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Cover photo: Cardenas Creek, river mile 71, left bank, looking up river.  
by Jeanne Suttkus

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# Distributional Checklist of the Mammals along the Colorado River in the Grand Canyon

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## ABSTRACT

Information obtained during field work carried out from September 1970 to June 1982 is presented for 35 species of mammals that were encountered along the Colorado River in the Grand Canyon. Systematic accounts, with information on distribution, are provided for each form. Comments are made about recent changes in the habitats for mammals in the area, and some of these changes are correlated with the distribution and abundance of mammals.

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# Distributional Checklist of Mammals along the Colorado River in the Grand Canyon

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## Introduction

The Colorado River throughout its course from the central Rocky Mountains to the Sea of Cortez has been of considerable interest for many years to students of mammalian distribution. However, because of the extremely rugged terrain and the difficulty of access in many areas, systematic efforts to learn about the distributions of mammals along portions of the Colorado River, especially in the depths of the Grand Canyon, have lagged behind these kinds of biological investigations in other areas of the western United States.

Near the end of the last century, Merriam (1890) pioneered the survey of mammals along the Colorado River. Grinnell (1914a, 1914b) discussed the distribution of mammals in the lower Colorado River valley of Arizona and California. Bailey (1935) presented a review of the mammals in the region of the Grand Canyon. Goldman (1937) described some of the effects of the Colorado River in northern Arizona on the distribution of mammals. Kelson (1951) and Durrant (1952) commented on the influence of the Colorado River on the distribution of mammals in Utah. Hayward *et al.* (1958) discussed the ecologic distribution of some vertebrates in the upper Colorado River basin, and Tanner (1965) studied some rodents in the vicinity of Canyonlands National Park. Mammals along the Colorado River and Green River in Canyonlands National Park were reported on by Armstrong (1979a, 1979b) and Johnson (1981). Durrant and Dean (1959) studied mammals at river level in Glen Canyon at the north end of the Grand Canyon. General information on mammalian distribution in this area and

the rest of Arizona was provided by Cockrum (1960, 1964). Hoffmeister (1971) published a comprehensive review of the mammals in the Grand Canyon National Park. Mammals of the Arizona Strip, that area of Arizona west and north of the Colorado River, were described by Hoffmeister and Durham (1971). Recent information on the distribution of mammals along the Colorado River in the Grand Canyon was provided by Ruffner and Carothers (1975), Ruffner and Tomko (1976), Ruffner *et al.* (1978), and Suttikus *et al.* (1978). A bibliography of works on the Grand Canyon and lower Colorado River from 1540 to 1980 was assembled by Spamer *et al.* (1981). Information on mammals of the national parks was presented by Van Gelder (1982).

The purposes of this report are to present a systematic account of the mammals that occur along the Colorado River in the Grand Canyon, and to provide some detailed information on the distribution of mammals in this relatively unstudied area.

## Methods

The specimens of mammals reported herein were obtained during more than a decade (from September 1970 to June 1982) of periodic trips down the Colorado River using rubber rafts as the platforms to provide logistic support for field research on mammals. These specimens were assembled in order to document geographic and ecologic distributions of mammals along 294.5 miles of the Colorado River from Lee's Ferry, Coconino County,

Arizona, to Sand Point, Mohave County, Arizona.

Mammals were collected by hand, snap traps, live traps, mist nets, and guns. Specimens were prepared in the field as conventional study skins and skulls, some partial skeletons and embryos were retained, and some specimens were preserved entire in fluid. Localities were described in the field with the aid of the Belknap (1981) series of Grand Canyon River Guides. Additional mapping was done from the "Geologic Map of the Grand Canyon National Park, Arizona" (1:62,500, Grand Canyon Natural History Association and Museum of Northern Arizona, Flagstaff, 1976). Distances down the river were taken from Lee's Ferry, river mile 0, right bank. Specimens, field notes, catalogues, photographs, and related information were deposited at the Museum of Natural History, Tulane University; the United States National Museum of Natural History; and the U. S. Fish and Wildlife Service Biological Survey collections under the care of the Denver Wildlife Research Center.

In the accounts of species that follow, synonymies were not included because this information was made available by Hall (1981). Keys to the mammals of the area were presented by Cockrum (1960), Hoffmeister (1971), and Hall (1981), and were not reproduced in this report. Vernacular nomenclature and the order of presentation were taken mostly from Jones *et al.* (1982).

### Study Area

The study area includes both banks of the Colorado River from Lee's Ferry near the Arizona-Utah border to Sand Point near the Arizona-Nevada state line. This area is in one of the longest and most unobstructed portions of the Colorado River of which to conduct a study of mammals. The area extends from just below the Glen Canyon Dam for 294.5 miles to the upper part of the Mead Reservoir.

All of the study area falls within the Arizona climatic pattern, which is a regime of winter precipitation, spring drought, summer rains, and fall dry periods (Lowe, 1964). The northern part of the area studied is in the Navahonian biotic province; the southern portion is included in the Mohavian biotic province (Dice, 1943, Lowe, 1964).

Before the closure of the Glen Canyon Dam in 1963, the Colorado River was heavily laden with silt, warm in summer, and cold in winter. The water levels ranged from essentially no flow during periods of drought to flows of catastrophic proportions during some flood periods (Fenneman, 1931). Because most of the water in the river comes from the bottom of Lake Powell as released through the Glen Canyon Dam, the Colorado River is now clear and cold. The water levels fluctuate daily dependent on releases through the dam in accordance with the demands for hydroelectric power.

The aforementioned changes in the river have had some dramatic impacts on the vegetation along the banks throughout the study area. The riparian vegetation along the Colorado River in the bottom of the Grand Canyon has been discussed and described in detail by Lowe (1964), Hoffmeister (1971), McDougall (1964), Dolan *et al.* (1974), Karpiscak (1976), Theroux (1976), Dolan *et al.* (1977), Ruffner *et al.* (1978), Suttikus *et al.* (1978), Carothers *et al.* (1979), and Carothers and Dolan (1982).

During our study, we sampled mammals at 50 localities along the river; there were 25 sites on the right bank and 25 on the left bank. General descriptions of many of these localities were provided by Suttikus *et al.* (1978). The numbers of the localities in the following list correspond with numbers on the map (Figure 1).

### List of Localities

1. Lee's Ferry, river mile 0, right bank.
2. 3.9 miles N Marble Canyon, river mile 2, right bank.
3. House Rock, river mile 17, right bank.
4. River mile 19, left bank.
5. River mile 21.8, right bank.
6. River mile 22, left bank.
7. River mile 26, left bank.
8. Stanton Cave, river mile 31.8, right bank.
9. Buck Farm Canyon, river mile 41, right bank.
10. President Harding Rapid, river mile 44, left bank.
11. Little Nankoweap, river mile 50, right bank.
12. Kwagunt Creek, river mile 56, right bank.
13. Kwagunt Rapid, river mile 56.5, left bank.
14. Lava Canyon, river mile 65.5, left bank.
15. Tanner Rapid, river mile 68, left bank.
16. Cardenas Creek, river mile 71, left bank.  
Cardenas Creek, river mile 71, right bank.
17. Unkar Rapid, river mile 72, right bank.
18. Granite Rapid, river mile 93.5, left bank.
19. Boucher Creek, river mile 96.5, left bank.
20. Crystal Creek, river mile 98.2, right bank.
21. Tuna Creek, river mile 99.3, left bank.
22. Lower Bass Camp, river mile 108.5, right bank.
23. River mile 109.5, right bank.
24. River mile 112, right bank.
25. River mile 114, right bank.
26. Elves Chasm, river mile 116, left bank.
27. River mile 119.5, left bank.
28. River mile 124, left bank.
29. Stone Creek, river mile 132, right bank.
30. Deer Creek Falls, river mile 136.2, left bank.
31. Overhang, river mile 137, left bank.
32. Backwater Camp, river mile 137.2, left bank.
33. Fishtail Canyon, river mile 139, right bank.
34. River mile 151.5, right bank.
35. Tuckup Canyon, river mile 164.5, right bank.
36. River mile 165, right bank.
37. National Canyon, river mile 166.5, left bank.
38. Fern Glen Canyon, river mile 168, right bank.
39. Mohawk Canyon, river mile 171.5, left bank.
40. Lava Falls Rapid, river mile 182, right bank.
41. River mile 183, right bank.
42. Whitmore Wash, river mile 188, right bank.
43. River mile 196, left bank.
44. Granite Park, river mile 209, left bank.
45. River mile 212.5, left bank.
46. 220 Mile Canyon, river mile 220, right bank.
47. Bridge Canyon dam site, river mile 238, left bank.
48. Scorpion Island, river mile 279.5, left bank.
49. Sand Point, river mile 294.5, left bank.

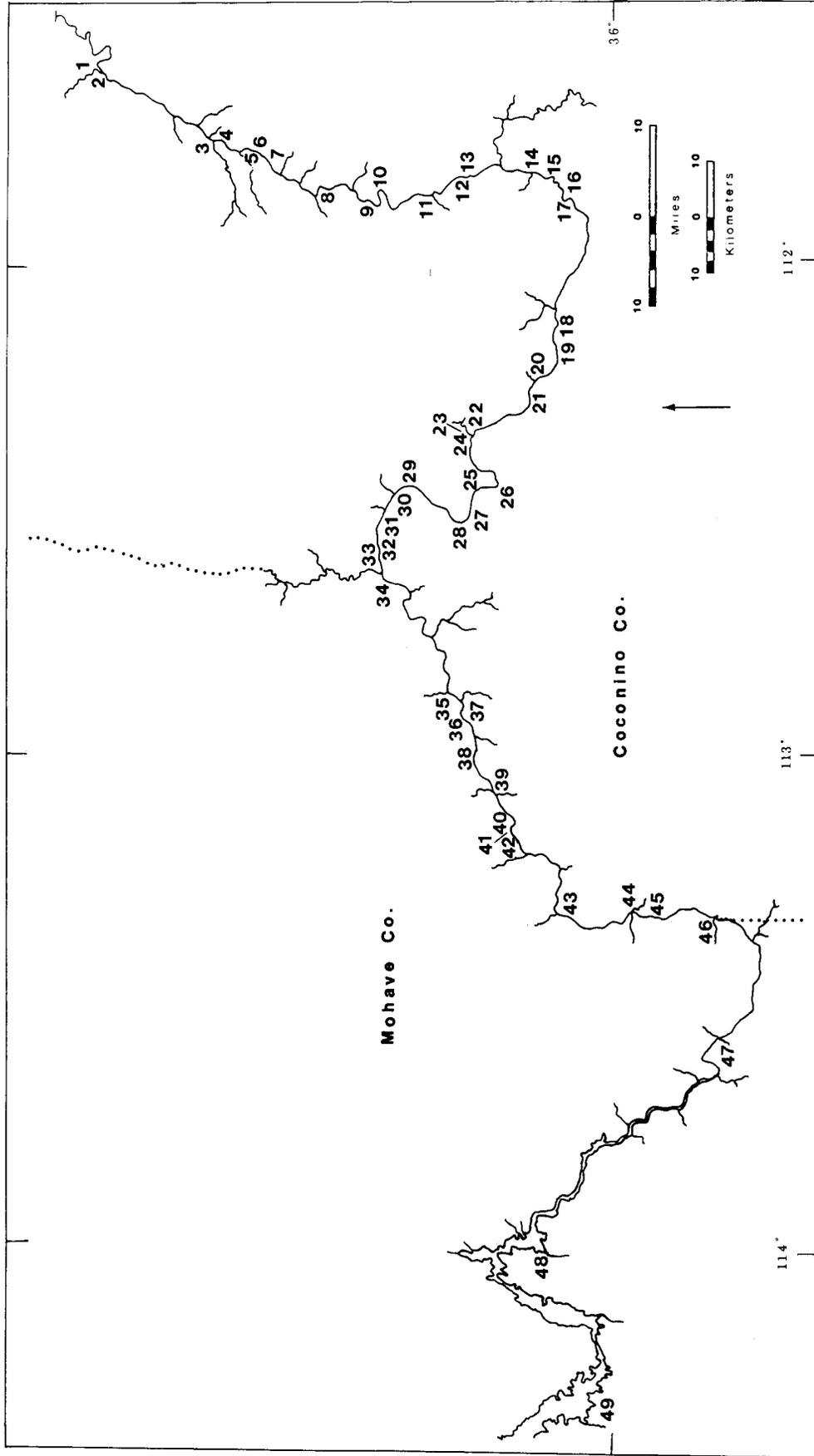


Figure 1. Map of the Colorado River in the bottom of the Grand Canyon. Numbers on the map correspond to the numbers in the list of localities.

## Results

A checklist of the mammals encountered by us along the Colorado River in the bottom of the Grand Canyon is provided below. This list includes only those taxa of mammals from the study area for which we have either substantiated sight records or voucher specimens that are deposited in a museum. For details of the distribution of these forms in the area, as well as other general information, see the accounts of species that follow.

### Checklist of Mammals Studied

#### ORDER CHIROPTERA Bats

##### Family Vespertilionidae (Vespertilionid Bats)

<i>Myotis yumanensis</i>	Yuma Myotis
<i>Myotis thysanodes</i>	Fringed Myotis
<i>Myotis californicus</i>	California Myotis
<i>Pipistrellus hesperus</i>	Western Pipistrelle
<i>Euderma maculatum</i>	Spotted Bat
<i>Plecotus townsendii</i>	Townsend's Big-eared Bat
<i>Idionycteris phyllotis</i>	Allen's Big-eared Bat
<i>Antrozous pallidus</i>	Pallid Bat

##### Family Molossidae (Molossid Bats)

<i>Tadarida brasiliensis</i>	Brazilian Free-tailed Bat
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#### ORDER LAGOMORPHA Lagomorphs

##### Family Leporidae (Hares and Rabbits)

<i>Sylvilagus audubonii</i>	Desert Cottontail
<i>Lepus californicus</i>	Black-tailed Jack Rabbit

#### ORDER RODENTIA Rodents

##### Family Sciuridae (Squirrels)

<i>Eutamias dorsalis</i>	Cliff Chipmunk
<i>Ammospermophilus harrisi</i>	Harris' Antelope Squirrel
<i>Ammospermophilus leucurus</i>	White-tailed Antelope Squirrel
<i>Spermophilus variegatus</i>	Rock Squirrel

##### Family Heteromyidae (Heteromyids)

<i>Perognathus amplus</i>	Arizona Pocket Mouse
<i>Perognathus formosus</i>	Long-tailed Pocket Mouse
<i>Perognathus intermedius</i>	Rock Pocket Mouse
<i>Dipodomys merriami</i>	Merriam's Kangaroo Rat

##### Family Castoridae (Beavers)

<i>Castor canadensis</i>	Beaver
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##### Family Cricetidae (New World Rats and Mice)

<i>Reithrodontomys megalotis</i>	Western Harvest Mouse
<i>Peromyscus eremicus</i>	Cactus Mouse
<i>Peromyscus maniculatus</i>	Deer Mouse
<i>Peromyscus crinitus</i>	Canyon Mouse
<i>Peromyscus boylii</i>	Brush Mouse
<i>Peromyscus truei</i>	Pinon Mouse
<i>Neotoma albigula</i>	White-throated Woodrat
<i>Neotoma lepida</i>	Desert Woodrat
<i>Neotoma devia</i>	Arizona Woodrat

#### ORDER CARNIVORA Carnivores

##### Family Canidae (Canids)

<i>Canis latrans</i>	Coyote
<i>Urocyon cinereoargenteus</i>	Gray Fox

##### Family Procyonidae (Procyonids)

<i>Bassariscus astutus</i>	Ringtail
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##### Family Mustelidae (Mustelids)

<i>Spilogale putorius</i>	Spotted Skunk
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#### ORDER ARTIODACTYLA Even-toed Ungulates

##### Family Cervidae (Cervids)

<i>Odocoileus hemionus</i>	Mule Deer
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##### Family Bovidae (Bovids)

<i>Ovis canadensis</i>	Mountain Sheep
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#### ORDER PERISSODACTYLA Odd-toed Ungulates

##### Family Equidae (Equids)

<i>Equus asinus</i>	Domestic Ass
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## Species Accounts

### Family Vespertilionidae

*Myotis yumanensis* (H. Allen)  
Yuma Myotis

This species occurs from southwestern British Columbia southward across the southwestern United States, except for the central Great Basin, into Mexico to the Distrito Federal and throughout Baja California.

*Myotis yumanensis yumanensis* (H. Allen)

The Yuma myotis ranges from western Nevada, extreme northwestern Colorado and central Utah, and from southern Colorado southward to Durango and most of Baja California (Hall, 1981).

Ruffner *et al.* (1978) reported that this bat was distributed widely along the Colorado River from Lee's Ferry to the Grand Wash Cliffs; they listed specimens from the vicinity of river mile 33 to 38 and from Havasu Creek. Suttkus *et al.* (1978) reported on specimens from river mile 41 and river mile 294.5, which is south of the Grand Wash Cliffs. Hoffmeister (1971) stated that these bats were common at Phantom Ranch and in Havasu Canyon. On 22 August 1981, we found several dozen *M. yumanensis* roosting on the tops of vegas in an old house at Lee's Ferry; both adult and young bats were present.

Specimens examined, 43.—Coconino County: Lee's Ferry, river mile 0, right bank, 7; River mile 19, left bank, 2; Buck Farm Canyon, river mile 41, right bank, 26; Cardenas Creek, river mile 71, left bank, 2; Lower Bass Camp, river mile 108.5, right bank, 1; Deer Creek Falls, river mile 136.2, left bank, 2; Backwater Camp, river mile 137.2, left bank, 1. Mohave County: Fern Glen Canyon, river mile 168, right bank, 1; Sand Point, river mile 294.5, left bank, 1.

*Myotis thysanodes* Miller  
Fringed Myotis

This bat occurs from southern British Columbia southward throughout the western and southwestern United States and into

Mexico to Chiapas. There is an isolated population in the Black Hills of South Dakota and adjacent parts of Wyoming and Nebraska.

*Myotis thysanodes thysanodes* Miller

This subspecies ranges from southern British Columbia and throughout the western and southwestern United States, as noted above, and in Mexico to Morelos (O'Farrell and Studier, 1980).

Only a single specimen of the fringed myotis has been obtained along the Colorado River in the bottom of the Grand Canyon (Suttkus *et al.*, 1978).

Specimens examined, 1.—Coconino County: River mile 19, left bank, 1.

*Myotis californicus* (Audubon and Bachman)  
California Myotis

The California myotis occurs from southwestern British Columbia southward across the western United States throughout Baja California and in Mexico to Chiapas. This species is absent from the central portion of the Great Basin.

*Myotis californicus stephensi* Dalquest

This form ranges from western Nevada and adjacent California into northern Baja California, southwestern Sonora, western Arizona, northwestern New Mexico, and into western Colorado and southeastern Utah (Hall, 1981).

Hoffmeister (1971) and Ruffner *et al.* (1978) considered this the most common myotis within the Grand Canyon. These bats were observed in a day roost near the mouth of Havasu Creek, and were found roosting in Stanton's Cave (Ruffner *et al.*, 1978). We found these animals especially common in the upper portion of the area studied.

Specimens examined, 80.—Coconino County: Lee's Ferry, river mile 0, right bank, 4; River mile 19, left bank, 22; River mile 26, left bank, 1; Buck Farm Canyon, river mile 41, right bank, 19; Cardenas Creek, river mile 71, left bank, 4; Boucher Creek, river mile 96.5, left bank, 4; Lower Bass Camp, river mile 108.5, right bank, 21; River mile 112, right bank, 1; Deer Creek Falls, river mile 136.2, left bank, 1; Backwater Camp, river mile 137.2, left bank, 3.

*Pipistrellus hesperus* (H. Allen)  
Western Pipistrelle

This species occurs from southeastern Washington and eastern Oregon southward through much of California and adjacent western Nevada, and from the Great Salt Lake through Utah and western Colorado throughout the Southwest to Baja California and in Mexico as far south as Morelos.

*Pipistrellus hesperus hesperus* (H. Allen)

This subspecies ranges throughout the Southwest, mostly west of the Arizona-New Mexico state line, and throughout Baja California and in western Mexico to Morelos (Hall, 1981).

The western pipistrelle is widely distributed all along the Colorado River in the bottom of the Grand Canyon. Hoffmeister (1971) and Ruffner *et al.* (1978) commented that these were the most common bats in the Grand Canyon. Frequently, these small bats were observed flying during the day over the river, especially in narrow

portions of the canyon.

Specimens examined, 87.—Coconino County: Lee's Ferry, river mile 0, right bank, 1; River mile 19, left bank, 7; Buck Farm Canyon, river mile 41, right bank, 16; Little Nankoweap, river mile 50, right bank, 3; Cardenas Creek, river mile 71, left bank, 6; Boucher Creek, river mile 96.5, left bank, 2; Lower Bass Camp, river mile 108.5, right bank, 9; Deer Creek Falls, river mile 136.2, left bank, 16; Overhang, river mile 137, left bank, 3; Backwater Camp, river mile 137.2, left bank, 7. Mohave County: River mile 183, right bank, 1; Granite Park, river mile 209, left bank, 9; Scorpion Island, river mile 279.5, left bank, 6; Sand Point, river mile 294.5, left bank, 1.

*Euderma maculatum* (J. A. Allen)  
Spotted Bat

This monotypic species ranges from south-central Montana and southern Idaho through Nevada and southeastern California to western Wyoming, Colorado, and New Mexico southward on the Mexican Plateau to Querétaro (Watkins, 1977).

Hoffmeister (1971) included the spotted bat in the list of mammals that may be present in the Grand Canyon National Park. Poché (1981) reported that these bats were fairly common in Fort Pierce Wash, which is on the Utah-Arizona border near the Nevada state line. A modern summary of the biology of the spotted bat was presented by Poché (1981).

On the morning of 19 June 1979, we captured a male *E. maculatum* in a mist net set across the upper end of a ravine at river mile 19, left bank. The animal was photographed and released; it flew up the ravine and disappeared apparently into a crevice in the cliffs above the ravine where it was captured. The elevation at river mile 19, left bank, is 912 m (2,990 ft.) according to Ruffner *et al.* (1978); Reynolds (1981) found a specimen of this bat at an elevation of 3,230 m (10,600 ft.). To our knowledge, this is the first record of *E. maculatum* in the bottom of the Grand Canyon along the Colorado River and in the Grand Canyon National Park. In addition, this may be the lowest elevation recorded for the spotted bat in this portion of its geographic range.

Specimens examined, 0.

*Plecotus townsendii* Cooper  
Townsend's Big-eared Bat

This species occurs from southern British Columbia throughout the western United States to Oaxaca. In addition, some populations occur in eastern Oklahoma, southwestern Missouri, and northwestern Arkansas, as well as in West Virginia and Virginia. In the East, the species is distributed in the vicinity of caves; in the West, these animals are more widespread in distribution.

*Plecotus townsendii pallescens* (Miller)

Townsend's big-eared bats range from southeastern British Columbia through central Washington, Oregon, and California throughout the Great Basin, Rocky Mountains, and western Great Plains southward to Sonora, much of Chihuahua, and southwestern Texas (Hall, 1981).

*Plecotus townsendii* is fairly common along the Colorado River in the Grand Canyon from river mile 19 to river mile 168. These animals were captured in mist nets at a total of eight places in the study area. The presence of a large colony of *P. townsendii* in Stanton Cave, river mile 31.8, right bank, was discussed by Ruff-

ner and Carothers (1975) and Suttikus *et al.*, (1978).

Specimens examined, 28.—Coconino County: River mile 19, left bank, 8; Stanton Cave, river mile 31.8, right bank, 5; Buck Farm Canyon, river mile 41, right bank, 2; Cardenas Creek, river mile 71, left bank, 4; Unkar Rapid, river mile 72, right bank, 2; Lower Bass Camp, river mile 108.5, right bank, 4; Backwater Camp, river mile 137.2, left bank, 1. Mohave County: Tuckup Canyon, river mile 164.5, right bank, 1; Fern Glen Canyon, river mile 168, right bank, 1.

*Idionycteris phyllotis* (G. M. Allen)

Allen's Big-eared Bat

This species occurs from southern Utah and Nevada southward mostly on the Mexican Plateau to the Distrito Federal, Mexico (Hall, 1981).

Hoffmeister (1971) included Allen's big-eared bat in the list of mammals that may be present in the Grand Canyon National Park. Ruffner and Carothers (1975) reported a male *I. phyllotis* taken at Shiva Temple, and another male taken at Basin Spring; both of these localities are within the Grand Canyon National Park.

On the morning of 26 August 1981, we obtained a male *I. phyllotis* from a mist net stretched across a small pool in Buck Farm Canyon, river mile 41, right bank. To our knowledge, this is the first specimen of this bat taken in the bottom of the Grand Canyon near the Colorado River.

Specimens examined, 1.—Coconino County: Buck Farm Canyon, river mile 41, right, bank, 1.

*Antrozous pallidus* (Le Conte)

Pallid Bat

This species occurs from southern British Columbia southward through Baja California, as well as across the Great Basin and on the Colorado Plateau, and southward in Mexico to Hidalgo.

*Antrozous pallidus pallidus* (Le Conte)

This form ranges throughout much of the Great Basin, the Colorado Plateau, southwestern part of the Great Plains, and to central Mexico (Hall, 1981).

Pallid bats are reported as being widely distributed in the Grand Canyon, especially in the northern portion (Hoffmeister, 1971, Ruffner *et al.*, 1978). However, Hoffmeister (1971) plotted only a single locality along the Colorado River for this species, Ruffner *et al.*, (1978) reported capturing these bats at four localities, and Suttikus *et al.* (1978) had specimens from two localities.

Specimens examined, 11.—Coconino County: Lee's Ferry, river mile 0, right bank, 5; River mile 19, left bank, 3; Buck Farm Canyon, river mile 41, right bank, 3.

**Family Molossidae**

*Tadarida brasiliensis* (I. Geoff. St.-Hilaire)

Brazilian Free-tailed Bat

Brazilian free-tailed bats occur throughout about the southern one-half of the United States, the West Indies, Central America except for the Yucatan Peninsula, and much of South America.

*Tadarida brasiliensis mexicana* (Saussure)

This subspecies ranges from about the Missouri River throughout the western United States southward in Mexico to Chiapas (Hall, 1981).

Hoffmeister (1971) postulated that this species probably occurred in many areas in the bottom of the Grand Canyon. Ruffner *et al.* (1978) reported on specimens from five places in the Inner Gorge, all along the left bank of the Colorado River. Bat Cave, river mile 266, was mined commercially for guano for several years; the guano deposits were made probably by Brazilian free-tailed bats. Suttikus *et al.* (1978) reported that no bats were present in this cave when they visited it on 8 September 1976.

Specimens examined, 2.—Coconino County: Lee's Ferry, river mile 0, right bank, 1; Lower Bass Camp, river mile 108.5, right bank, 1.

**Family Leporidae**

*Sylvilagus audubonii* (Baird)

Desert Cottontail

The desert cottontail occurs from central Montana, Wyoming, and adjacent North Dakota, South Dakota, and Nebraska westward to the Pacific Coast and southward throughout Baja California and in Mexico as far as central Veracruz and Puebla.

*Sylvilagus audubonii arizonae* (J. A. Allen)

This form ranges from southern Nevada and adjacent western Utah to southeastern California and western Arizona through most of Sonora (Chapman and Willner, 1978).

Hoffmeister (1971) reported the desert cottontail as being abundant on the South Rim of the Grand Canyon, but no specimens were available from along the Colorado River in the bottom of the canyon. Ruffner *et al.* (1978) suggested that *S. audubonii* may enter the Inner Gorge of the Grand Canyon. On 9-10 June 1980, several animals were seen and collected during the day on Scorpion Island.

Specimens examined, 4.—Mohave County: Scorpion Island, river mile 279.5, left bank, 4.

*Lepus californicus* Gray

Black-tailed Jack Rabbit

Except for part of the Central Valley, this species occurs throughout California and across the Great Basin from southern Washington and southwestern Montana southward throughout Baja California, and in the Great Plains from southern South Dakota into Mexico to Hidalgo.

*Lepus californicus deserticola* Mearns

This subspecies ranges from southwestern Montana and southern Idaho through most of Nevada and adjacent western Utah southward through western Arizona and southeastern California into northern Baja California and Sonora (Hall, 1981).

We observed black-tailed jack rabbits in the vicinity of Lee's Ferry and on Scorpion Island. Because of its preference for open, brushy country, it seems that there are few suitable habitats for this species within the Grand Canyon. Hoffmeister (1971) reported *L. californicus* as common on the South Rim and uncommon on

the North Rim of the Grand Canyon. Ruffner *et al.* (1978) suggested that this hare may enter the Inner Gorge on occasion.

Specimens examined, 0.

### Family Sciuridae

#### *Eutamias dorsalis* (Baird) Cliff Chipmunk

Cliff chipmunks are known from extreme southern Idaho, southwestern Wyoming, northwestern Colorado, across much of Utah and eastern Nevada southward across Arizona and western New Mexico to eastern Sonora, western Chihuahua, and into northern Durango. An apparent isolated population occurs along the coast in central Sonora.

#### *Eutamias dorsalis dorsalis* (Baird)

This form occurs in central Arizona, western New Mexico, and in eastern Sonora and western Chihuahua into northern Durango (Hall, 1981).

According to Hoffmeister (1971), these animals "... are found not only along the edge of the South Rim but also down in the canyon, as at Indian Garden and Havasu Canyon." Ruffner *et al.* (1978) were unaware of any specimens from the inner gorge of the Grand Canyon, but they reported sight records from about five places on the left bank between river mile 27 and river mile 186. During our studies along the Colorado River, we have seen cliff chipmunks several times in the vicinity of river mile 19, left bank. On 24 August 1981, an animal was trapped at this locality; another chipmunk was taken on 20 June 1982. To our knowledge, these are the first specimens of *E. dorsalis* from the bottom of the grand Canyon along the Colorado River.

Specimens examined, 2.—Coconino County: River mile 19, left bank, 2.

#### *Ammospermophilus harrisi* (Audubon and Bachman) Harris' Antelope Squirrel

Harris' antelope squirrel occurs throughout southern Arizona, the southwestern corner of New Mexico, and northern Sonora. Throughout its range, this animal seems relatively wary and difficult to observe closely, as compared with other ground squirrels.

#### *Ammospermophilus harrisi harrisi* (Audubon and Bachman)

This form is found in south-central Arizona, the southwestern corner of New Mexico, and north-central Sonora (Hall, 1981).

This species has not been recorded from within the Grand Canyon (Hoffmeister, 1971), but it does occur along the east side of the lower Colorado River (Suttkus *et al.*, 1978); Cockrum (1960) examined specimens from 4 mi SW Pierce Ferry. We found this antelope squirrel fairly abundant on Scorpion Island, river mile 279.5, left bank. This island, which was formed by the filling of Mead Reservoir, is just upriver from Pierce Ferry (sometimes referred to as Pierce Landing).

Specimens examined, 10.—Mohave County: Scorpion Island, river mile 279.5, left bank, 10.

#### *Ammospermophilus leucurus* (Merriam) White-tailed Antelope Squirrel

The white-tailed antelope squirrel ranges from southeastern

Oregon and southwestern Idaho southward through Baja California, and occurs in the deserts of the Great Basin and on the Colorado Plateau in Nevada, Utah, western Colorado, northern Arizona, and northwestern New Mexico. A rather typical habitat seems to be rocks at the edges of sandy grasslands.

#### *Ammospermophilus leucurus escalante* (Hansen)

This form occurs in the northern Arizona Strip and adjacent southwestern Utah (Hall, 1981).

Hoffmeister (1971) considered that this species was primarily, but not exclusively, restricted to the Inner Gorge and the Grand Canyon proper. Ruffner, *et al.* (1978) referred to specimens taken at river mile 52-56, right bank, 66-71, left bank, 168, right bank, and 185.5-188, right bank. Mead and Phillips (1981) stated that this squirrel was found throughout the Grand Canyon. We were successful in obtaining specimens at only two localities along the Colorado River. Cockrum (1960) referred specimens from "N side Colorado R., Lees Ferry (Lee Ferry)" to *A. l. cinnamomeus*. We agree with the comment by Armstrong (1979a) that "... populations of antelope ground squirrels do not seem as distinctive as current nomenclature might lead one to imagine."

Specimens examined, 106.—Coconino County: Lee's Ferry, river mile 0, right bank, 105; River mile 21.8, right bank, 1.

#### *Spermophilus variegatus* (Erxleben) Rock Squirrel

Rock squirrels range from Utah, Colorado, and southeastern Nevada southward to Puebla. It seems that these animals are associated usually with colluvial rubble in semiarid foothills and mountains.

#### *Spermophilus variegatus grammurus* (Say)

This subspecies occurs in southern Utah and adjacent Colorado southward through Arizona and New Mexico into Sonora and Chihuahua (Hall, 1981).

These animals occur along the Colorado River above the Nevada-Arizona state line (Cockrum, 1960, Hoffmeister, 1971). According to Ruffner *et al.* (1978), rock squirrels are especially common at Havasu Creek. We spotted these animals frequently in the vicinity of river mile 19, left bank.

Specimens examined, 4.—Coconino County: River mile 19, left bank, 2; Granite Rapid, river mile 93.5, left bank, 1; Elves Chasm, river mile 116, left bank, 1.

#### *Spermophilus variegatus utah* (Merriam)

This form is found in central and southwestern Utah, the Arizona Strip, and in southern Nevada (Hall, 1981).

Ruffner *et al.* (1978) reported specimens from the vicinity of river mile 31.5-35 and at Phantom Ranch, river mile 88. Except for Phantom Ranch, where these animals were seen frequently, rock squirrels seemed less common on the right bank than on the other side of the Colorado River. The difficulties of identifying to subspecies rock squirrels from each side of the Colorado River were mentioned by Hoffmeister (1971), Armstrong (1979a), and Hall (1981).

Specimens examined, 2.—Coconino County: House Rock, river mile 17, right bank, 1. Mohave County: River mile 165, right bank, 1.

### Family Heteromyidae

#### *Perognathus amplus* Osgood Arizona Pocket Mouse

*Perognathus amplus* is confined to north-central Arizona, an area adjacent to the Nevada-Arizona border, and south-central Arizona, as well as in northwestern Sonora.

#### *Perognathus amplus pergracilis* Goldman

This subspecies is found in west-central Arizona, along the Nevada-Arizona border (Hall, 1981).

Hoffmeister (1971) did not record this species from within the Grand Canyon. Cockrum (1960) reported on a series of specimens that were collected near Pierce Landing, Arizona, in 1942. The current distribution and status of this subspecies in west-central Arizona seems unclear, especially since the filling of Mead Reservoir.

Specimens examined, 2.—Mohave County: Scorpion Island, river mile 279.5, left bank, 2.

#### *Perognathus formosus* Merriam Long-tailed Pocket Mouse

This species occurs in the Great Basin from the Great Salt Lake and northwestern Nevada southward along the west side of the Colorado River into northern Baja California.

#### *Perognathus formosus domisaxensis* Cockrum

This pocket mouse ranges from southern Utah to northern Arizona north of the Colorado River (Hall, 1981).

Since Cockrum (1956) described this form, a considerable amount of information has become known about the distribution of long-tailed pocket mice in the Grand Canyon in particular and in northwestern Arizona in general (Hoffmeister, 1971, Ruffner *et al.* 1978, Suttikus *et al.* 1978, Hall, 1981). It was our impression that these animals were not at all common in the area studied.

Specimens examined, 2.—Coconino County: Lee's Ferry, river mile 0, right bank, 1; 3.9 miles N Marble Canyon, river mile 2, right bank, 1.

#### *Perognathus formosus melanocaudus* Cockrum

This subspecies occurs in the southern part of the Arizona Strip along the north side of the Colorado River (Hall, 1981).

Ruffner *et al.* (1978) reported specimens from about 12 localities in the bottom of the Grand Canyon. We found these mice most commonly at Unkar Rapid, river mile 72, right bank. See the comments above about the distribution of long-tailed pocket mice in the Grand Canyon. To our eyes these populations of *P. formosus* do not seem as distinctive as current nomenclature leads us to imagine.

Specimens examined, 35.—Coconino County: Buck Farm Canyon, river mile 41, right bank, 4; Little Nankoweap, river mile 50, right bank, 3; Cardenas Creek, river mile 71, right bank, 7; Unkar Rapid, river 72, right bank, 20; Fishtail Canyon, river mile 139, right bank, 1.

#### *Perognathus intermedius* Merriam Rock Pocket Mouse

*Perognathus intermedius* occurs in south-central Utah, central New Mexico, and southward into Sonora and Chihuahua.

#### *Perognathus intermedius crinitus* Benson

This form ranges from southern Utah into northwestern Arizona almost to the Nevada-Arizona border south of the Colorado River (Hall, 1981).

All of our records of the rock pocket mouse are from below the confluence of the Little Colorado River with the Colorado River. Ruffner *et al.* (1978) reported specimens from two localities above the Little Colorado River, and from 16 places along the lower portion of the Colorado River. We found these animals especially common at Cardenas Creek, river mile 71, left bank, where they were trapped mostly among sand dunes. Specimens from our southernmost localities should be examined more closely in connection with the determination of subspecific affiliations.

Specimens examined, 232.—Coconino County: Lava Canyon, river mile 65, left bank, 2; Tanner Rapid, river mile 68, left bank, 1; Cardenas Creek, river mile 71, left bank, 87; Boucher Creek, river mile 96.5, left bank, 6; River mile 119.5, left bank, 1; Deer Creek Falls, river mile 136.2, left bank, 30; Overhang, river mile 137, left bank, 9; Backwater Camp, river mile 137.2, left bank, 3; National Canyon, river mile 166.5, left bank, 1; Mohawk Canyon, river mile 171.5, left bank, 1; River mile 196, left bank, 3; Granite Park, river mile 209, left bank, 26. Mohave County: Bridge Canyon dam site, river mile 238, left bank, 51; Scorpion Island, river mile 279.5, left bank, 10; Sand Point, river mile 294.5, left bank, 1.

#### *Dipodomys merriami* Mearns Merriam's Kangaroo Rat

Merriam's Kangaroo rat ranges from western Nevada and adjacent southeastern California across southern Arizona and New Mexico southward into Baja California, Sonora, and central Mexico to San Luis Potosi.

#### *Dipodomys merriami merriami* Mearns

This subspecies occurs in western Nevada, adjacent southeastern California, southern Arizona, and into northwestern Sonora (Hall, 1981).

*Dipodomys merriami* was not reported from the Grand Canyon National Park by Hoffmeister (1971), who discussed some reasons why these kangaroo rats probably do not occur in the area. Ruffner *et al.* (1978) listed records from Grapevine Wash, river mile 274, left bank. On Scorpion Island, river mile 279.5, left bank, this kangaroo rat was the most common mammal that we encountered.

Specimens examined, 65.—Mohave County: Scorpion Island, river mile 279.5, left bank, 62; Sand Point, river 294.5, left bank, 3.

### Family Castoridae

#### *Castor canadensis* Kuhl Beaver

Beavers are known from throughout most of the United States and Canada, except for parts of the arid Southwest, the southern Great Basin, and the peninsula of Florida. These mammals are restricted to areas with constant water supplies. Beavers were extirpated from many areas of their natural range by fur trappers. Since 1900, some of these regions have been restocked with animals not always of the same subspecies that had been extirpated.

*Castor canadensis repentinus* Goldman

This form occurs in the Colorado River drainage from the Tavaputs Plateau in Utah southward to the mouth of the Colorado River in the Sea of Cortez (Jenkins and Busher, 1979).

Ruffner *et al.* (1978) made a census of beavers by counting bank burrows along the Colorado River from Nankoweap Canyon to Kwagunt Creek; four burrows were observed in this 3-mile section of the river. Durrant and Dean (1959) estimated 10 active dens per river mile in Glen Canyon. Brazell *et al.* (1977) reported a total of 105 dens, 64 of them active, in Canyonlands National Park, Utah.

Beavers and their fresh signs have been seen by us from Lee's Ferry, river mile 0, to the vicinity of Fern Glen Canyon, river mile 168. Additional sightings of beavers in tributaries of the Colorado River were at Bright Angel Creek (Hoffmeister, 1971), Paria River (Suttkus *et al.*, 1978), and Little Colorado River (Ruffner *et al.*, 1978). The post-dam development of extensive riparian habitat may have led to an expansion of beaver populations in the Grand Canyon (Carothers *et al.*, 1979). Brazell *et al.* (1977) reported that willows and cottonwoods were utilized extensively for food by beavers along the Green River and the Colorado River in Canyonlands National Park; tamarisk was not used by beavers in this area.

Specimens examined, 0.

**Family Cricetidae***Reithrodontomys megalotis* (Baird)

## Western Harvest Mouse

This species inhabits grasslands and shrublands in North America from British Columbia and Alberta to Oaxaca and from Indiana to California.

*Reithrodontomys megalotis megalotis* (Baird)

This subspecies ranges from British Columbia throughout most of the Great Basin and the arid Southwest, and in Mexico to Guanajuato (Hall, 1981).

Hoffmeister (1971) referred to two localities in the bottom of the Grand Canyon for the western harvest mouse. This species was not common adjacent to the Grand Canyon in the Arizona Strip (Hoffmeister and Durham, 1971). Ruffner *et al.* (1978) reported specimens from four places along the right bank of the Colorado River. In the bottom of the Grand Canyon, these mice seemingly require rather mesic areas with dense ground cover (Ruffner *et al.*, 1978, Suttkus *et al.*, 1978).

Specimens examined, 3.—Coconino County: Buck Farm Canyon, river mile 41, right bank, 3.

*Peromyscus eremicus* (Baird)

## Cactus Mouse

This species ranges from southern Nevada and adjacent southwestern Utah southward throughout most of Baja California and to Sinaloa and San Luis Potosi.

*Peromyscus eremicus eremicus* (Baird)

This form occurs from southern Nevada southward into Baja California and northern Sonora, as well as on the Mexican Plateau to Durango (Veal and Caire, 1979).

Durrant and Dean (1959) did not collect these mice in Glen Can-

yon. Merriam (1890) found that this species was the most common mammal in the Grand Canyon. Hoffmeister (1971) and Suttkus *et al.* (1978) reported that the cactus mouse was the most ubiquitous *Peromyscus* that they encountered. This species was collected from nearly every available habitat in the Arizona Strip (Hoffmeister and Durham, 1971). Ruffner *et al.* (1978) reported specimens from a total of 61 localities in the Inner Gorge, and thought that the cactus mouse was the most widely distributed and the most abundant mammal there.

Specimens examined, 898.—Coconino County: Lee's Ferry, river mile 0, right bank, 5; River mile 19, left bank, 77; River mile 22, left bank, 14; River mile 26, left bank, 2; Buck Farm Canyon, river mile 41, right bank, 61; President Harding Rapid, river mile 44, left bank, 2; Little Nankoweap, river mile 50, right bank, 7; Kwagunt Creek, river mile 56, right bank, 6; Kwagunt Rapid, river mile 56.5, left bank 12; Lava Canyon, river mile 65.5, left bank, 14; Tanner Rapid, river mile 68, left bank, 8; Cardenas Creek, river mile 71, left bank, 99; Cardenas Creek, river mile 71, right bank, 11; Unkar Rapid, river mile 72, right bank, 49; Boucher Creek, river mile 96.5, left bank, 26; Crystal Creek, river mile 98.2, right bank, 2; Tuna Creek, river mile 99.3, left bank, 5; Lower Bass Camp, river mile 108.5, right bank, 132; River mile 114, right bank, 4; River mile 119.5, left bank, 6; River mile 124, left bank, 2; Stone Creek, river mile 132, right bank, 5; Deer Creek Falls, river mile 136.2, left bank, 38; Overhang, river mile 137, left bank, 34; Backwater Camp, river mile 137.2, left bank, 35; Fishtail Canyon, river mile 139, right bank, 3. Mohave County: Tuckup Canyon, river mile 164.5, right bank, 17; National Canyon, river mile 166.5, left bank, 6; Fern Glen Canyon, river mile 168, right bank, 133; Mohawk Canyon, river mile 171.5, left bank, 4; Lava Falls Rapid, river mile 182, right bank, 7; River mile 183, right bank, 2; Whitmore Wash, river mile 188, right bank, 6; River mile 196, left bank, 4; Granite Park, river mile 209, left bank, 22; River mile 212.5, left bank, 2; 220 Mile Canyon, river mile 220, right bank, 5; Bridge Canyon dam site, river mile 238, left bank, 20; Scorpion Island, river mile 279.5, left bank, 4; Sand Point, river mile 294.5, left bank, 6.

*Peromyscus maniculatus* (Wagner)

## Deer Mouse

The deer mouse ranges throughout nearly all of North America; it is absent only in Alaska, northern Canada, and the southeastern United States. This species is one of the most ubiquitous rodents in North America.

*Peromyscus maniculatus rufinus* (Merriam)

This subspecies occurs in the southern Rocky Mountains and on the Colorado Plateau from north-central Colorado to southern New Mexico and Arizona (Hall, 1981).

Hoffmeister (1971) reported that these mice were especially uncommon in the bottom of the Grand Canyon; he listed specimens from three localities along the Colorado River. Ruffner *et al.* (1978) reported specimens from eight localities on the right bank and from five places on the left side of the river. In the Arizona Strip (Hoffmeister and Durham, 1971) and in Canyonlands National Park (Armstrong, 1979a), *P. maniculatus* was found mostly in areas disturbed by man. Ruffner *et al.* (1978) postulated that numbers of these mice may have increased in the Inner Gorge of the Grand Canyon since the closing of Glen Canyon Dam and the

corresponding changes in vegetation along the Colorado River.

Specimens examined, 23.—Coconino County: Lee's Ferry, river mile 0, right bank, 7; Buck Farm Canyon, river mile 41, right bank, 6; Lava Canyon, river mile 65.5, left bank, 2; Tanner Rapid, river mile 68, left bank, 1; Cardenas Creek, river mile 71, left bank, 3; Cardenas Creek, river mile 71, right bank, 1; Unkar Rapid river mile 72, right bank, 1; Boucher Creek, river mile 96.5, left bank, 2.

*Peromyscus crinitus* (Merriam)  
Canyon Mouse

*Peromyscus crinitus* occurs from southeastern Oregon and adjacent Idaho southward through Nevada, eastern California, parts of Utah and western Colorado, northwestern New Mexico, northern and western Arizona, and into northwestern Mexico.

*Peromyscus crinitus stephensi* Mearns

This form ranges from southern Utah across southern Nevada, southern California, adjacent western Arizona, and into northern Mexico (Hall, 1981).

Canyon mice occur all along the Inner Gorge of the Grand Canyon wherever there is suitable habitat (Hoffmeister, 1971, Hoffmeister and Durham, 1971). Ruffner *et al.* (1978) recorded this species from a total of 47 localities along the Colorado River. Hoffmeister (1971) correlated the distribution of canyon mice in the Grand Canyon with the presence of seed producing plants on rocky slopes. Also, he discussed some possible effects of food materials provided by man on the distribution and abundance of this species, especially in the vicinity of Phantom Ranch. Suttkus *et al.* (1978) found this *Peromyscus* especially abundant at Buck Farm Canyon, river mile 41, right bank. In addition, they mentioned some possible effects of geologic catastrophe on a population of canyon mice. Armstrong (1979a) thought that this species might be the most abundant mammal along the Colorado River in Canyonlands National Park.

Specimens examined, 370.—Coconino County: Lee's Ferry, river mile 0, right bank, 3; House Rock, river mile 17, right bank, 6; River mile 19, left bank, 22; River mile 22, left bank, 5; Buck Farm Canyon, river mile 41, right bank, 146; Little Nankoweap, river mile 50, right bank, 4; Kwagunt Creek, river mile 56, right bank, 2; Cardenas Creek, river mile 71, left bank, 1; Unkar Rapid, river mile 72, right bank, 7; Boucher Creek, river mile 96.5, left bank, 5; Crystal Creek, river mile 98.2, right bank, 1; Lower Bass Camp, river mile 108.5, right bank, 36; River mile 109.5, right bank, 3; River mile 114, right bank, 4; Stone Creek, river mile 132, right bank, 3; Deer Creek Falls, river mile 136.2, left bank, 10; Overhang, river mile 137, left bank, 11; Backwater Camp, river mile 137.2, left bank, 5; Fishtail Canyon, river mile 139, right bank, 1; River mile 151.5, right bank, 2. Mohave County: Tuckup Canyon, river mile 164.5, right bank, 14; Fern Glen Canyon, river mile 168, right bank, 62; Lava Falls Rapid, river mile 182, right bank, 3; River mile 183, right bank, 1; Whitmore Wash, river mile 188, right bank, 4; 220 Mile Canyon, river mile 220, right bank, 4; Bridge Canyon dam site, river mile 238, left bank, 4.

*Peromyscus boylii* (Baird)  
Brush Mouse

The brush mouse occurs in the southwestern United States from

northern California and Utah southward into northern Baja California and to Honduras and El Salvador.

*Peromyscus boylii rowleyi* (J. A. Allen)

This form ranges from the Colorado Plateau and the southwestern part of the Great Plains southward to Zacatecas in central Mexico (Hall, 1981).

*Peromyscus boylii* was reported from throughout the Grand Canyon National Park (Hoffmeister, 1971), and from along the Colorado River in the bottom of the Grand Canyon (Hoffmeister and Durham, 1971, Ruffner *et al.*, 1978, Suttkus *et al.*, 1978). Although brush mice were widely distributed in our study area, they were not very common at any of the localities where we encountered them.

Specimens examined, 100.—Coconino County: Lee's Ferry, river mile 0, right bank, 1; River mile 19, left bank, 25; Buck Farm Canyon, river mile 41, right bank, 45; Little Nankoweap, river mile 50, right bank, 2; Cardenas Creek, river mile 71, left bank, 2; Unkar Rapid, river mile 72, right bank, 4; Boucher Creek, river mile 96.5, left bank, 1; River mile 109.5, right bank, 9; Deer Creek Falls, river mile 136.2, left bank, 2. Mohave County: Tuckup Canyon, river mile 164.5, right bank, 1; Fern Glen Canyon, river mile 168, right bank, 4; Granite Park, river mile 209, left bank, 3.

*Peromyscus truei* (Schufeldt)  
Pinon Mouse

The species occurs from central Oregon and southern Wyoming to eastern Colorado and western Texas throughout much of the southwestern United States into Baja California and as far as Oaxaca. These mice are associated with rocky habitats, and usually with pinon and juniper.

*Peromyscus truei truei* (Schufeldt)

This form ranges from southern Oregon, eastern California, and western Nevada across Arizona and New Mexico and into Colorado and adjacent eastern Utah (Hoffmeister, 1981).

The pinon mouse was not reported from within the Inner Gorge of the Grand Canyon by Hoffmeister (1971), who found it elsewhere in the area. Ruffner *et al.* (1978) listed two specimens from Cove Canyon, river mile 174, right bank. We found this species at three localities along the Colorado River.

Specimens examined, 3.—Coconino County: Lee's Ferry, river mile 0, right bank, 1; Buck Farm Canyon, river mile 41, right bank, 1. Mohave County: Tuckup Canyon, river mile 164.5, right bank, 1.

*Neotoma albigula* Hartley  
White-throated Woodrat

This species occurs from southern Utah and Colorado into central Texas and southward to Puebla in central Mexico.

*Neotoma albigula albigula* Hartley

This woodrat ranges throughout south-central Arizona, New Mexico, and west Texas into parts of Sonora and Chihuahua (Hall, 1981).

Hoffmeister (1971) provided few records (south of the Colorado River) for *N. albigula* in the bottom of the Grand Canyon. Suttkus *et al.* (1978) found this animal at only two localities along the left bank of the Colorado River. Ruffner *et al.* (1978) listed the species

from three places on the right bank and from two localities on the left bank of the Colorado River. We encountered white-throated woodrats only on the left side of the river.

Specimens examined, 27.—Coconino County: Lava Canyon, river mile 65.5, left bank, 1; Tanner Rapid, river mile 68, left bank, 2; Cardenas Creek, river mile 71, left bank, 24.

*Neotoma lepida* Thomas  
Desert Woodrat

*Neotoma lepida* ranges from southeastern Oregon and adjacent Idaho southward across the Great Basin and throughout Baja California.

*Neotoma lepida monstrabilis* Goldman

This form occurs in southwestern Utah and in Arizona north of the Colorado River (Hall, 1981).

Hoffmeister and Durham (1971) found these animals in almost every habitat throughout the Arizona Strip. Ruffner *et al.* (1978) reported on specimens taken from 17 localities along the Colorado River. We captured this woodrat most frequently at Buck Farm Canyon, river mile 41, right bank, and at Lower Bass Camp, river mile 108.5, right bank.

Specimens examined, 70.—Coconino County: Lee's Ferry, river mile 0, river bank, 6; Buck Farm Canyon, river mile 41, right bank, 14; Little Nankoweap, river mile 50, right bank, 3; Kwagunt Creek, river mile 56, right bank, 2; Cardenas Creek, river mile 71, right bank, 9; Unkar Rapid, river mile 72, right bank, 4; Crystal Creek, river mile 98.2, right bank, 2; Lower Bass Camp, river mile 108.4, right bank, 16; River mile 109.5, right bank, 1; River mile 112, right bank, 1; River mile 114, right bank, 1; Fishtail Canyon, river mile 139, right bank, 1. Mohave County: Tuckup Canyon, river mile 164.5, right bank, 1; Fern Glen Canyon, river mile 168, right bank, 7; Whitmore Wash, river mile 188, right bank, 1.

*Neotoma devia* Goldman  
Arizona Woodrat

This species occurs in western Arizona south and east of the Colorado River (Mascarello, 1978).

Ruffner *et al.* (1978) listed specimens (identified as *N. lepida*) taken at 14 places along the Colorado River. Suttkus *et al.* (1978) found these animals (also reported as *N. lepida*) abundant at Bridge Canyon dam site, river mile 238, left bank.

Specimens examined, 51.—Coconino County: River mile 19, left bank, 3; River mile 22, left bank, 3; Kwagunt Rapid, river mile 56.5, left bank, 1; Lava Canyon, river mile 65.5, left bank, 1; Tanner Rapid, river mile 68, left bank, 1; Cardenas Creek, river mile 71, left bank, 2; Boucher Creek, river mile 96.5, left bank, 3; Tuna Creek, river mile 99.3, left bank, 2; River mile 119.5, left bank, 2; River mile 124, left bank, 1; Deer Creek Falls, river mile 136.2, left bank, 6; Overhang, river mile 137, left bank, 1. Mohave County: Mohawk Canyon, river mile 171.5, left bank, 2; River mile 196, left bank, 2; Bridge Canyon dam site, river mile 238, left bank, 19; Scorpion Island, river mile 279.5, left bank, 1; Sand Point, river mile 294.5, left bank, 1.

**Family Canidae**

*Canis latrans* Say  
Coyote

The coyote occurs from eastern Alaska southward across western Canada and the United States (except for part of the eastern and southeastern United States) throughout Central America to Costa Rica. This is one of the more ubiquitous carnivores of the continent.

*Canis latrans mearnsi* Merriam

This form ranges in southern Nevada and adjacent southeastern California across southern Utah and southwestern Colorado, Arizona, and western New Mexico into much of Sonora and Chihuahua (Bekoff, 1977).

Hoffmeister (1971) stated that this species occurred throughout the Grand Canyon National Park, but was more abundant above the Inner Gorge. Ruffner *et al.* (1978) reported the coyote as present throughout the Inner Gorge, but was most common below Separation Canyon, river mile 240, right bank. Also, they indicated that these animals were observed most commonly as singles or in groups of 2 or 3 above this area, but they were seen in groups of 5 to 10 animals below this part of the Colorado River. In addition, Ruffner *et al.* (1978) saw a coyote swim across the Colorado River at river mile 260. Hoffmeister and Durham (1971) reported that *C. latrans* was present nearly everywhere in the Arizona Strip. We saw a coyote near the shore of Mead Reservoir at river mile 277, right bank.

Specimens examined, 0.

*Urocyon cinereoargenteus* (Schreber)  
Gray Fox

Except for the northern Great Basin, northern Rocky Mountains, the northern Cascades, and the western part of the Great Plains, the gray fox occurs throughout the United States southward into Mexico and much of Latin America.

*Urocyon cinereoargenteus scottii* Mearns

This subspecies ranges from southern Nevada and adjacent southeastern California across much of Utah and Colorado southward across western Texas and into Mexico to central Veracruz (Hall, 1981).

Hoffmeister (1971) reported that the gray fox occurs throughout the Grand Canyon National Park. The species was found to be present in most of the Arizona Strip (Hoffmeister and Durham, 1971). Cockrum (1960) reported specimens from Havasu Creek and Kanab Creek. Ruffner *et al.* (1978) provided sight records from the vicinity of river mile 164, right bank, and near river mile 209, left bank. We have seen gray foxes at Lee's Ferry, river mile 0, right bank, and at river mile 51, right bank.

Specimens examined, 0.

**Family Procyonidae**

*Bassariscus astutus* (Lichtenstein)  
Ringtail

The ringtail occurs from southwestern Oregon, parts of California, southeastern Nevada, parts of Utah and Colorado across the southern Great Plains to Arkansas and Louisiana, and southward

throughout Baja California and in Mexico to Oaxaca.

*Bassariscus astutus arizonensis* Goldman

This form ranges from eastern Utah and western Colorado through most of Arizona south of the Colorado River, and in adjacent western New Mexico (Hall, 1981).

Hoffmeister (1971) found that the species was abundant in the Grand Canyon. Ruffner *et al.* (1978) reported sight records from eight places along the left bank of the Colorado River. Suttkus *et al.* (1978) commented on the abundance of these animals at Overhang, river mile 137, left bank.

Specimens examined, 4.—Coconino County: Overhang, river mile 137, left bank, 2; Backwater Camp, river mile 137.2, left bank, 2.

*Bassariscus astutus nevadensis* Miller

This subspecies occurs in western Utah and adjacent southeastern Nevada into Arizona north of the Colorado River (Hall, 1981).

Hoffmeister and Durham (1971) reported that ringtails were not common in the Arizona Strip. Ruffner *et al.* (1978) listed sight records from eight places along the right bank of the Colorado River, and reported a specimen from the vicinity of river mile 31.5-35, right bank. It was our impression that *B. astutus* was less common and not as easily observed on the right side of the river as on the opposite bank. The subspecific differentiation of ringtails on either side of the Colorado River has not been completely demonstrated (Hoffmeister, 1971).

An interesting summary of Late Holocene diets of *Bassariscus* in the Grand Canyon was presented by Mead and Van Devender (1981). These data provide an indication of the past distribution and abundance of ringtails in the area, as well as a means for the reconstruction of the local faunal community.

Specimens examined, 2.—Coconino County: Lower Bass Camp, river mile 108.5, right bank, 1; River mile 109.5, right bank, 1.

**Family Mustelidae**

*Spilogale putorius* (Linnaeus)

Spotted Skunk

The spotted skunk ranges from southwestern British Columbia and northern Minnesota southward throughout the western, central, and southeastern United States, throughout Baja California, and south as far as Costa Rica.

*Spilogale putorius gracilis* Merriam

This subspecies occurs throughout the Great Basin, from southeastern Washington to central Arizona and New Mexico, and from eastern California to eastern Colorado (Hall, 1981).

Hoffmeister (1971) wrote that "Spotted skunks are the commonest carnivores within the canyon . . ." Ruffner *et al.* (1978) reported these animals from throughout the area from Lee's Ferry to the Grand Wash Cliffs. Suttkus *et al.* (1978) saw these skunks feeding on *Peromyscus* and interacting with ringtails at Overhang, river mile 137, left bank. On two occasions we caught spotted skunks in rat traps set for *Neotoma*. Hoffmeister (1971) listed *S. p. gracilis* as occurring on the north side of the Colorado River and *S. p. leucoparia* as the subspecies on the south side of the river. Hall (1981) drew the line between these two forms in central

Arizona.

Specimens examined, 8.—Coconino County: Lower Bass Camp, river mile 108.5, right bank, 3; Deer Creek Falls, river mile 136.2, left bank, 1; Overhang, river mile 137, left bank, 2; Backwater Camp, river mile 137.2, left bank, 2.

**Family Cervidae**

*Odocoileus hemionus* (Rafinesque)

Mule Deer

This species ranges in western North America from the southern Yukon and Mackenzie Territories, along the Pacific Coast on the west and to Minnesota and Iowa on the east, and southward in Mexico throughout Baja California and to central Tamaulipas.

*Odocoileus hemionus hemionus* (Rafinesque)

This form occurs from the southern Yukon and Mackenzie Territories southward to central Arizona and New Mexico (Hall, 1981).

Hoffmeister and Durham (1971) found mule deer present throughout most of the Arizona Strip, mostly in the pinon-juniper and ponderosa pine habitats. Ruffner *et al.* (1978) recorded this species as common in the Inner Gorge of the Grand Canyon from Lee's Ferry to Phantom Ranch. Suttkus *et al.* (1978) listed observations of mule deer from three places on the right bank (river mile 36.5-54) and three localities on the left bank (river mile 51.5-58.7) on the Colorado River. In addition, on 3 June 1980, we saw a mule deer drink on the right bank of the Colorado River, river mile 51, then swim across to the opposite bank; it is noteworthy that the water level of the river was very high at this time.

Specimens examined, 0.

**Family Bovidae**

*Ovis canadensis* Shaw

Mountain Sheep

*Ovis canadensis* ranges from British Columbia and adjacent Alberta southward into Baja California and northern Mexico.

*Ovis canadensis nelsoni* Merriam

This form occurs in southern Nevada, southern California, and adjacent northwestern Arizona (Hall, 1981).

Hoffmeister (1971) and Ruffner *et al.* (1978) reported on observations of mountain sheep from throughout the Inner Gorge of the Grand Canyon from river mile 76 to river mile 225. Guse (1974) and Berger (1977) provided additional information on the distribution and status of this species in the Grand Canyon. These animals apparently are more common on the south side of the Colorado River than on the north bank. We have seen mountain sheep at seven places on the left bank and at four localities on the right side of the Colorado River.

Specimens examined, 1.—Coconino County: Tuna Creek, river mile 99.3, left bank, 1.

### Family Equidae

*Equus asinus* Linnaeus  
Domestic Ass

This is the ancestor of the domestic ass, or burro, which is sometimes referred to as *Equus africanus* (Fitzinger). The present geographic range, as well as comments on the nomenclature, of this form are presented by Corbet (1978).

The history of this species in the Grand Canyon National Park was discussed by Hoffmeister (1971). The distribution of these animals on the south side of the Colorado River was presented by Berger (1977). Ruffner *et al.* (1978) said that this species was widespread in the Inner Gorge of the Grand Canyon. Suttkus *et al.* (1978) reported 14 sightings of these animals on the right side of the Colorado River between river mile 208 and river mile 220. We have seen these mammals on the south side of the river also, especially from about river mile 190 to river mile 238. For some information on management problems and this species, see the report by Allen *et al.* (1981).

Specimens examined, 1.—No precise locality.

Additional species of mammals reported by other investigators from along the Colorado River in the bottom of the Grand Canyon are listed below. Some discussions and insights about the current status of these forms in the study area were provided by Hoffmeister (1971), Ruffner *et al.* (1978), and Suttkus *et al.* (1978).

#### Additional Mammals Reported from the Bottom of the Grand Canyon

##### ORDER INSECTIVORA Insectivores

##### Family Soricidae (Shrews)

*Notiosorex crawfordi* Desert Shrew Ruffner *et al.* (1978)

##### ORDER CHIROPTERA Bats

##### Family Vespertilionidae (Vespertilionid Bats)

*Lasiomycteris noctivagans* Silver-haired Bat Ruffner *et al.* (1978)  
*Lasiurus borealis* Red Bat Hoffmeister (1971)  
*Lasiurus cinereus* Hoary Bat Hoffmeister (1971)

##### ORDER RODENTIA Rodents

##### Family Heteromyidae (Heteromyids)

*Dipodomys ordii* Ord's Kangaroo Rat Durrant and Dean (1959)  
*Dipodomys microps* Chisel-toothed Kangaroo Rat Cockrum (1960)

##### ORDER CARNIVORA Carnivores

##### Family Procyonidae (Procyonids)

*Procyon lotor* Raccoon Hoffmeister (1971)  
Ruffner *et al.* (1978)

##### Family Mustelidae (Mustelids)

*Lutra canadensis* River Otter Hoffmeister (1971),  
Hoffmeister and Durham (1971),  
Ruffner *et al.* (1978)

### Family Felidae (Cats)

<i>Felis concolor</i>	Mountain Lion	Hoffmeister (1971), Hoffmeister and Durham (1971), Ruffner <i>et al.</i> (1978)
<i>Felis rufus</i>	Bobcat	Hoffmeister (1971), Hoffmeister and Durham (1971), Ruffner <i>et al.</i> (1978)

Lists of the Recent mammals reported from deposits in Stanton Cave, river mile 31.8, right bank (Euler, 1978), and from Vulture Cave, river mile 274, left bank (Mead and Phillips, 1981), are included here for comparison with the list of mammals that occur now in the area. There are many variables associated with deposits in caves, however, these data provide a means for the reconstruction of the local mammalian communities, and serve as some clues for determining changes that may have occurred in the mammalian fauna of the area.

#### Recent Mammals Reported from Stanton Cave, River Mile 31.8, Right Bank

Euler (1978)

<i>Notiosorex crawfordi</i>	<i>Canis latrans</i>
<i>Myotis</i> sp.	<i>Urocyon cinereoargenteus</i>
<i>Eptesicus fuscus</i>	<i>Bassariscus astutus</i>
<i>Sylvilagus</i> sp.	<i>Procyon lotor</i>
<i>Spermophilus</i> sp.	<i>Lutra canadensis</i>
<i>Castor canadensis</i>	<i>Felis concolor</i>
<i>Peromyscus</i> sp.	<i>Odocoileus hemionus</i>
<i>Neotoma</i> sp.	<i>Ovis canadensis</i>
<i>Ondatra zibethicus</i>	<i>Equus asinus</i>

#### Recent Mammals Reported from Vulture Cave, River Mile 274, Left Bank

Mead and Phillips (1981)

<i>Notiosorex crawfordi</i>	<i>Neotoma</i> sp.
<i>Marmota flaviventris</i>	<i>Microtus</i> sp.
<i>Ammospermophilus leucurus</i>	<i>Erethizon dorsatum</i>
<i>Spermophilus variegatus</i>	<i>Bassariscus astutus</i>
<i>Perognathus intermedius</i>	<i>Odocoileus</i> sp.
<i>Dipodomys</i> sp.	<i>Antilocapra americana</i>
<i>Peromyscus</i> sp.	<i>Ovis canadensis</i>

Based on the best available information about the past and the present distributions of mammals in the study area and in adjacent areas, we developed the following brief list of those species that may be found in the bottom of the Grand Canyon during the course of future biological investigations in the area.

#### Hypothetical List of Mammals that may be Present in the Bottom of the Grand Canyon

##### ORDER CHIROPTERA Bats

##### Family Phyllostomatidae (Phyllostomatid Bats)

*Macrotus californicus* California Leaf-nosed Bat

## Family Vespertilionidae (Vespertilionid Bats)

*Myotis leibii* Small-footed Myotis

## Family Molossididae (Molossid Bats)

*Tadarida macrotis* Big Free-tailed Bat

## ORDER RODENTIA Rodents

## Family Geomyidae (Pocket Gophers)

*Thomomys bottae* Botta's Pocket Gopher

## Family Muridae (Old World Rats and Mice)

*Rattus norvegicus* Norway Rat*Mus musculus* House Mouse**Discussion**

As mentioned previously here and by other authors, habitats for mammals immediately adjacent to the Colorado River in the area studied have changed considerably in recent years. These changes were directly related to the closure of Glen Canyon Dam and corresponding changes in the river, patterns of erosion, and deposition of sediments along the river. Informative summaries and discussions of changes in the river and the riparian vegetation along the banks were provided by Dolan *et al.* (1974, 1977, 1978), Karpiscak (1976), Carothers *et al.* (1979), and Carothers and Dolan (1982). The influences of some of these changes on the distribution and abundance of mammals in the area were discussed by Ruffner *et al.* (1978) and Suttkus *et al.* (1978). For example, *P. maniculatus* may have increased in the bottom of the Grand Canyon since the closure of Glen Canyon Dam and the resultant changes in vegetation along the Colorado River (Ruffner *et al.*, 1978). We encountered these deer mice mostly in areas used heavily by humans. In addition, the presence and abundance of some species of bats may be reflections of changes in vegetation and corresponding changes in insect populations along the river. Although they did not discuss mammals specifically, excellent comments on the impacts of recent changes in the river and adjacent habitats on some other organisms were provided by Carothers and Dolan (1982).

Heavy recreational use and human presence on the river and on the available beaches within the study area impact the substrata and vegetation along the banks. In addition to trampling and corresponding erosion, the widespread incorporation of human debris into the substrata at numerous beaches to form a "sand-box condition," as described by Dolan *et al.* (1977), may be important contributions to the use of certain sites by mammals. Hoffmeister (1971) commented briefly on some possible influences of food materials provided by humans on mammals, especially in the vicinity of Phantom Ranch. Ruffner *et al.* (1978) reported that some mammals, such as *B. astutus* and *S. putorius*, frequented areas used heavily by people. Suttkus *et al.* (1978) commented on the impressive number of mammals that were observed at night in their camp sites.

Because of what has taken place already, as well as plans for the future in connection with the needs for water, hydroelectric power, and recreation, it is rather safe to predict that the Colorado River and adjacent habitats within the Grand Canyon will continue to undergo changes. The recent and future changes in this

interesting system will be reflected in the distribution and abundance of mammals that occupy the area. The results of field studies, such as reported here, add to the base of information needed for understanding the aforementioned changes and for making predictions about the impacts of future changes on the mammalian fauna of the area.

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