 1961, Maintenanceman Glen Hickman, (10); head of Red Canyon, August 27, 1962, Seasonal Ranger William E. Baird, (4).

Odocoileus hemionus hemionus (Rafinesque)

Mule Deer

Cervus hemionus Rafinesque. 1817. Amer. Monthly Mag., vol. 1, No. 6, p. 436, Oct., 1817.

Cervus macrotis, Say. 1823. In Long, Account of an expedition from Pittsburgh to the Rocky Mountains, . . . , vol. 2, p. 88, (Mora River, near present town of Mora, New Mexico).

Cariacus macrotis, True. 1884. Proc. U. S. Nat. Mus., vol. 7 (App. Circ. 29), p. 592, Nov. 29, 1884.

Odocoileus hemionus, Merriam. 1898. Proc. Biol. Soc. Washington, vol. 12, p. 100, April 30, 1898.

Cariacus virgultus, Hallock. 1899. Forest and Stream, vol. 52, No. 21, p. 404, May 27, 1899. (Near Hallock, Kittson County, Minnesota. See V. Bailey (December, 1926), North Amer. Fauna 49, p. 41, January 8, 1927.)

Type Locality -- Mouth of Big Sioux River, South Dakota. (V. Bailey,

North Amer. Fauna No. 49 (December, 1926), p. 41, January 8, 1927).
Other Common Names -- Rocky Mountain Mule Deer, Black-tailed Deer.
Comments -- Mule Deer were ubiquitous in the Monument and adjacent areas. Reports and complaints have been frequent from orchard raisers in the Redlands that deer damage trees and fruit. Attempts to keep the 8-foot chain link fence along the Redlands in repair to prevent deer from migrating from the Monument into the agricultural areas have been futile. Deer have even been observed crawling through 3-foot drainage culverts to travel to and from the Monument. Most of the Pinyon Mesa and Glade Park areas have been open to deer hunting with the take usually limited to two deer, hunters'choice of sex and age.

The Monument deer herd fluctuations are dependent upon seasonal vertical stratification due to migrations influenced primarily by seasonal weather conditions. No population studies have been made in the Monument, but it was estimated that the winter population (about 150-200) exceeded that of summer by three or four times. Severity of winter temperatures and snowfall on Pinyon Mesa influences downward migration of deer, especially large bucks. Summer populations are mostly composed of does and young-of-year fawns. Does may remain in the Monument to drop fawns, which usually make their appearance in mid-June.

Subspecies determination was based on distribution. The state of Colorado lies well within the described limits of O. h. hemionus and the closest subspecies is O. h. crooki with marginal records in Colorado Canyon, Arizona (Hall and Kelson, 1959).
Specimens Examined -- Total 2, distributed as follows: one mile east of West Glade Park Road junction on Rim Rock Drive, 6415 feet, PHM (1); boundary fence, one-quarter mile west of utility area, 5800 feet,

PHM (1).

Bison bison bison (Linnaeus)

Bison

/Bos/ bison Linnaeus. 1785. Systema naturae, ed, 10, vol. 1, p. 72.

Bison americanus, True. 1884. Proc. U. S. Nat. Mus., vol. 7 (App. Circ. 29), p. 592, Nov. 29, 1884.

B/ison/ bison, Jordan, 1888. Manual of the vertebrate animals of the Northern United States, . . . , ed. 5, p. 337.

Bison americanus pennsylvanicus, Shoemaker. 1915. A Pennsylvania bison hunt, p. 9. (Pennsylvania. Description based on hearsay and therefore regarded as invalid by Skinner and Kaisen, 1947, Bull. Amer. Mus. Nat. Hist., vol. 89, p. 163, Oct. 31, 1947. See Opinion 2, International Commission on Zoological Nomenclature Inst. Spec. Publ. 1938, pp. 5-6, July, 1910.)

Bison bison septentrionalis (sic), Figgins. 1933. Proc. Colorado Mus. Nat. Hist., vol, 12, p. 28, Dec. 5, 1933. (Six miles northeast of Palmer, Merrick County, Nebraska. Regarded as identical with bison by Skinner and Kaisen, 1947, Bull. Amer. Mus. Nat. Hist., vol. 89, pp. 161, 163, Oct. 31, 1947.)

Type Locality -- Mexico (See Thomas, Proc. Zool. Soc. London, 1911, pt. 1, p. 154, March 22, 1911. Southern or southeastern United States, not Mexico, regarded as type locality by Reed, 1952, Jour. Mamm., vol. 33, No. 3, p. 392, Aug. 19, 1952.)

Other Common Names -- American Buffalo, Buffers, Plains Bison.

Comments -- Considerable space was devoted to the Monument bison herd because of its historic influence and surrounding controversy concerning

management of wildlife in the Monument and related administrative problems.

The Colorado National Monument bison herd is an unique segment of the western Colorado fauna. The idea of bison in the Monument was developed in Grand Junction about 1923 by the Chamber of Commerce and former Monument Custodian John Otto.

Three animals were shipped to Grand Junction via railroad in 1926, three years after the start of local subscription to provide funds for fencing and shipping expenses. The original herd consisted of two cows and one bull shipped from the Denver Mountain Parks by the Colorado Game and Fish Department (Miller, 1962). Insofar as records indicate, the Denver Mountain Parks acquired their animals from Yellowstone National Park between 1914 and 1918. The composition of the original Denver herd is not known, but there is a record of four bulls being sent from the Park to Denver between 1914 and 1923.

The paternal herd bull expired the day after arrival in the Monument, but the two cows had little trouble in making the trip or in adjusting to their new range. A bull calf was born the next year (1927) and a new herd bull was provided by the State Game and Fish Department. It was from this start that the present herd was produced.

The only additional breeding stock for the herd was introduced between 1928 and 1932 when a man by the name of Knight placed his private herd of four cows in the Monument with the agreement that the Monument would keep about one-half of the off-spring. Mr. Knight removed his portion of eight animals in 1932.

The herd is restricted to the canyon floors, the Precambrian bench above the Redlands and the narrow grasslands between the escarpment and

the north fence. The canyons to which they have access are: Monument, Lizard, Gold Star, Ute and Red. Monument and Ute Canyons are more easily accessible and provide more range. The total range area is about 2500 acres.

The range, for the most part, is poor for bison and includes mostly annual grasses, sagebrush and saltbush, but few perennial grasses. No extensive range or food habit studies have been made and only one inconclusive series of stomach analyses has been made.

Management of the herd was initiated in 1932 when Dr. D. H. Madsen, National Park Service Wildlife technician, made a casual review of the bison and their range. McDougall (1940) made additional studies of the animals and the range and recommended that the herd be maintained at 15 animals, additional range opened, and more water developed in the canyons. Dr. McDougall was back in the Monument in 1941 with Rouse, Fish and Wildlife Service biologist, Wichita Wildlife Refuge, to reevaluate the situation. As a result of the 1941 study, it was determined that the carrying capacity of the range was about 20 animals. Secretarial approval for reductions to maintain the herd was granted on June 17, 1941.

Reductions since 1941 have resulted in 85 animals having been slaughtered and carcasses provided to Ute and Navajo Indians. There have been 24 known deaths among the herd since its beginning, bringing the total number of bison removed from the Monument to 109.

There has never been evidence of contagious disease or serious parasitic infestations in the herd or in any individual. Autopsy of six animals of the 1960 reduction by the author and Mr. R. L. Hoover revealed no endoparasites and that the animals were fat and appeared

to be in excellent physical condition.

Weights and measurements of five animals of the 1960 reduction were compared with data from animals of similar age and sex from the Wichita Mountains Wildlife Refuge as described by Halloran (1960). There was no notable difference. There were no particularly large animals in the Colorado National Monument herd, but averages compared favorably with those of larger herds. Cole (1956) made similar observations and also noted that in 1956 there was a 20 percent birth rate among cows of the Monument herd. This figure compared favorably with the birth rate among the Wind Cave National Park cows. On this evidence, previous statements made in various National Park Service reports that the Colorado National Monument herd is "dwarfed" should be disregarded.

The idea of replacement of a native species of animal, long extinct from the Grand Valley, was probably based on erroneous assumptions by the instigators of the Monument bison herd. There is doubt that bison were ever in the Grand Valley, and it is probably a safe assumption that they at least were never numerous. The closest authentic record of bison herds is in North Park of north-central Colorado. One large skull was found at the base of Chalk Mountain, Grand Mesa, Mesa County, by A. A. Look of Grand Junction. If this skull was of historic origin, and the possibility exists, this would be the only recorded "wild" specimen of bison from the Grand Valley region. There is the possibility that the Look skull was from an escaped animal of the Knight herd, but Mr. Knight had the reputation of keeping close watch over his herd.

Measurements -- Two adult females averaged 2609.9 (2679.7-2540.0);

340.4 (342.9-337.8); 539.8 (508.0-571.5); 138.1 (129.7-136.5). One adult male measured: 2578.1; 330.2; 571.5; 146.1.

Specimens Examined -- Total 14, distributed as follows: Monument Canyon, COLM (1); Colorado National Monument, COLM (2); fence along Redlands, 1960 reduction program, PHM (10); base of Chalk Mountain, Grand Mesa, Mesa County, Colorado, 7500 feet, PHM (1).

HYPOTHETICAL AND EXTINCT SPECIES

Myotis evotis evotis (H. Allen)

Long-eared Myotis

Anderson (1961) collected M. evotis from the edge of a pinyon-juniper forest near a burn area at 7400 feet in Mesa Verde National Park. The specimens were taken in a mist net set across a dirt road near Rock Springs. Anderson (1959) also shot a single specimen on Grand Mesa three miles east and four miles south of Collbran, Mesa County, at 6800 feet. M. evotis is included here as a result of those two collections and from additional specimens collected in Black Canyon of the Gunnison National Monument at 8000 feet by the author.

Myotis thysanodes thysanodes Miller

Fringed Myotis

M. thysanodes was collected by Anderson (op. cit.) in Mesa Verde at the same time as M. evotis described in the preceding paragraph. One specimen was collected. It was included in the Monument's fauna because of the distribution in Colorado and because of the ecologically similar conditions to those of the collection site in Mesa Verde.

Myotis californicus subsp.

California Myotis

Warren (1942) indicated a collection from Rifle, Garfield County, as M. c. californicus but identified specimens from Ashbaugh's Ranch, Montezuma County, as M. c. stephensi. Cary (1911) listed a specimen from the Grand Valley near Morris, seven miles west of Rifle, Garfield County, as M. californicus ssp. Hall and Kelson (1959) used Warren's Rifle specimen as marginal for californicus and the Montezuma County specimen as marginal for stephensi. Durrant (1952) recorded a specimen of stephensi from four miles north of Thompson, Grand County, Utah. This was a marginal record according to Hall and Kelson (op. cit.). Based on that somewhat incongruous distribution, it was impossible to ascertain sub-specific classification without local specimens. It is probably safe to assume that Myotis californicus occupies most of the warm Grand Valley and its margins, including the Monument area.

Lasionycteris noctivagans (LeConte)

Silver-haired Bat

The silver-haired bat was collected in Rifle, Garfield County, by Warren (1942) who believed that it breeds in the Canadian Life Zone but makes extensive vertical migrations into the Transition and Upper Sonoran Life Zones. Cary (op. cit.) listed a Biological Survey specimen from Rifle collected by Loring in 1893, and the Warren specimen may be identical with that one. That specimen may have been an accidental or Lasionycteris may utilize the Grand Valley as an avenue for migration. It is considered as a possibility in the Colorado National Monument

fauna with that possibility being derived from either Grand Valley (Upper Sonoran) or Pinyon Mesa (Transition-Canadian Zone) influence.

Lasiurus cinereus cinereus (Palisot de Beauvois)

Hoary Bat

The lone Mesa County specimen was a mounted specimen, seen by Cary (1911) in 1904, and owned by Dr. S. M. Bradbury who stated that it was collected in the town of Grand Junction. Several specimens were collected by the author in Black Canyon of the Gunnison National Monument, Montrose County, at 8000 feet. This is probably a Transition to Montane mammal in western Colorado and may only occasionally occur in the Monument.

Tadarida brasiliensis mexicana (Saussure)

Mexican Free-tailed Bat

This cave bat occasionally inhabits buildings and has been found at several locations not far from the Monument area. Warren (1942) collected it from Newcastle, Garfield County, and Cary (op. cit.) also took 4 specimens from Newcastle. Anderson (1961) recorded 2 specimens from Mesa Verde where it was collected in Cliff Palace. It is possible that Tadarida fly up the Grand Valley, thus creating the possibility that an occasional one might turn up in Colorado National Monument.

Tadarida molossa (Pallas)

Big Free-tailed Bat

This bat was included here on the basis of a specimen owned by Dr. S. M. Bradbury, Grand Junction, who told Cary (op. cit.) that he obtained it from two small boys who found it in Grand Junction in about 1900.

Warren, (op. cit.) stated that identification was "fairly certain" and considers that it was the first Colorado record of the species. The specimen was destroyed by fire. This specimen was undoubtedly an accidental and is included only on the basis of the Grand Junction specimen's close proximity to the Monument.

Citellus lateralis lateralis (Say)

Golden-mantled Ground Squirrel

The golden-mantled ground squirrel was not collected in Colorado National Monument during the course of the study, but observations were made of it in Glade Park and on Pinyon Mesa. The nearest record was one-half mile south of the Glade Park Store. Former Park Naturalist Dwight L. Hamilton reported seeing lateralis in the Saddlehorn Picnic area in 1957, but this observation record is unlikely due to a lack of additional substantiating records in five years of subsequent study. Mr. Hamilton probably misidentified Citellus leucurus as lateralis. It is likely that this mammal will, in time, be found in the higher sections of the Monument.

Thomomys bottae aureus J. A. Allen

Golden Pocket Gopher

A. H. Howell collected an adult female aureus at Grand Junction, November 7, 1895. Cary (1911) described the specimen as "a beautiful golden gray in winter pelage." Warren (1942) did not indicate that he ever found it in Mesa County.

The location of two subspecies of T. bottae in Grand Junction adds some confusion to the pocket gopher situation in the Grand Valley. Since

the Carnegie Museum collected specimens of howelli in Grand County, Utah, and since no pocket gopher evidence was found in the Monument or observations made south of the Colorado River in the Grand Valley, aureus may be limited in distribution to east of the Colorado River and north of the Gunnison River, a situation that Finley (1958) found in woodrats. This interesting distribution pattern will only be revealed with additional study. It may someday be found in the East Entrance area of the Monument.

Thomomys bottae howelli Goldman

Grand Junction Pocket Gopher

Grand Junction is the type locality for this subspecies and its range is probably along the Colorado River. Warren (1942) restricted it to the Grand Valley but Durrant (1952) listed 6 specimens in the Carnegie Museum from ten miles north of Moab, Grand County, Utah. Little is known of specific locations in the Grand Valley and it was not collected in the Monument. No pocket gopher evidence was observed south of the Colorado River but mounds were frequently seen on the north side of the river, especially along Highway 6-50 between Grand Junction and Fruita. Range in the Grand Valley is probably restricted to north and west of the Colorado River.

Thomomys bottae optabilis Goldman

Botta's Pocket Gopher

Warren (op. cit.) collected 3 specimens of optabilis from the Sieber Ranch on the Little Dolores River, Mesa County. This location is about twenty-five miles west of the Monument boundary at an elevation of about

5675 feet. Most mammal species from the Seiber Ranch collected by Warren are closely related to forms associated with higher elevations in Colorado National Monument. This was true in Citellus leucurus where cinamomeus was found at the Sieber Ranch and at upper elevations in the Monument, and pennipes was found in the Grand Valley and in the lower elevations in the Monument. A similar situation may exist in local pocket gophers except that the pocket gophers have not been found in the Monument. Additional study might reveal that optabilis, if it is found in the Monument, will appear at the higher elevations.

Onychomys leucogaster pallescens Merriam

Northern Grasshopper Mouse

The Grand Valley distribution of the grasshopper mouse appeared to be limited to the north side of the Colorado River, but that might be due to more general collecting on that side of the river. This animal was not found in the Monument, but general ecological conditions are favorable to it. It may eventually be found on the south side of the river and in Colorado National Monument. Cary (1911) described its habitat as associated with sandy soils in the deserts north of Fruita. It was collected near other rodent burrows such as Dipodomys and Citellus.

Cary (op. cit.) indicated that the Book Cliffs form the northern limits of pallescens and separated that subspecies from brevicaudus which is found on the north side of the Book Cliffs.

Neotoma lepida sanrafaeli Kelson

Desert Woodrat

Finley (1958) found N. lepida restricted in the Grand Valley to the

north side of the Colorado River, east to Palisade, Mesa County. It was not collected in the Monument but it is possible that migrations extend into the Monument and future collections might reveal its presence in the vicinity of Kodels Canyon, at low elevations.

Microtus longicaudus mordax (Merriam)

Long-tailed Vole

Warren collected Microtus at Grand Junction, 4600 feet, prior to 1911. There was no evidence as to the collection site or habitat, but presumably it was near the Gunnison River at Grand Junction. Hall (1953) listed the specimen as a marginal record for mordax. The 4600 feet elevation is below that which would normally be considered the low altidinal range for mordax in Colorado. Areas near the East Entrance in No Thoroughfare Canyon and near the West Entrance below the Fruita Reservoir are ecologically favorable for Microtus, and although none were collected at either site it is possible that mordax occupies these areas during peak population years. Warren also collected a specimen from Sieber Ranch, Little Dolores River, 5675 feet, in 1909.

Canis lupus youngi Goldman

Gray Wolf

Goldman indicated that the gray wolf historically occupied west and central Colorado (Warren, 1942). No records were found that revealed the wolf in Colorado National Monument and the nearest locality records are three western Colorado accounts. A few wolves were seen in the western part of San Miguel and Montrose Counties in the winter of 1906-07 and 4 or 5 were seen between Cortez and Mancos, Montezuma County, in the

winter of 1904-05 (Cary, 1911). Warren, in his museum catalogue cards, recorded a report of a wolf from near Fruita in 1909.

Vulpes fulva macroura Baird

Red Fox

Red foxes have been frequently collected by government predatory control trappers in the desert north of Fruita and Loma in Mesa and Garfield Counties. Such records usually occurred in winter. One melanistic female was trapped ten miles north of Loma, 5300 feet, Garfield County, on February 22, 1963, by Mr. J. D. Peters, Fruita.

Vulpes will unlikely be found in the Monument at lower elevations where it must cross the Grand Valley from the Book Cliffs, but it is quite conceivable that it might migrate down from Pinyon Mesa during severe winters to occupy the Monument in the higher elevations.

Ursus horribilis bairdi Merriam

Grizzly Bear

Grizzly bears at one time probably occupied most of the mountainous sections of Colorado and many of the major river drainages of the lower elevations. A lack of historical records and accurate specimen data will most likely preclude accurate distribution and taxonomy of grizzlies prior to white man's invasion of the State. While Colorado National Monument does not fall totally into either of the general distribution areas, some of the last Colorado grizzly records were close enough to speculate that the Monument area might have been included in the historical territory or migration routes of the big bears. Cary (1911) gave the following data:

"Mr. William Cross, the Glenwood Springs taxidermist, showed me a photograph of the skin of a very large silver-tip killed in October, 1906, on the northern side of the Book Plateau, in extreme western Garfield County, by Mr. Harry Payne Whitney, of New Haven, Connecticut."

"The skin of a large silver-tip which was trapped on West Dolores River in the spring of 1906 is owned by Mr. Harry Pyle, of Dolores."

"The foreclaws on the skin of a large old cinnamon bear from the Uncompahgre Plateau, 15 miles west of Montrose, are markedly smaller and shorter than those of the smaller of Mr. Lampton's two silver-tips (from the Williams River Mountains)."

"Mr. E. R. Warren, of Colorado Springs, has in his collection the skull of a medium-sized silver-tip which was killed some years ago in the Dry Creek Basin, west of the San Miguel Mountains, by Mr. Jack Watson, of Norwood. The Dry Creek Basin is Upper Sonoran country, the altitude being not over 6,000 feet--an unusually low elevation for the silver-tip."

One of the most interesting accounts of local grizzlies was given by Warren (1942) and is the story of "Big-foot Mary," a large female grizzly killed in the Dominguez Country about twenty-five miles south of Grand Junction in Mesa County. She was killed in October, 1925, after a reputation of twenty-five years on Dominguez and Unaweep Creeks in southeastern Mesa County, an area about 20 miles square. Warren (op. cit.) stated the bear was 8½ feet long and rendered 166 pounds of "lard."

Antilocapra americana americana (Ord)

Pronghorn

The range of the pronghorn in Mesa County prior to settlement by white man undoubtedly included areas that are today part of Colorado National Monument. Hoover, Till and Ogilvie (1959) indicated that pronghorn were present in Mesa County in early pioneer days and reached a population low during World War I. Howard Schultz, Grand Junction, stated to R. L. Hoover, Colorado Game and Fish Department, that he saw pronghorn

on the family ranch, about four miles north of Loma, in 1902 and last saw them in that vicinity in 1905.

William McGinley and his partner are reported to have killed 32 head of pronghorn in deep snow somewhere between the cities of Grand Junction and Delta in 1881.

At present, there are sufficient numbers of the animal in the County to provide a limited annual hunting season, but this is due to transplantations by the State Game and Fish Department in 1949-50. At that time a total of 70 animals were released in areas of the desert southeast of Grand Junction and north of Loma.

Wormington and Lister (1956) excavated a pronghorn skull from the Luster Cave archaeological site in Glade Park. This site is about 15 miles from the Monument, just west of the state line in Utah and is on the northwestern edge of the Uncompahgre Plateau. The skull was in the midst of a concentration of cultural debris, was in a very good state of preservation, and appeared to have been purposely buried. Age calculations for the site were not attempted and it is not possible to determine when the skull was interred, but the cultural and stratigraphic indications were that the site was Fremont.

Location of pronghorn remains on Glade Park makes an interesting distribution pattern in the Monument area. Not only did pronghorn range in the Colorado River Valley and lower sections of what is now Colorado National Monument, but, if it can be assumed that Indians killed the animal found in the Luster Cave site in that vicinity, pronghorn can be established in the open areas of Glade Park adjacent to the Monument at higher elevations.

On the basis of the above records, pronghorn were included in this

report as an extinct species of the Monument. Early distribution probably included that area of the Monument to the base of the Precambrian escarpment and the open sagebrush flats in the upper parts of the Monument.

Ovis canadensis canadensis Shaw

Rocky Mountain Bighorn

This is probably an extinct species of mammal in Colorado National Monument and probably occupied the Monument area prior to the advent of Caucasian man in the area. Terrain of the Monument is unfavorable to this species of bighorn, but local records substantiated the placement of the bighorn in the Monument area during early historic or prehistoric times.

The only records of bighorn within the present Monument boundaries were in the form of Indian petroglyphs. One clearly-defined character on a slab of Wingate Sandstone that has fallen from the No Thoroughfare Canyon wall is that of a bighorn ram. Naturally it was indeterminate to assign the ram depicted on the rock to No Thoroughfare Canyon, but such a possibility is conceivable. Another, much larger, pictograph has been discovered near the mouth of Red Canyon. Nusbaum, former Chief Archaeologist, Mesa Verde National Park, stated in his narrative report of May, 1936, that the pictograph predates the historic Ute Indians who occupied the Grand Valley until 1881.

Buechner (1960) stated that in 1907 bighorn were not uncommon in Mesa County and were mostly on the east side of the Dolores River between Salt Canyon and the mouth of West Creek, on the broken southwest face of the Uncompahgre Plateau. This would place bighorn within twenty airline miles of the Monument vicinity in historic times, just four years

prior to its establishment as a National Monument.

A museum card from the Warren Collection indicated that "Eldridge, Ela and Sullivan" found a bighorn skull on the Dolores River in Mesa County in 1905. The depository for that skull is unknown and no published account of the collection was found. That site would be near the area mentioned by Buechner (op. cit.) and was probably authentic.

Both Buechner (op. cit.) and Moser (1962) mentioned that bighorn occupied the Book Cliff Plateau area in former years and that a small band still exists there.

The only recent report of bighorn in the immediate area was by a sheepherder who exhibited a large ram skull in Fruita in 1959. He stated that the skull was found on Pinyon Mesa during the fall of 1959. That location was about sixteen miles from the Monument at an elevation of about 9000 feet and there is some doubt if the skull actually came from Pinyon Mesa. More likely it came from the La Sal Mountains of eastern Utah; however, Durrant (1952) did not report them from that mountain range.

VI. DISCUSSION AND CONCLUSIONS

A total of 5725 trap nights was expended in the various plant associations at varying altitudes of Colorado National Monument in 1961-62. This resulted in 316 specimens collected for a trapping success of 5.5 percent. An analysis of the ecological and altitudinal trapping successes in the plant associations is shown in Table I, below.

TABLE I

TRAPPING PERCENTAGES DISTRIBUTED BY ELEVATION IN THE MONUMENT

Elevation and Vegetation	Number Trap-nights	Number Specimens	Number Species	Percent Trapping Success
Upper Sagebrush	1812	80	6	4.9
Lower Sagebrush	723	14	3	1.9
Upper Oak-serviceberry	368	33	4	9.0
Lower Oak-serviceberry	250	11	3	4.4
Upper Grass	364	31	6	8.5
Lower Grass	350	21	6	6.0
Seep	508	9	4	1.8
Greasewood	600	54	5	9.0
Pinyon-Juniper	750	63	6	8.4
Totals	5725	316	14	5.5

Warren (1942) and Cary (1911) both placed the upper limits of the Upper Sonoran Life Zone in west-central Colorado at about 6000 feet; however, the area is incised with canyons and other features that produce a rough, broken terrain. The Upper Sonoran Life Zone, in most

places, extends to the upper elevations of the Monument (7030 feet). In some sheltered areas, small in size, the Transition Life Zone interdigitates with the Upper Sonoran Zone and intrudes either as fingers of vegetation or exists as isolated "islands," often being somewhat incongruous with a surrounding of Upper Sonoran vegetation.

A base altitude of 5780 feet was chosen as the differentiating elevation of the Monument to separate "upper" from "lower" elevations. This altitude was chosen because it was near the 6000-foot level and closely coincided with canyon rims in the vicinity of the Park Headquarters and also near Cold Shivers Point (6106 feet) thus culminating two rather abrupt gains of altitude from the Grand Valley floor near the north and south ends of the Monument. It was also chosen because it closely corresponded with descriptions of the transition between the two life zones (Warren, 1942; Cary, 1911). Material gathered from 5780 feet was placed in the "lower" category.

When possible, trap lines were placed in areas where the vegetation composition corresponded to types sampled at the reciprocal elevation. Some vegetation types did not grow at all elevations. Greasewood was found at low elevations but not in sufficiently pure stands at the higher elevations to include there. Most of the oak-serviceberry sites were at the higher elevations and nearly all of the pinyon-juniper forests were above 5780 feet. A few of the types such as sagebrush and grass were widespread over the Monument. Some areas including seeps, reservoirs and "caves" were highly localized and no attempt was made to associate them with the more broad vegetative types. Correlation between the mammalian species and habitats was the primary goal of this study.

Some difficulty was encountered in attempting to analyze vegetative

cover in an area so small as Colorado National Monument. Only in a small percentage of trap lines was a pure stand of primary vegetation found. Usually high percentages of other plant species were found growing within the sample site. Because of this, the category "saltbush" was omitted and included with sagebrush. At times, juniper intruded into lower elevations and was found in association with sagebrush or greasewood. Sagebrush often was found in predominantly grassy areas. When trapping in areas of sparse vegetation, such as dry streambeds, the site was assigned to that vegetative type that appeared to be climatic.

The greatest trapping success was achieved in areas that contained a mixture of shrubby plants and grass sparsely interspersed with juniper. This was noticeably true of sagebrush and of saltbush. The distribution of mammals as related to habitats must be restricted to the smaller species because those species of greater mobile potential such as ungulates, carnivores, lagomorphs, and bats were not collected in sufficient numbers for use in this study, but were used to indicate qualitative distribution.

Quantitative and qualitative analysis of the small mammals indicated higher population densities at the higher elevations. In situations where it was possible to sample similar vegetation types growing at various altitudes, it was found that mammal populations were more abundant in both density and numbers of species at the higher elevations. For results of the collecting efforts, see Table II.

Sagebrush -- This association, above 5780 feet, produced the lowest trapping success (4.9%) of any habitat in the upper elevations as a result of the heaviest trapping efforts (1912 trap-nights). Sagebrush was the most abundant vegetation found in the Monument and it was determined that

TABLE II

ALTITUDINAL DISTRIBUTION OF SPECIES
AND SUBSPECIES

Species	Lower Elevations	Upper Elevations
Myotis lucifugus carissma	0	2
Myotis volans interior	2	0
Myotis subulatus melanorhinus	1	0
Pipistrellus hesperus hesperus	10	5
Eptescus fuscus pallidus	3	1
Plecotus townsendi pallescens	2	0
Antrozous pallidus pallidus	4	0
Lepus townsendii townsendii	0	2
Lepus californicus texianus	0	2
Sylvilagus auduboni warreni	1	3
Cynomys leucurus	5	0
Citellus variegatus grammurus	3	3
Citellus leucurus pennipes	31	0
Citellus leucurus cinnamoneus	0	2
Eutamias minimus operarius	0	1
Eutamias quadrivittatus hopiensis	36	40
Perognathus apache caryi	4	1
Dipodomys ordii sanrafaeli	4	6
Reithrodontomys megalotis aztecus	8	11
Peromyscus crinitus auripectus	5	13
Peromyscus maniculatus osgoodi	44	108
Peromyscus truei truei	40	56
Neotoma mexicana inopinata	1	5
Neotoma cinerea arizonae	2	5
Mus musculatus domesticus	1	2
Erethrizon dorsatum couesi	0	3
Vulpes macrotis arsipus	2	0
Urocyon cinereoargenteus scottii	1	3
Canis latrans lestes	0	2
Euarctos americanus amblycens	0	1
Bassariscus astutus flavus	3	1
Taxidea taxus taxus	1	4
Spilogale putorius gracilis	0	2
Mephitis mephitis estor	0	2
Felis concolor hippolestes	0	22
Lynx rufus pallescens	1	9
Cervus canadensis nelsoni	0	1
Odocoileus hemionus hemionus	0	2
Bison bison bison	14	0
Totals	229	320

saltbush, although often nearly as abundant as sagebrush, was subordinate to sagebrush in nearly all circumstances. In only one instance was a very small, almost pure, stand of saltbush found.

Upper elevation sagebrush accounted for the most specimens collected (80) and the most species trapped (11). There did not appear to be any species restricted to sagebrush in the Monument, but at least two species, Dipodomys ordii and Perognathus apache, may be more frequently found in loose, sandy soils with sparse sagebrush than elsewhere in the upper elevations.

Only one specimen of Perognathus was caught in sagebrush as was only one specimen of Reithrodontomys megalotis. Otherwise, species trapped in upper elevation sagebrush were comparatively numerous. Those two species were collected in other plant associations at lower elevations in greater abundance. Citellus leucurus cinnamomeus was trapped in a marginal sagebrush-coniferous area and has been listed in the pinyon-juniper habitat.

The species recorded from upper elevation sagebrush were:

Myotis lucifugus
Pipistrellus hesperus
Eptesicus fuscus
Lepus townsendii
Lepus californicus
Sylvilagus audubonii
Eutamias quadrivittatus
Perognathus apache
Dipodomys ordii
Reithrodontomys megalotis
Peromyscus crinitus
Peromyscus maniculatus
Peromyscus truei
Neotoma mexicana
Neotoma cinerea
Mus musculus
Erethrizon dorsatum
Urocyon cinereoargenteus

The sagebrush at lower elevations contained fewer mammal species than in the upper elevations; 723 trap-nights produced 14 specimens for 1.9 percent trapping success. Only five species were represented in those collections. One other species, Antrozous pallidus, was collected in a mist net near the mouth of East Monument Canyon and not far from

nearby sagebrush.

Antrozous pallidus	Peromyscus truei
Citellus leucurus pennipes	Neotoma cinerea
Peromyscus maniculatus	

Oak-serviceberry -- Except for very small areas, this association was most extensive along the Rim Rock Drive near the head of Ute Canyon where it grows in side pockets of Entrada Sandstone. Quercus gambellii was a little more abundant than Amelanchier in that chaparral situation.

The upper oak-serviceberry association, in 368 trap-nights, produced 33 specimens of four species for a 9.0 percent trapping success. That was the highest percentage of trapping success obtained above 5780 feet and equalled the 9.0 percent trapping success of the greasewood association at lower elevations.

Species recorded from oak-serviceberry in the upper elevations were:

Lepus townsendii	Peromyscus truei
Reithrodontomys megalotis	Neotoma mexicana
Peromyscus maniculatus	Odocoileus hemionus

It was found that no species of Monument mammals was restricted to the oak-serviceberry habitat but, Reithrodontomys megalotis was the mammal most frequently collected in the association and in no other association was Reithrodontomys so numerous.

The one collection site that might be considered lower oak-serviceberry was mostly serviceberry mixed with Cercocarpus, Artemisia, and Rus trilobata. It was in a rocky, shallow-soiled dry wash in Fruita Canyon. Only 250 trap-nights were expended there but resulted in 11 specimens for 4.4 percent trapping success. Despite that relatively poor trapping success, the qualitative results were good with five species being trapped and two carnivores collected in the immediate vicinity. The species obtained there were:

Eutamias quadrivittatus
Peromyscus crinitus
Peromyscus maniculatus
Peromyscus truei
Neotoma mexicana
Bassariscus astutus
Taxidea taxus

Grass -- The upper grass flats produced 31 specimens of six species from 364 trap-nights for 8.5 percent trapping success. None of the Monument species appeared to be limited to the grass habitats of the higher elevations. The species trapped in this association from the upper Monument elevations were:

Eutamias quadrivittatus
Citellus variegatus
Dipodomys ordii
Peromyscus crinitus
Peromyscus maniculatus
Peromyscus truei
Neotoma cinerea

This association contained lower population densities at lower elevations. Trapping success was 6.0 percent for 21 specimens from 350 trap-nights. Six species were trapped and three species of bats were shot near the grass-dominated mouth of North Monument Canyon. No species exclusively inhabited the grassland areas at any altitude in the Monument.

Species obtained in the Monument's low-elevation grasses were:

Myotis volans
Pipistrellus hesperus
Eptesicus fuscus
Citellus leucurus pennipes
Eutamias quadrivittatus
Reithrodontomys megalotis
Peromyscus maniculatus
Peromyscus truei
Mus musculus

Citellus leucurus pennipes was found in sagebrush and grass habitats in the lower elevations, and as indicated previously, there appeared to be vertical stratification between the two subspecies in western Colorado.

Pinyon-juniper -- The open coniferous forests of the Monument produced 63 specimens from 750 trap-nights for 8.4 percent success. There were eight species found in the pinyon-juniper associations but none limited

to the habitat. Myotis luciiugus was found only in or near the pinyon-juniper forest.

Citellus leucurus cinnamomeus was found above 5500 feet in sagebrush or grass openings often associated with nearby pinyon-juniper forests. Since this subspecies was replaced in the lower elevations by C. l. pennipes in sagebrush and grass associations, it is probable that the pinyon-juniper association may be an influencing factor for cinnamomeus. More likely, the limiting factors are soil types and depths rather than vegetation.

The species collected in pinyon-juniper association of the upper Monument elevations were:

Myotis lucifugus
Eutamias quadrivittatus
Citellus leucurus cinnamomeus
Peromyscus crinitus
Peromyscus maniculatus
Neotoma mexicana
Peromyscus truei
Neotoma cinerea

Greasewood -- The greasewood area near the East Entrance Ranger Station in No Thoroughfare Canyon was one of the best trapping sites of the study. The number of species caught was only five, but out of 600 trap-nights 54 specimens were caught for a 9.0 percent success. Greasewood had the highest trapping success of any low-elevation site.

The greatest success in trapping Perognathus was in the greasewood association where soils were deep. Dipodomys was not found in greasewood, and there did not appear to be any species limited to greasewood. Species trapped in greasewood were:

Eutamias quadrivittatus
Perognathus apache
Reithrodontomys megalotis
Peromyscus maniculatus
Peromyscus truei

Seep -- This damp, heavily vegetated locality did not produce the results that were anticipated. No species were limited to the marshy areas, but instead nine specimens of four species were trapped as a result of 508

trap-nights. This was 1.8 percent trapping success. It was surprising to find Peromyscus crinitus in such a habitat because in every other instance it was found in dry, rocky outcrops or near canyon walls.

Species collected in the seep near the West Entrance Station were:

Reithrodontomys megalotis	Peromyscus truei
Peromyscus crinitus	Neotoma cinerea

Fruita Reservoirs -- Collection efforts were limited to over the water. No efforts were made to trap near the water's edge because the town of Fruita's water department kept the shoreline free of vegetation. Several evenings were spent collecting bats over the reservoirs using shotguns and stretched-wire collection methods. Only Pipistrellus was collected. It was found that other bats do not often use the reservoirs.

Vertical stratification analysis of distribution showed that 2431 trap-nights were expended in the lower elevations of the Monument, resulting in 109 specimens of eight species for a 4.5 percent trapping success.

Only in Citellus leucurus and Eutamias minimus was positive evidence found that indicated any vertical stratification of the Monument's mammals. In Citellus leucurus, it was found that C. l. pennipes occupied the lower elevations, whereas C. l. cinnamomeus was found in the higher elevations. There were also habitat differences between the two subspecies dependent upon elevation. Eutamias minimus was collected by Sutton (1953) at a higher elevation in the Monument, but nowhere else in the Monument. Eutamias minimus, no doubt, extends its range downward into the Monument from the higher elevations of Glade Park and Pinyon Mesa.

As indicated in the collection data tables, the small mammals were more numerous at the higher elevations where comparisons were made in

similar habitats. In every instance the upper elevation association produced better trapping success than its analogue at a lower elevation.

Specimen data obtained by methods other than trapping (road kills, shooting, mist-netting, live traps, and observations) were secured for the orders Chiropters, Lagomopha, Carnivora and Artiodactyla. These specimens were mostly mammals of high mobile potential and were not restricted to any habitat or elevation in the Monument, although some of the species were only collected in one altitudinal range or plant association. In most cases only small collections were made and no accurate habitat determinations attempted. Of the bats, Antrozous pallidus, Myotis volans, and Plecotus townsendii were collected only at lower elevations, and Myotis lucifugus was found only in the upper elevations.

Larger mammals, although not restricted to elevation or habitat, did display population densities related to elevation. It was found that Lepus townsendii was more populous in the upper elevations of the Monument, whereas Lepus californicus was more numerous in the lower altitudes. Cervus canadensis, Odocoileus hemionus, Felis concolor, and Euarctos americanus were found in all elevations of the Monument but were more numerous in the pinyon-juniper and sagebrush associations of the canyon rims and floors than in the lower elevations of the north boundaries of the Monument.

VII. SUMMARY

1. A study was made of the occurrence and distribution of the mammals of Colorado National Monument, Mesa County, Colorado, with most of the study being conducted between June, 1961, and March, 1963.

2. Seven ecological habitats, at two altitudinal levels, were examined in the study area and data recorded on the mammals of each habitat. The associations were: sagebrush, grass, greasewood, pinyon-juniper, oak-serviceberry (chaparral), seeps, and reservoirs. Trapping success varied in the lower elevations from 1.8 percent in the seep to 9.0 percent in greasewood. In the upper elevations trapping success fluctuated from 4.9 percent in sagebrush to 9.0 percent in oak-serviceberry.

3. It was found that no mammal species in the Monument was restricted to a single vegetative type, but some of the habitats studied showed differentiation in qualitative productivity of species. The upper sagebrush produced 18 species; lower sagebrush, 5 species; upper chaparral, 6 species; lower chaparral, 7 species; upper grass, 7 species; lower grass, 9 species; pinyon-juniper, 8 species; greasewood, 5 species; and the seep, 4 species. Only one species was collected at the reservoirs.

4. Only two species displayed vertical stratification in their distribution in the Monument. Citellus leucurus was collected as two subspecies, with C. l. pennipes found in the lower parts of the area and C. l. cinnamomeus occupying the upper elevations. Eutamias minimus appears to be restricted to the higher elevations.

5. The study resulted in the examination of 544 mammal specimens of 39

species and subspecies. Trapping within the Monument produced 316 specimens from 5725 trap-nights for a 5.5 percent trapping success. Monument elevations of 5780 feet and above produced 207 specimens for a trapping success of 6.3 percent and the elevations below 5780 feet accounted for 109 specimens from 2431 trap-nights and 4.5 percent trapping success.

6. Literature was carefully examined to determine mammal species that might hypothetically have inhabited the Monument area and it was determined that 15 subspecies of mammals have been found in adjacent areas and may be considered potential parts of the Monument's fauna. Four species of mammals are considered extinct from the area, and one species (Bison bison) has been introduced into the Monument presumably to reintroduce an extirpated species. Mus musculus was the only exotic mammal species found in the Monument during the study.

7. One addition to the known fauna of Colorado (Vulpes macrotis) and 10 additions to the reported fauna of Mesa County resulted from the study.

8. Peromyscus maniculatus was the most commonly collected mammal in the Monument (152 specimens). Peromyscus truei was the second most common mammal collected (96 specimens), and Eutamias quadrivittatus was the third most abundant mammal collected (76 specimens).

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