

Vertebrate Survey
for
Sequoia and Kings Canyon National Parks
and
Devils Postpile National Monument

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Sierra Network Inventory Project

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Executive Summary

This work was accomplished as part of the Sierra Nevada Network's Biological Inventory Plan. The objectives were to: a) search for vertebrates that may be resident within the park but which are not recorded or the reports are not substantiated, b) characterize species-habitat relationships and relative abundance, c) take standard measurements of captured vertebrates and collect voucher specimens as necessary, d) record all vertebrate observations, and e) characterize small mammal fauna in habitats and geographic areas where we have the least data. The emphasis was on small mammals.

The three-person crew documented 131 vertebrate species. Six-hundred ninety-five vertebrates, representing 26 species, were captured. For Kings Canyon National Park, the survey resulted in the addition of three new species (western whiptail, ornate shrew, and California mouse) and came close to adding two more species when they were seen just outside the park boundary (western pond turtle and possibly western skink), found two species for which only single and old previous records existed (California pocket mouse in 1916 and pinyon mouse in 1942), and added five species to the Grant Grove unit (California mountain kingsnake, gopher snake, Couch's garter snake, wood duck, and brush mouse). Three new species were found in Devils Postpile National Monument (sagebrush lizard, montane shrew and brush mouse). No new species were found in Sequoia National Park.

Distribution information was collected on all of the species observed, and habitat data were collected on all of the species captured. The majority of the captures involved eleven species for which enough information was collected to summarize recorded habitat parameters.

The report makes two recommendations: 1) to continue the effort to find undocumented and inadequately documented vertebrate species, and 2) expand the parks understanding of species/habitat relationships. This information is important for current and future management planning.

INTRODUCTION

In 2000, the Sierra Nevada Network (SIEN) developed an Biological Inventory Plan (Sierra Nevada Network Working Group 2000) which identified a vertebrate survey as one of SIEN's inventory tasks. The vertebrate inventory needs of the SIEN parks were not identical. Yosemite National Park needed to improve their inventory of small mammals having previously completed inventories of most of the other vertebrate groups. Because Sequoia and Kings Canyon National Parks had an extensive wildlife observation database and each of the units had vertebrate lists and recent or concurrent surveys for birds and bats, the surveys for Sequoia and Kings Canyon National Parks and Devils Postpile National Monument targeted missing and questionable taxa as determined by range maps and habitat. The surveys in 2003 focused on small mammals, but searched for all vertebrates except birds, bats, and fish. Birds were recorded opportunistically, but formal surveys for birds and bats were being conducted by another study. Fish were on the list of targeted species, but they were not included in this survey. The fish surveys involve few sites and could be accomplished using existing permanent park staff.

The objectives of this effort are:

- 1) Search for vertebrates that may be resident within the park boundary which are a) previously unrecorded, b) recorded but documentation questionable, or c) reliable historic record without recent records.
- 2) Characterize the habitat and record captures (or observations) per unit effort.
- 3) Take standard measurements and collect voucher specimens as necessary to verify identification.
- 4) Record all vertebrate observations.
- 5) Characterize small mammal fauna in habitats and geographic areas where Parks have least data.

Records were recorded for each park unit. Because Kings Canyon National Park exists in two non-contiguous units (the Grant Grove unit and remainder of Kings Canyon National Park) created by different legislative histories, separate lists were created for each unit.

METHODS

The project was initiated by developing a list of target species. This involved: a) mapping, examining and analyzing the wildlife observation database; b) looking at range maps and habitat descriptions in field guides; and c) looking at museum records, particularly the online search for the University of California, Berkeley, Museum of Vertebrate Zoology.

A list of potential survey sites was developed from the list of targeted species. These sites were selected on the basis of habitat and proximity to known records of targeted species. The primary survey sites were those that offered the best likelihood of finding new species or obtaining new distribution and abundance information. Alternate sites with similar opportunities were selected for each of the primary sites to be used in the event of not being able to get equipment or supplies to a particular primary site. The areas that were surveyed are shown on Figure 1.

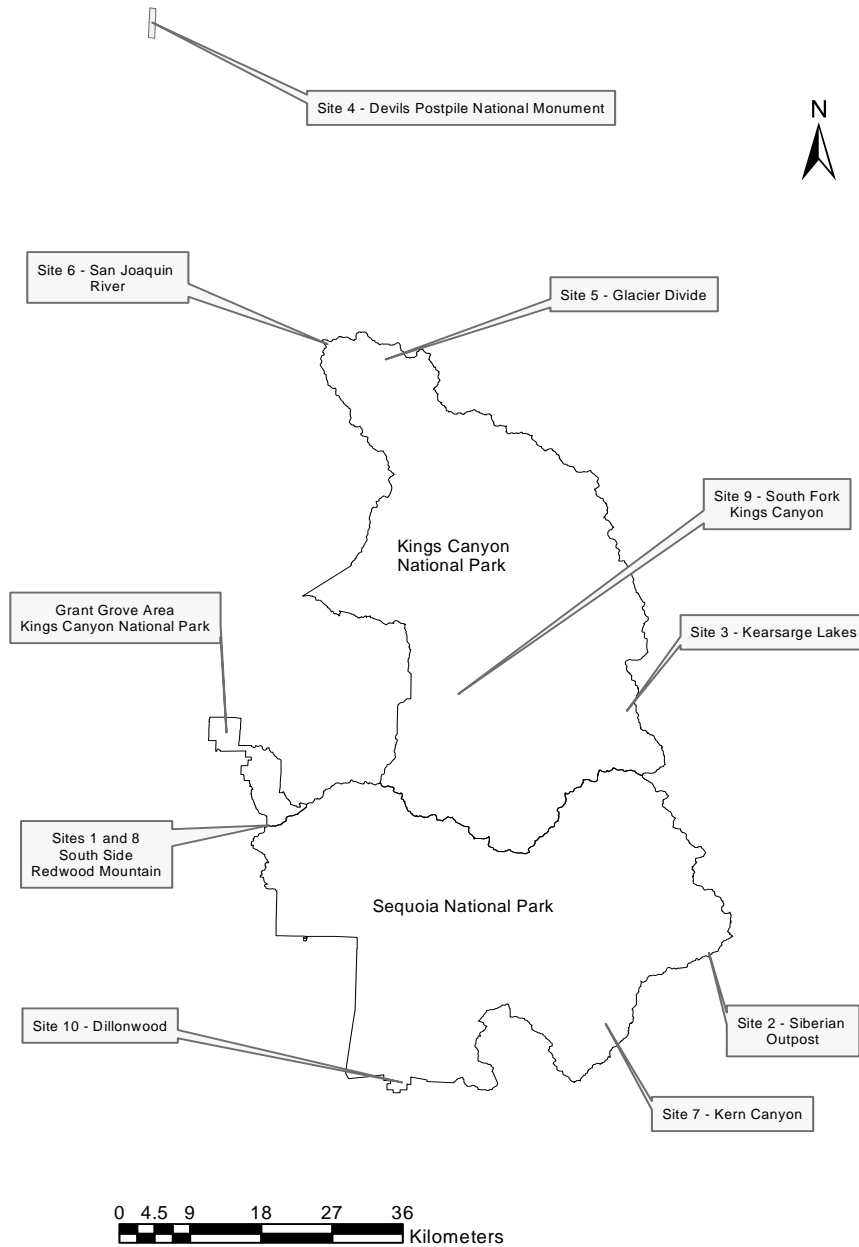


Figure 1. Map shows the distribution of sites where vertebrate surveys were conducted in 2003. Survey sites were located in Sequoia and Kings Canyon National Parks and within Devils Postpile National Monument.

The crew consisted of three biological science technicians under the supervision of the Sequoia and Kings Canyon National Park wildlife ecologist. Prior to field work, the crew visited the Museum of Vertebrate zoology at the University of California, Berkeley, to examine and photograph study skins of targeted species that are difficult to recognize. The crew also received training in preparation of museum skins from Dr. James Patton and Dr. Christopher Conroy who were doing field work in Yosemite National Park.

The field surveys began on June 3, 2003 (except for one day on May 21), and finished September 25, 2003. During that time, the crew surveyed ten sites (Fig. 1). Trapping effort for the ten sites included 2,771 trap nights using Sherman live traps (Model LFATDG - 7.6 x 8.9 x 22.9 cm or Model XLK - 7.6 x 9.5 x 30.5 cm) for catching rodents, 34 trap nights using Tomahawk live traps (Model 108 (81 x 25 x 30 cm) for capturing small forest carnivores, and 6 trap nights using 0.9 liter pit-traps for shrews and salamanders. Additional vertebrates were hand captured for identification when there were opportunities. The Sherman traps were baited with a mixture of rolled oats and peanut butter mixed sufficiently dry that the bait did not stick together. The Tomahawk traps were baited with fish-flavored cat food and covered with burlap. The pit trap was discontinued after one trap site to avoid soil disturbance in relatively pristine areas.

Each trapping site consisted of multiple trap lines. Each trap line was intended to represent a distinctive vegetation type at the site such as chamise chaparral, mixed chaparral, canyon live oak forest, montane meadow, etc. On each trap line, Sherman traps were scattered loosely at approximately 15 m intervals following routes that appeared to capture the diversity of the habitat and considered accessibility and safety. Each trap line typically consisted of 10-15 Sherman traps and occasionally a Tomahawk trap in the vicinity. The coordinates of each trap were recorded using a Garmin III⁺ GPS receiver. In addition, the elevation, habitat, microhabitat, and cover were recorded for each trap. For the trap site, the crew recorded date, survey time, maximum and minimum temperature (when then equipment worked), precipitation, vegetation type, and site description. Moon phase was entered later from a lunar calendar. Nearly all trap lines were photographed to create a visual record.

Captured rodents were ear notched to distinguish recaptures. Recorded information included species, sex, age (adult, subadult, juvenile), weight, hind foot length, ear notch length, tail length, total length (if dead), reproductive condition, parasites, and general comments. The handlers wore respirators, rubber gloves, and eye protection for hantavirus protection (Mills *et al.* 1995). Animals captured in Tomahawk traps were identified and released without handling. Animals that were observed, but not handled, were recorded for the wildlife observation database. Sometimes animals were photographed with a digital camera for later reference.

RESULTS

Table 1 summarizes the species and number of vertebrate captures for each of the ten survey sites. Table 2 provides a listing of all vertebrate species (excluding fish) observed or trapped during the surveys.

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Table 1. Vertebrates captured at the ten survey sites in 2003. Numbers include recaptures. Shannon's diversity (H') and Pielou's evenness (J') indices include only identified rodents and were computed using natural logarithms.

Species	Survey Site										Total	
	1	2	3	4	5	6	7	8	9	10		
Amphibians												
<i>Taricha torosa</i>	1											1
<i>Hyla regilla</i>					1							1
Reptiles												
<i>Sceloporous graciosus</i>				1			1					2
<i>Cnemidophorus tigris</i>	2											2
<i>Elgaria coerulea</i>						1						1
<i>Lampropeltis zonata</i>	1											1
Mammals												
<i>Sorex</i> sp.			1									1
<i>Sorex monticolus</i>				1								1
<i>Sorex ornatus</i>			2									2
<i>Sorex trowbridgii</i>					1							1
<i>Bassariscus astutus</i>	1											1
<i>Martes americana</i>				2								2
<i>Spilogale putorius</i>									1			1
<i>Spermophilus beecheyi</i>							1					1
<i>Spermophilus beldingi</i>				8	15							23
<i>Spermophilus lateralis</i>		13	31	2		13						59
<i>Tamias alpinus</i>		4	8									12
<i>Tamias speciosus</i>		6	3	10		9						28
<i>Tamias</i> sp.			3									3
<i>Chaetodipus californicus</i>	1							1				2
<i>Peromyscus boylii</i>	104			4		6	7	40	45	2		208
<i>Peromyscus californicus</i>	21							3	1			25
<i>Peromyscus maniculatus</i>		22	43	24	35	95	2			11		232
<i>Peromyscus truei</i>	2					18		3				23
<i>Microtus longicaudus</i>			3	5	5		12		4	1		30
<i>Microtus montanus</i>		1			4							5
<i>Microtus</i> sp.					1							1
Arvicolinae unidentified					3							3
<i>Neotoma cinerea</i>							1					1
<i>Neotoma fuscipes</i>	8								1			9
Total Individuals Captured	151	46	91	62	65	142	24	47	53	14		695
H' (rodents captured)	0.76	1.27	1.17	1.50	1.05	1.06	1.19	0.57	0.64	0.66		1.79
J' (rodents captured)	0.47	0.79	0.72	0.84	0.76	0.66	0.74	0.41	0.34	0.60		0.68

Survey Sites: 1= Redwood Mountain South Late Spring, 2 = Siberian Outpost, 3 = Kearsarge Lakes, 4 = Devils Postpile National Monument, 5 = Glacier Divide, 6 = San Joaquin River, 7 = Kern Canyon, 8 = Redwood Mountain South Late Summer, 9 = South Fork Kings Canyon, 10 = Dillonwood

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Table 2. Vertebrates observed or captured at the ten survey sites.

Order Family	Binomial Name	Common Name	1	2	3	4	5	6	7	8	9	10
Amphibians												
Caudata Salamandridae	<i>Taricha torosa</i>	California newt	X									
Anura Hylidae	<i>Hyla regilla</i>	Pacific treefrog	X	X	X	X	X				X	
Reptiles												
Testudine Emydidae	<i>Clemmys marmorata</i>	western pond turtle								A		
Squamata Phrynosomatidae	<i>Sceloporus graciosus</i>	sagebrush lizard				X			X		X	
	<i>Sceloporus occidentalis</i>	western fence lizard	X			X			X	X	X	
Teiidae	<i>Cnemidophorus tigris</i>	western whiptail	X									
Scincidae	<i>Eumeces skiltonianus</i>	western skink	A?									
Anguillidae	<i>Elgaria coerulea</i>	northern alligator lizard				X		X				
	<i>Elgaria multicarinata</i>	southern alligator lizard	X							X		
Colubridae	<i>Lampropeltis zonata</i>	California mountain kingsnake	X							X		
	<i>Pituophis melanoleucus</i>	gopher snake								X		
	<i>Thamnophis couchii</i>	Couch's garter snake								X	X	
	<i>Thamnophis elegans</i>	western terrestrial garter snake									X	X
Viperidae	<i>Crotalus viridis</i>	western rattlesnake	X							X		
Birds												
Ciconiiformes Ardeidae	<i>Ardea herodias</i>	great blue heron	X						X	X	X	
Anseriformes Anatidae	<i>Aix sponsa</i>	wood duck								X		
	<i>Mergus merganser</i>	common merganser	X							X		
Falconiformes Accipitridae	<i>Accipiter cooperii</i>	Cooper's hawk								X		
	<i>Accipiter gentilis</i>	northern goshawk		X			X					
	<i>Accipiter striatus</i>	sharp-shinned hawk								X		
	<i>Aquila chrysaetos</i>	golden eagle		X								X
	<i>Buteo jamaicensis</i>	red-tailed hawk	X	X						X		
	<i>Haliaeetus leucocephalus</i>	bald eagle			X							
	<i>Pandion haliaetus</i>	osprey							X			
Galliformes Phasianidae	<i>Dendragapus obscurus</i>	blue grouse							X			X
Odontophoridae	<i>Callipepla californica</i>	California quail	X									
	<i>Oreortyx pictus</i>	mountain quail	X								X	
Scolopacidae	<i>Actitis macularia</i>	spotted sandpiper				X						
Laridae	<i>Larus californicus</i>	California gull			X	X						
Strigiformes Tytonidae	<i>Bubo virginianus</i>	great horned owl									X	
	<i>Strix occidentalis</i>	spotted owl										X
Apodiformes Apodidae	<i>Aeronautes saxatalis</i>	white-throated swift	X									
	<i>Cypseloides niger</i>	black swift	X									
Trochilidae	<i>Calypte anna</i>	Anna's hummingbird	X							X		
	<i>Selasphorus sp</i>	<i>Selasphorus</i> hummingbird							X			
Coraciiformes Alcedinidae	<i>Ceryle alcyon</i>	belted kingfisher							X		X	
Piciformes Picidae	<i>Colaptes auratus</i>	northern flicker	X		X				X		X	X
	<i>Dryocopus pileatus</i>	pileated woodpecker									X	X
	<i>Melanerpes formicivorus</i>	acorn woodpecker									X	
	<i>Picoides albolarvatus</i>	white-headed woodpecker				X			X			
	<i>Sphyrapicus ruber</i>	red-breasted sapsucker				X			X			
	<i>Sphyrapicus thyroideus</i>	Williamson's sapsucker				X						

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Order Family	Binomial Name	Common Name	1	2	3	4	5	6	7	8	9	10
Passeriformes Tyrannidae	<i>Contopus cooperi</i>	olive-sided flycatcher						X				
	<i>Contopus sordidulus</i>	western wood-pewee				X						
	<i>Empidonax difficilis</i>	Pacific-slope flycatcher						X				
	<i>Empidonax hammondii</i>	Hammond's flycatcher							X			
	<i>Empidonax sp.</i>	<i>Empidonax</i> flycatcher						X				
	<i>Sayornis nigricans</i>	black phoebe								X	X	X
Vireonidae	<i>Vireo cassinii</i>	Cassin's vireo						X	X			
	<i>Vireo sp.</i>	vireo unidentified						X				
Corvidae	<i>Aphelocoma californica</i>	western scrub jay	X							X		
	<i>Corvus corax</i>	common raven	X	X	X	X				X	X	X
	<i>Cyanocitta stelleri</i>	Steller's jay	X			X	X	X	X	X	X	X
	<i>Nucifraga columbiana</i>	Clark's nutcracker		X	X	X	X	X	X		X	X
Paridae	<i>Baeolophus inornatus</i>	oak titmouse	X							X		
	<i>Poecile gambeli</i>	mountain chickadee		X	X	X		X	X		X	X
Aegithalidae	<i>Psaltriparus minimus</i>	bush tit	X									
Sittidae	<i>Sitta canadensis</i>	red-breasted nuthatch				X			X			X
	<i>Sitta carolinensis</i>	white-breasted nuthatch		X	X	X	X	X	X		X	X
Certhiidae	<i>Certhia americana</i>	brown creeper			X	?	X	X		X	X	
Troglodytidae	<i>Catherpes mexicanus</i>	canyon wren	X									
	<i>Salpinctes obsoletus</i>	rock wren		X	X				X			
	<i>Thryomanes bewickii</i>	Bewick's wren	X							X		
	<i>Troglodytes troglodytes</i>	winter wren										X
Cinclidae	<i>Cinclus mexicanus</i>	American dipper	X			X		X		X	X	
	<i>Regulus satrapa</i>	golden-crowned kinglet		X		X						
Sylviidae	<i>Polioptila caerulea</i>	blue-gray gnatcatcher	X									
Turdidae	<i>Catharus guttatus</i>	hermit thrush		X	X			X				
	<i>Myadestes townsendi</i>	Townsend's solitaire					X	X				
	<i>Sialia currucoides</i>	mountain bluebird		X								?
	<i>Sialia mexicana</i>	western bluebird										
	<i>Turdus migratorius</i>	American robin	X	X	X	X		X	X		X	X
Timaliidae	<i>Chamaea fasciata</i>	wren tit	X							X		
Motacillidae	<i>Anthus rubescens</i>	American pipit		X								
Parulidae	<i>Dendroica coronata</i>	yellow-rumped warbler		X	X	?	X	X				X
	<i>Dendroica townsendi</i>	Townsend's warbler							X			
	<i>Oporornis tolmiei</i>	Macgillivray's warbler							X			
	<i>Vermivora celata</i>	orange-crowned warbler				X			X			
	<i>Vermivora ruficapilla</i>	Nashville warbler	X					X	X			
	<i>Wilsonia pusilla</i>	Wilson's warbler				X						
	<i>Piranga ludoviciana</i>	western tanager	X			X						
Emberizidae	<i>Junco hyemalis</i>	dark-eyed junco		X	X	X	X	X	X		X	X
	<i>Melospiza melodia</i>	song sparrow				X						
	<i>Passerella iliaca</i>	fox sparrow			X			X				
	<i>Pipilo maculatus</i>	spotted towhee	X									X
	<i>Spizella passerina</i>	chipping sparrow		X				X				
	<i>Zonotrichia leucophrys</i>	white-crowned sparrow		X	X	X	X					X
	<i>Passerina amoena</i>	lazuli bunting	X									
	<i>Pheucticus melanocephalus</i>	black-headed grosbeak	X									
Icteridae	<i>Euphagus cyanocephalus</i>	Brewer's blackbird				X			X			
Fringillidae	<i>Carduelis psaltria</i>	lesser goldfinch	X							X	X	
	<i>Carpodacus cassinii</i>	Cassin's finch		X	X	X	X					
	<i>Carpodacus purpureus</i>	purple finch						X			X	
	<i>Leucosticte tephrocotis</i>	gray-crowned rosy finch			X		X					
	<i>Loxia curvirostra</i>	red crossbill		X								
Mammals												
Insectivora Soricidae	<i>Sorex monticolus</i>	montane shrew				X						

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Order Family	Binomial Name	Common Name	1	2	3	4	5	6	7	8	9	10
	<i>Sorex ornatus</i>	ornate shrew			X							
	<i>Sorex trowbridgii</i>	Trowbridge's shrew					X					
Carnivora	<i>Canis latrans</i>	coyote		X			X					
Canidae	<i>Urocyon cinereoargenteus</i>	gray fox									X	
Ursidae	<i>Ursus americanus</i>	black bear			X	X				X		X
Procyonidae	<i>Bassariscus astutus</i>	ringtail	X									
Mustelidae	<i>Martes americana</i>	marten				X						
	<i>Mustela frenata</i>	long-tailed weasel		X			X					
	<i>Spilogale putorius</i>	spotted skunk									X	
Artiodactyla Cervidae	<i>Odocoileus hemionus</i>	mule deer			X	X	X		X		X	X
Rodentia Sciuridae	<i>Marmota flaviventris</i>	yellow-bellied marmot		X	X		X		X			
	<i>Sciurus griseus</i>	western gray squirrel	X						X	X	X	X
	<i>Spermophilus beecheyi</i>	California ground squirrel	X						X	X	X	
	<i>Spermophilus beldingi</i>	Belding's ground squirrel				X	X					
	<i>Spermophilus laterals</i>	golden-mantled ground squirrel		X	X	X	X		X			
	<i>Tamias alpinus</i>	alpine chipmunk		X	X		X					
	<i>Tamias merriami</i>	Merriam's chipmunk	A									
	<i>Tamias speciosus</i>	lodgpole chipmunk		X	X	X	X	X	?			
	<i>Tamiasciurus douglasli</i>	Douglas' squirrel			X	X	X		X		X	X
Geomyidae	<i>Thomomys bottae</i>	Botta's pocket gopher	S									
	<i>Thomomys monticola</i>	mountain pocket gopher		S	S	S	S					
Heteromyidae	<i>Chaetodipus californicus</i>	California pocket mouse	X							X		
Muridae	<i>Peromyscus boylii</i>	brush mouse	X			X		X	X	X	X	X
	<i>Peromyscus californicus</i>	California mouse	X							X	X	
	<i>Peromyscus maniculatus</i>	deer mouse		X	X	X	X	X	X			X
	<i>Peromyscus truei</i>	pinyon mouse	X					X		X		
	<i>Microtus longicaudus</i>	long-tailed vole			X	X	X		X		X	X
	<i>Microtus montanus</i>	montane vole		X			X					
		unidentified Arvicoline rodent						X				
		<i>Neotoma cinerea</i>	bushy-tailed woodrat							X		
	<i>Neotoma fuscipes</i>	dusky-footed woodrat	X								X	
Lagomorpha Ochotonidae	<i>Ochotona princeps</i>	pika			X		X		X			
Leporidae	<i>Lepus townsendii</i>	white-tailed jack rabbit		X			X					
Primates Hominidae	<i>Homo sapiens</i> *	human	X	X	X	X		X	X	X	X	X
Total species observed or sign observed (excludes codes A and ?)			44	31	31	40	28	26	38	31	35	26

Survey Sites: 1= Redwood Mountain South Late Spring, 2 = Siberian Outpost, 3 = Kearsarge Lakes, 4 = Devils Postpile National Monument, 5 = Glacier Divide, 6 = San Joaquin River, 7 = Kern Canyon, 8 = Redwood Mountain South Late Summer, 9 = South Fork Kings Canyon, 10 = Dillonwood

Codes: X = Present, A = Observed adjacent park boundary, S = Listed from sign (specimen not observed), ? = specimen not verified, * = Excluding observers

Data on trap-station captures for the identified rodents is summarized by vegetation type, primary habitat, microhabitat, and trap-site cover in Tables 3, 4, 5, and 6. Other vertebrate captures include:

Taricha torosa - One capture in a Sherman trap in mixed chaparral in an area of short graminoids and forbs with over two-thirds cover.

Hyla regilla - One capture in a Sherman trap in an alpine wet meadow under a shrub with one to two-thirds cover.

Table 3. Capture rate as captures per trap night (# traps x # nights) for rodents in vegetation types that were surveyed. These species comprise 657 captures during 2,674.5 trap nights (0.246 captures/trap night). The incidental capture of a *Spermophilus beecheyi* in a Sherman trap in a mixed-conifer forest was excluded.

Vegetation Type	Species (captures/trap night)													Rodent Diversity (H')	Trap Nights
	<i>Chaetodipus californicus</i>	<i>Microtus longicaudus</i>	<i>Microtus montanus</i>	<i>Neotoma cinerea</i>	<i>Neotoma fuscipes</i>	<i>Peromyscus boylii</i>	<i>Peromyscus californicus</i>	<i>Peromyscus maniculatus</i>	<i>Peromyscus truei</i>	<i>Spermophilus beldingi</i>	<i>Spermophilus lateralis</i>	<i>Tamias alpinus</i>	<i>Tamias speciosus</i>		
Mixed Chaparral	0.004				0.015	0.162	0.043		0.009					0.935	537
Canyon Live Oak Forest						0.250								0	84
Black Oak forest						0.017								0	60
Oak Woodland						0.286								0	28
Southern Sierra Foothill Riparian Woodland						0.350	0.012							0.150	80
Sierran Mixed Coniferous Forest		0.003		0.003		0.046		0.057	0.014		0.023		0.034	1.623	350
Bigtree Forest								0.143						0	28
Montane Meadow		0.067				0.061	0.003	0.061		0.026				1.389	312
Montane Chaparral					0.008	0.158		0.120	0.008		0.015			1.038	133
Jeffrey Pine-Fir Forest						0.033		0.133					0.067	0.956	30
Montane/Alpine Riparian Scrub		0.018				0.036		0.333	0.024		0.012	0.006	0.006	0.924	165
Lodgepole Pine Forest											0.104		0.042	0.598	48
Whitebark/Lodgepole Pine Forest								0.290			0.016		0.048	0.576	62
Foxtail Pine Forest								0.133			0.111		0.089	1.085	45
Mixed Subalpine Conifer Forest								0.228						0	101
Subalpine/Alpine Meadow		0.043	0.035					0.096						0.997	115
Dry Subalpine/Alpine Meadow			0.005					0.173	0.042		0.115	0.016	0.016	1.297	191
Wet Subalpine/Alpine Meadow								0.047		0.054	0.007			0.882	149
Low-angle Rock Slabs and Ledges								0.122		0.071	0.030	0.041	0.010	1.359	98.5
Alpine Boulder/Rock Field								0.069			0.172	0.069		0.995	58

Sceloporus graciosus - Two captures, one in a Sherman trap in a mixed hardwood-conifer forest under a rock with over two-thirds cover and a hand capture in mixed conifer forest.

Table 4. Rodent captures by primary habitat at trap stations.

Primary Habitat	Number of Captures by Rodent Species													Captures of All Species	Rodent Diversity (H')	Trap Stations	
	<i>Chaetodipus californicus</i>	<i>Microtus longicaudus</i>	<i>Microtus montanus</i>	<i>Neotoma cinerea</i>	<i>Neotoma fuscipes</i>	<i>Peromyscus boylii</i>	<i>Peromyscus californicus</i>	<i>Peromyscus maniculatus</i>	<i>Peromyscus truei</i>	<i>Spermophilus beecheyi</i>	<i>Spermophilus beldingi</i>	<i>Spermophilus lateralis</i>	<i>Tamias alpinus</i>				<i>Tamias speciosus</i>
bare - rock substrate							10				13	8		31	1.079	47	
bare - sand or gravel										3				3	0	2	
herbaceous - alpine dry meadow							8			4	18	3		33	1.148	36	
herbaceous - alpine/subalpine wet meadow		8	4				20			8		1		34	1.306	59	
herbaceous - montane dry meadow							4	8			4		2	18	1.273	10	
herbaceous - montane wet meadow		18				16	1	15		8	1	0		77	1.473	116	
woodland - foxtail pine							6				5			11	0.689	15	
woodland - juniper							5						1	6	0.451	9	
forest - hardwood/conifer						11								12	0	35	
forest - canyon live oak						22								22	0	21	
forest - lodgepole pine							25				7		9	43	0.936	53	
forest - mixed conifer						6	50	5	1		8		14	91	1.241	111	
forest - palustrine wetland	1					17								19	0.215	25	
forest - sequoia grove							4							4	0	14	
shrub - montane chaparral					1	23	28	2			2		1	58	1.214	36	
shrub - mixed chaparral	1				8	97	23	6	5					154	1.004	135	
shrub - river wash		1		1		13	1	23	3		1			43	1.232	40	
shrub - sagebrush			1				24						1	26	0.325	24	
shrub - wetland scrub-shrub		3				3	4							10	1.089	11	
Total	2	30	5	1	9	208	25	232	23	1	23	59	12	28	695	2.194	799

Cnemidophorus tigris - Two captures in Sherman traps in mixed chaparral with one to two-thirds cover, one under a rock and one under a shrub.

Elgaria coerulea - One hand capture in a mixed conifer forest.

Lampropeltis zonata - One hand capture in mixed chaparral under a shrub with over two-thirds cover.

Table 5. Rodent captures by microhabitat at trap stations.

Microhabitat	Number of Captures by Rodent Species													Captures of All Species	Rodent Diversity (H')	Trap Stations	
	<i>Chaetodipus californicus</i>	<i>Microtus longicaudus</i>	<i>Microtus montanus</i>	<i>Neotoma cinerea</i>	<i>Neotoma fuscipes</i>	<i>Peromyscus boylii</i>	<i>Peromyscus californicus</i>	<i>Peromyscus maniculatus</i>	<i>Peromyscus truei</i>	<i>Spermophilus beecheyi</i>	<i>Spermophilus beldingi</i>	<i>Spermophilus lateralis</i>	<i>Tamias alpinus</i>				<i>Tamias speciosus</i>
anthropogenic structure														0	0	4	
burrow or crevice							2				1	2		5	1.055	14	
dead branch							3							3	0	2	
edge of stream		1				3	4			1				10	1.215	16	
forbs, short	1					5	3			6				15	1.235	14	
forbs, tall		5				7	5			1				19	1.239	26	
gravel or pebbles							1				1			2	0.693	1	
graminoid, short		1				3	2	2		3	6	2		19	1.813	23	
graminoid, tall	1	11				3	6	1		1				24	1.378	35	
log		3				11	26	2	1		3	1	9	57	1.633	65	
litter						5	1				1			7	0.796	13	
mixed graminoid and forbs, short		1	1			4	4	1						16	1.390	43	
mixed graminoid and forbs, tall		1				13	1	2						18	0.790	20	
rock		1				37	4	38	3		5	14	4	119	1.686	123	
soil, bare sand											1	1		2	0.693	3	
shrubs		5	4		9	80	14	73	9		6	14	1	6	227	1.814	220
stump		1		1		1		2						5	1.332	13	
tree						36	2	63	6		23	1	9	145	1.413	159	
unknown														2	0	5	
Total	2	30	5	1	9	208	25	232	23	1	23	59	12	28	695	2.194	799

Sorex monticolus - One was captured in a Sherman trap located in shrubs within a montane wet meadow. The site had over two-thirds cover.

Sorex ornatus - Two were captured in Sherman traps located in shrubs within a wet meadow that was part of an subalpine riparian community. Both sites had over two-thirds cover. The elevation (>3,400 m) was high for the species compared to other observations by the author in the southern Sierra Nevada and which were typically in chaparral.

Sorex trowbridgii - One was captured in a Sherman trap by a rock in an alpine wet meadow. The site had over two-thirds cover.

Table 6. Rodent captures by cover class at trap stations.

Cover Class	Number of Captures by Rodent Species													Captures of All Species	Rodent Diversity (H')	Trap Stations	
	<i>Chaetodipus californicus</i>	<i>Microtus longicaudus</i>	<i>Microtus montanus</i>	<i>Neotoma cinerea</i>	<i>Neotoma fuscipes</i>	<i>Peromyscus boylii</i>	<i>Peromyscus californicus</i>	<i>Peromyscus maniculatus</i>	<i>Peromyscus truei</i>	<i>Spermophilus beecheyi</i>	<i>Spermophilus beldingi</i>	<i>Spermophilus lateralis</i>	<i>Tamias alpinus</i>				<i>Tamias speciosus</i>
<33% cover		2	2			27	1	39	4		7	16	3	5	113	1.922	151
34 - 67% cover	2	5	3	1	2	104	11	135	14		9	21	2	16	339	1.756	367
>67% cover		23			7	77	13	58	5	1	7	22	7	7	241	2.053	276
unknown															2	0	5
Total	2	30	5	1	9	208	25	232	23	1	23	59	12	28	695	2.194	799

Sorex sp. - One unidentified shrew was captured in a Sherman trap located along a stream within a wet meadow that was part of a subalpine riparian community. The site had less than one-third cover.

Bassariscus astutus - One was captured in a Tomahawk trap under a tree with less than one-third cover in a palustrine forest wetland within southern Sierran foothill riparian woodland (0.143 captures/trap night).

Martes americana - Two were captured in Tomahawk traps, one under a tree with over two-thirds cover in a lodgepole pine within a montane meadow (0.200 captures/trap night), the other in tall graminoid vegetation with one to two-thirds cover under a lodgepole pine in a mixed coniferous forest (0.337 captures/trap night).

Spilogale putorius - One was captured in a Tomahawk trap in montane chaparral under a shrub with one to two-thirds cover (1.000 capture/trap night).

The phase of the moon was calculated for each trap night. While the distribution of trap nights was very irregularly distributed among the phases of the moon, capture success did improve with moon brightness (Figure 2). The coincident increase in capture success with increasing moon brightness was highly significant (P = 0.001). This is contrary to the findings of some other investigators who usually found activity highest at low or intermediate levels of moon brightness (Blair 1951; Topping et al. 1999), though Stinson (1952) did find a somewhat similar activity pattern for *P. maniculatus*. Some of the other investigators were working in open terrain where rodents may be more easily detected by predators in bright moonlight. Most of these surveys (except in meadows) were in heavy brush and forests with significant cover.

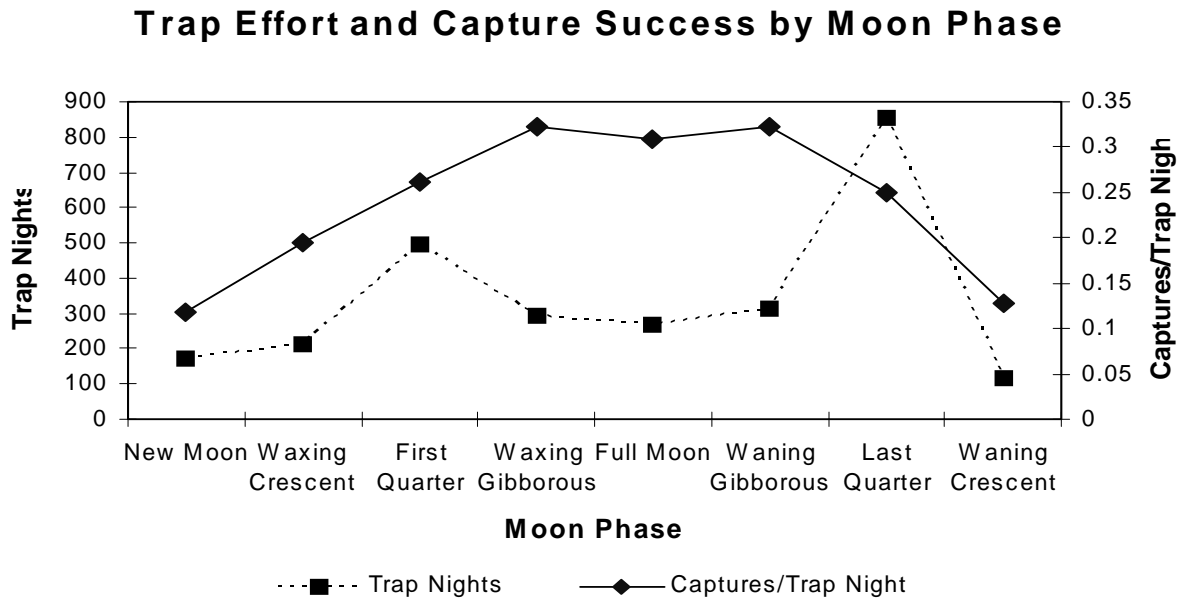


Figure 2. Most of the trapping occurred during the first and last quarter of the moon. However, the highest capture rates occurred when the moon was brightest (gibbous and full moon) and were worst when the moon was darkest (new and crescent).

Physical measurements (Table 7) and sex and age distribution (Table 8) data was collected on most of the animals handled. In most cases, measurements were on live animals. Normally, total length was measured on dead specimens.

Collections were made from 157 different animals. The team collected 156 tissue samples for DNA, primarily from live animals that were released subsequently. Some of these were discarded later due to discrepancies between the labels and data sheets. The crew prepared museum study skins of the 33 individuals that died as trap fatalities of which 28 were accompanied by skulls. Skulls were collected for each of the skins, but several were lost to rodent predation while they were being dried for shipment to the museum. All specimens went to the Museum of Vertebrate Zoology, University of California, Berkeley.

DISCUSSION

New Species:

Kings Canyon National Park - The survey resulted in the addition of two completely new species records for Kings Canyon National Park. These were *Cnemidophorus tigris* (western whiptail) and *Peromyscus californicus* (California mouse).

We came close to picking up two other species for the Park. On two occasions, *Clemmys marmorata* (western pond turtle), were seen in the river between Sequoia and Kings Canyon

Table 7. Measurements of captured vertebrates.

Species	Measurements (mean/standard deviation/sample size)					
	Total Length (mm)	Tail Length (mm)	Hind-foot Length (mm)	Ear Notch (mm)	Weight (gm)	
Amphibians <i>Taricha torosa</i>	150//1	75//1				
Reptiles <i>Sceloporous graciosus</i>	300//1	180//1				
<i>Cnemidophorus tigris</i>	351//1	241//1			38/1/2	
<i>Lampropeltis zonata</i>					150//1	
Mammals <i>Sorex</i> sp.	107/6/5	47/3/5	12/0.5/5	7/0.5/5	3.8/1/5	
<i>Spermophilus beldingi</i>		37//1	34//1	12//1	57//1	
<i>Spermophilus lateralis</i>	280//1	85/9/4	38/3/7	19/2/7	193/18/4	
<i>Tamias alpinus</i>	187/10/2	77/6/11	28/2/11	15/2/11	35/6/9	
<i>Tamias speciosus</i>	210//1	82/11/26	32/2/26	19/1/26	54/8/28	
<i>Tamias</i> sp.		84/6/2	33/1/2	20/1/2	66/13/3	
<i>Chaetodipus californicus</i>		94/15/2	22/1/2	13/0/2	24/2/2	
<i>Peromyscus boylii</i>	Adult	193//1	95/12/84	21/1/84	18/1/85	24/4/129
	Subadult	172//1	87/8/39	20/1/39	18/1/39	19/3/56
	Juvenile		81/9/12	20/1/13	18/2/13	15/2/15
<i>Peromyscus californicus</i>	Adult	230//1	111/9/10	23/1/10	23/2/11	34/8/18
	Subadult		76/11/2	20/0/2	22/0/2	19/0/2
	Juvenile		78/4/3	19/1/3	21/1/3	12/1/5
<i>Peromyscus maniculatus</i>	Adult	150/11/4	68/6/88	19/1/88	17/1/88	17/4/164
	Subadult	140//1	65/5/32	19/1/32	17/2/32	14/3/45
	Juvenile	116//1	55/5/7	18/2/7	16/2/7	9/2/9
<i>Peromyscus truei</i>	Adult	187/6/3	92/6/16	22/1/15	24/1/16	23/3/22
	Subadult		80//1	21//1	23//1	18//1
<i>Microtus longicaudus</i>	174/16/18	60/8/23	21/1/23	15/2/23	40/9/29	
<i>Microtus montanus</i>	125/7/4	35/2/5	19/0/5	12/2/5	25/4/5	
<i>Microtus</i> sp.		35//1	18//1		25//1	
Arvicolinae unidentified	139/20.5/3	39/2/3	19/1/3	15/0.3/3	30/15/3	
<i>Neotoma cinerea</i>		115//1	36//1	30//1	128//1	
<i>Neotoma fuscipes</i>		147/19/3	34/3/4	28/2/4	144/58/8	

Table 8. Sex and age class composition of captured small mammals. Numbers represent total captures for each taxon.

Species	Sex		Age Class		
	Male	Female	Adult	Subadult	Juvenile
<i>Spermophilus lateralis</i>	2	5	7		2
<i>Tamias alpinus</i>	6	6	6	5	
<i>Tamias speciosus</i>	17	10	22	2	1
<i>Chaetodipus californicus</i>		2	1	1	
<i>Peromyscus boylii</i>	116	90	133	57	15
<i>Peromyscus californicus</i>	7	18	18	2	5
<i>Peromyscus maniculatus</i>	137	87	170	45	9
<i>Peromyscus truei</i>	13	10	22	1	
<i>Microtus longicaudus</i>	15	15	25	2	1
<i>Microtus montanus</i>	2	3		2	
<i>Neotoma fuscipes</i>	5	4	4	4	1

National Parks. Because the Sequoia Boundary extends to the west bank of the river, the turtle could not be counted as Kings Canyon National Park. However, it is unlikely that turtles do not use the west bank. The survey team simply did not observe them there. The team also saw a skink in the mixed chaparral on the north end of Redwood mountain and within 50 meters of the park boundary. The team was unsuccessful at capturing the lizard, but it looked like *Eumeces skiltonianus* (western skink). Besides being observed barely outside the boundary, the actual identity of local skinks that have color patterns that resemble *E. skiltonianus* is problematic because scale counts do not match published descriptions. A live specimen from Sequoia National Park was sent to Berkeley Museum of Vertebrate Zoology for identification.

The survey team also captured two species for which there was only one previous and very old record. These include *Chaetodipus californicus* (California pocket mouse) and *Peromyscus truei* (pinyon mouse). The only record *P. truei* was from Zumwalt Meadow in 1942, and Joseph Dixon reported a *C. californicus* from Bullfrog Lake in 1916 (Sequoia and Kings Canyon National Parks Wildlife Observation Database 2004). The Bullfrog Lake site is a subalpine area that is very different from the foothill chaparral environment in which the species normally occurs in the southern Sierra Nevada.

In addition to the species above, the team found five species that were reported previously in Kings Canyon National Park, but not in the disjunct Grant Grove unit of the park. Those species include *Lampropeltis zonata* (California mountain kingsnake), *Pituophis melanoleucas* (gopher snake), *Thamnophis couchii* (Couch's garter snake), *Aix sponsa* (wood duck), and *Peromyscus boylii* (brush mouse).

Sequoia and Kings Canyon National Parks Combined - Special emphasis went into locating additional species of *Tamias* including *Tamias umbrinus* collected by Joseph Dixon at Bullfrog Lake in 1916 (Sequoia and Kings Canyon National Parks Wildlife Observation Database 2004). No new species of *Tamias* were found, and the team did not find *T. umbrinus* when they surveyed 1.5-2 km east of Bullfrog Lake in the Kearsarge Lakes area.

The survey team also placed a lot of emphasis on looking for *Phenacomys intermedius* (heather vole) and *Lepus americanus* (snowshoe hare), both species for which both parks have records but no specimens to substantiate the records. The nearest museum record located for *P. intermedius* was in Humphrey Basin just north of Kings Canyon National Park, and the nearest specimen for *L. americanus* at the University of California, Berkeley, Museum of Vertebrate Zoology was near Yosemite National Park. Both are species that can easily be confused with extant common species. *Phenacomys intermedius* resemble *Microtus montanus* (and other *Microtus* sp.), and *L. americanus* resemble the common *Lepus townsendii*. The team found no proof that either species was present. However, the search covered a small area in a big park. This search should continue including the search for more species of *Tamias*.

Devils Postpile National Monument - The team added three species to the vertebrate list for the monument. They include *Scoloporus graciosus* (sagebrush lizard), *Sorex monticolus* (montane shrew), and *Peromyscus boylii* (brush mouse).

Species/Habitat Relationships:

The terms vegetation type and primary habitat as used in this survey may be perceived as two terms for the same descriptor, and that is largely true. The vegetation types used in this survey are a modified version of Holland (1986) that has been used at Sequoia and Kings Canyon National Parks for nearly two decades. It is based primarily on floristic composition. It was used as a broad-brush descriptor of the vegetation for each trap line. Capture rates were computed by vegetation type. Within each trapline, the habitat was described at each trap using two levels of resolution, primary habitat and microhabitat. Primary habitat was intended to provide more of a structural emphasis than vegetation type alone. It asked, "did the species occur in a forest, shrubland, herbaceous (prairie or meadow), or a bare area?" Plant species were attached to some of these descriptors to provide a vision of the structure of the descriptor (e.g. A lodgepole pine forest has a different structure than canyon live oak forest.). In practice, this produced two taxonomic groups that might be considered synonyms, but are intended to give the reader two different perspectives (floristic composition and habitat structure) and at two levels of resolution (the trap line and the trap site). Microhabitat described physical features within the primary habitat (e.g. stumps, logs, trees, shrubs, etc.) and included a descriptor of the amount of cover provided to the organism. Within each trap line, there was considerable habitat variation that was captured by recording the habitat at each trap.

The results for all species are provided in the Tables 3 through 5 above. For those species which were captured more than a few times, the physical and floristic environment in which species were captured was summarized below.

Peromyscus maniculatus - This survey reinforced the author's impression of this species as an upper-elevation generalist (1,982-3,454 m). It showed up in more vegetation types (Table 3), and more primary habitats and microhabitats (Tables 4 & 5) than any other species collected. It did not show up in any low-elevation sites though the species was reported previously in low-elevation sites in postburn chamise chaparral (Werner 1982) and in unburned mixed chaparral (Werner 2003). Some of this expression of habitat diversity was undoubtedly a consequence of it also being the most abundant species captured. If one only catches a few specimens of a species, that species is less likely to appear in a lot of habitats. Indeed, a significant relationship ($P < 0.001$) existed between the diversity of sites for a species and the number of individuals captured. The highest capture rates for *Peromyscus maniculatus* in descending order of importance by vegetation type occurred in montane/alpine riparian scrub, whitebark/lodgepole pine forest, mixed subalpine conifer forest, dry subalpine/alpine meadow, bigtree forest, Jeffrey pine-fir forest, foxtail pine forest, and low-angle rock slabs and ledges. Basically the species capture rate was highest in the subalpine and upper montane sites. The primary habitat for the species was primarily forests of lodgepole and mixed conifers and several shrub communities (sagebrush, montane chaparral, and river wash), montane wet meadow, and bare rock substrate. The microhabitat where the species was captured was primarily trees, shrubs, rocks, and logs, and 34-67% cover.

Peromyscus boylii - This was the abundant mouse of the lower elevations, but which ranges into the mid-elevations sparingly. The species was captured from 1,095 to 2,574 m elevation, but the median elevation of all captures was 1,224 m, close to the lower end of its range. The highest capture rates in descending order were southern Sierra foothill riparian woodland, oak woodland, canyon live oak forest, mixed chaparral, and montane chaparral. The species abundance in montane chaparral was a surprise, but the species does occur at upper elevations. Other upper-elevation vegetation types included Jeffrey pine-fir forest, montane meadow, Sierran mixed coniferous forest, and montane/alpine riparian scrub; but the species is not common in any of these environments. The most important primary habitats were forests of canyon live oak and palustrine wetland and both shrublands of mixed and lower-elevation montane chaparral. This survey did not survey chamise chaparral, but we know it is another preferred habitat from other surveys done at Sequoia National Park (Werner 1982). The principle microhabitats for this species were tall mixed graminoids and forbs, shrubs, trees, rocks, and forbs and >33% cover.

Peromyscus californicus - This predominantly foothill species was captured primarily in mixed chaparral, and other park surveys have found them in chamise chaparral and blue oak woodland (Werner 1999). This survey found the species in a foothill riparian woodland, and the lone capture of this species in a montane meadow in Kings Canyon was not expected, but the elevation was only 1,471 m. There is also a mid-elevation record from 1979 from about 2,263 m at Little Baldy Saddle (Sequoia and Kings Canyon National Parks Wildlife Observation Database 2004). This survey only found the species between 1,118 and 1,471 m. The primary microhabitat was shrubs and areas of short mixed graminoids and forbs and cover >33%.

Peromyscus truei - In other park surveys, this species was captured extensively in foothill chamise and mixed chaparral (Werner 1982, 1996). In this survey, the majority of the captures were in the montane zone at the San Joaquin site. None were captured in similar habitat in Kings Canyon

though there is a 1942 record (Sequoia and Kings Canyon National Parks Wildlife Observation Database 2004) from Zumwalt Meadow, an area which was included in this survey. The highest capture rates were in montane/alpine riparian scrub and Sierran mixed coniferous forest. Capture rates were about two to three times lower in mixed chaparral, a habitat that the author normally associates with their distribution. They also showed up in montane chaparral at about the same capture rate as in mixed chaparral. The primary habitat was herbaceous montane dry meadows and secondarily several shrub types with trees, shrubs, and short graminoid vegetation for the predominant microhabitat. The captures were primarily at sites representing the 34-67 % cover class. Areas of grass and shrubs in the bottom of deep glaciated canyons appear to be good habitat locally. The elevation range for this survey was 1,235 to 2,574 m.

Microtus longicaudus - The crew captured this species primarily at montane meadows, subalpine/alpine meadows, and montane/alpine riparian scrub in descending order of importance. The primary habitat was the herbaceous environment of montane and alpine wet meadows and wetland scrub-shrub. The primary microhabitat was tall graminoids and tall forbs with over two-thirds cover. The species was always found at upper elevations, 1,525-3,413 m, and closely associated with water.

Microtus montanus - The species was found exclusively in subalpine/alpine wet meadows usually by shrubs and with two thirds or less cover. All specimens were captured at high elevations, 3,314-3,344 m. With only five specimens captured, this summary may not accurately portray the breadth of their occurrence within these parks. However, within the scope of the sites surveyed, they appear to be much less abundant and more limited in their distribution than *M. longicaudus*.

Neotoma fuscipes - This low-elevation species was found entirely in foothill mixed chaparral (1,184-1,224 m) except for one capture in montane chaparral in Kings Canyon at 1,469 m. The microhabitat was shrubs with most of the captures in areas with over two thirds cover.

Tamias speciosus - This upper-elevation species occurred in many of the vegetation types with the most important in descending order being foxtail pine forest, Jeffrey pine-fir forest, whitebark/lodgepole pine forest, lodgepole pine forest, and Sierran mixed coniferous forest. The species occasionally showed up in meadow and rocky areas. The primary habitat was forests of mixed conifer and forests of lodgepole pine. The most important microhabitat was logs but also included trees, shrubs and rocks, and they showed a slight preference for two thirds or less cover. The species was captured from 2,267 to 3,373 m. This chipmunk is generally seen by most park visitors in the montane zone since that is where most of the park developments exist, but the species appears to be more abundant in the forests and woodlands of the subalpine environment.

Tamias alpinus - This upper-elevation species that was captured from 3,337 to 3,504 m was found primarily in areas of low-angle rock slabs and ledges. Both this and *T. speciosus* had some occupation of dry subalpine/alpine meadows and riparian scrub, but not at the same locations. During this survey, the two species appeared to be mutually exclusive in partitioning available habitat. The primary habitat for *T. alpinus* was bare rock and alpine dry meadows in either areas of over two-thirds cover or one third or less cover. This split between the two extremes may be an

artifact of the small sample size for the species or it may reflect the extreme differences in cover between the two primary habitats with rocks providing extensive cover and dry meadows providing very little cover. The primary microhabitats were soil/sand, burrows/crevices, short graminoid vegetation, and rocks. This is the chipmunk that is generally encountered above treeline in rocks and dry meadows.

Spermophilus lateralis - This upper-elevation species was captured from 2,348 to 3,509 m primarily in alpine boulder/rock field, dry subalpine/alpine meadows, foxtail pine forest, and lodgepole pine forest in descending order of importance. The species also occurred in most of the other upper elevation vegetation types, but much less frequently. The primary habitats were bare rock substrates, alpine and montane dry meadows, woodlands of foxtail pine, and forests of lodgepole pine. The primary microhabitats were short graminoid vegetation, trees, and rocks, and the species showed a preference for less than one third cover. Within the survey area, this is primarily a species that prefers areas that are high elevation, open to sparsely canopied, and dry.

Spermophilus beldingi - This upper-elevation species captured from 2,294 to 3,427 m also was restricted latitudinally to Devils Postpile National Monument and the northern portions of Kings Canyon National Park. In descending order of frequency, it occurred in low-angle rock slabs and ledges, wet subalpine/alpine meadows, and montane wet meadows. The primary habitat was both wet and dry alpine meadows, but also included montane wet meadows and areas of bare sand or gravel. The primary microhabitat was short forbs and short graminoid vegetation, and the species was captured primarily in sites with less than one third cover. Compared to the previous species, *S. beldingi* lives in more open terrain and includes wetter sites.

Physical Measurements:

While most of the species collected appeared typical of other specimens from these parks, most of the *Peromyscus californicus* had different measurements and lighter body weights than previous *P. californicus* collected in Sequoia National Park. The cluster tree (Fig. 3) is based on adults and specimens with no missing values. The raw numbers were standardized and the dendrogram was run with average linkage and Euclidean distance. Each individual is labeled with its crew catalogue number. Figure 3 shows three individuals (VIC0085, VIC0113, VIV0017) at the bottom that come closest to classic *P. californicus*. Then there is a cluster of three (VIC0625,

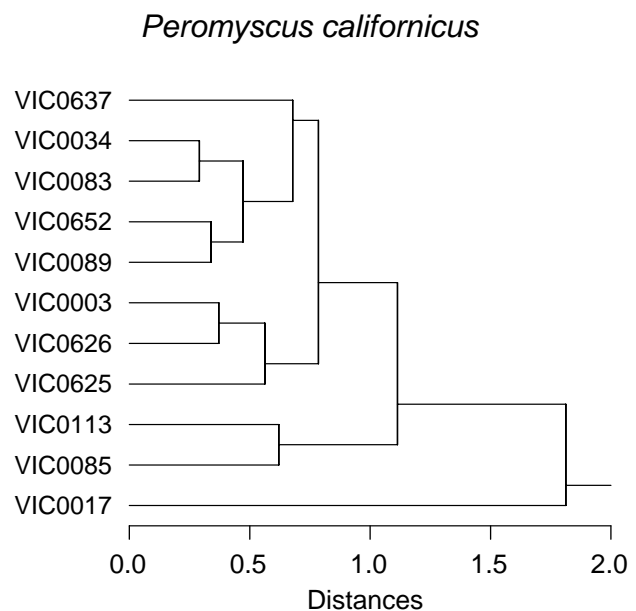


Figure 3. Dendrogram shows relationships of adult *Peromyscus californicus* for which measurements were available on weight, ear notch, tail length, and hind foot length. Individuals are identified by the crew catalogue numbers.

VIC0626, VIC0003) and the lone individual at the top (VIC0637) which linked to *P. boylii* when pooled with other *Peromyscus*. Compared to the first group, these had lower body weights, shorter ears, shorter tails, and slightly shorter feet. A third cluster of four *P. californicus* (VIC0089, VIC0652, VIC0083, VIC0034) has appropriate ear length, but they had lighter weight, shorter tails, and small hind feet. This cluster grouped with *P. truei*. This could mean that these two groups were misidentified, but they had the visual characteristics of *P. californicus*, and curiously, these individuals remained largely clumped (rather than dispersed) among the *P. truei* and *P. boylii* super clusters. The second and third groups appeared to be distinctive.

RECOMMENDATIONS

1) The effort to find undocumented and inadequately documented vertebrate species within these Parks should continue for the following reasons: a) If undocumented species exist, they are probably either relict populations or populations at the extreme margins of their range. Either way, they are likely to be populations that are very sensitive to environmental change. It is also important that the Parks know where they are so that future management actions can be evaluated adequately to avoid impact to those populations. b) The work by Dr. David Wake at U.C. Berkeley has produced several species of terrestrial salamanders that are new to science as well as new to the park and adjacent areas (Jockusch et al. 1998, Wake et al. 2002). Based on how little area has actually been surveyed, there is potential for additional new species of terrestrial salamanders as well as finding other species of vertebrates that were not previously documented in these Parks or which represent new known range or habitat. The Parks need to be willing to assist, and where possible support, credible investigators willing to do surveys using both traditional and new tools like DNA. Work like Dr. Wake's not only has potential to find new species, but it helps us understand the spatial and phylogenetic relationships of extant fauna. It helps us understand the origins and development of park fauna, and survey data helps us prioritize the significance of individual populations. This is information that is critical to prioritizing distribution of funds for future management needs, both protection and restoration.

2) The effort to expand the parks understanding of species/habitat relationships should continue. This one-year effort gave this author, a twenty-five year employee of these parks, new quantitative insights in understanding some of the common species. Considering the size and diversity of habitat within these parks, this survey just brushed the surface of acquiring a deeper understanding of the distribution and habitat utilization by park vertebrates. This information is important for evaluating the potential wildlife effects of management programs, particularly for programs like fire management which has a significant influence on the structure and composition of vegetation.

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Conroy trained the team to prepare study skins and how to collect genetic samples. Dr. Eileen Lacey provided access to study skins at the Museum of Vertebrate Zoology, University of California, Berkeley, and Dr. Christopher Conroy identified the shrews.

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APPENDICES

A-I SURVEY PROTOCOL

Vertebrate Surveys - Small Mammals Using Traps

1. Rodents and other small mammals.

Investigative Objective: Acquire inventory of rodent species and their relative abundance within both common and unique environments.

Operational Objectives:

- Minimal small mammal data collected includes species captured, sex, age (adult, subadult, juvenile), capture location, body measurements, date, and whether or not it is marked.
- Minimal habitat data include habitat type, UTM location, vegetation structure, dominant species composition cover, slope, aspect, elevation, general substrate description, and moisture description.
- Investigators will cause minimal disturbance to habitat and monitored species.

Methods:

Plot Size: No formal plot exits. The areas surveyed should be at least a hectare in size of uniform habitat. The area should be large enough to eliminate captures from adjacent communities.

Trap Stations: Rodent traps are distributed loosely at approximately (not measured) 15 m intervals. Each trap has an unique number.

Traps: To capture rodents, 23 x 8 x 9 cm (or 30 x 8 x 9) Sherman live traps are placed on firm substrate. If firm substrate is not available, use the most stable site available. The traps must not move when the animals enter them. The trap is either flat or the rear is slightly higher than the front of the trap. The bottom of the trap should be nearly flush with the surface of the ground. The trap should not sit below the surface of the earth. A wad of cotton is placed in the rear top corner of the trap. It is pressed in to keep it as far from the entrance as possible and above the trigger. Externally, the trap needs to be insulated if there is any potential for the sun to shine on the trap. This can be done with corrugated cardboard or other insulating materials. The insulation needs to extend beyond the widest dimensions of the trap to prevent the sun hitting the trap at any time of the day.

Bait/Setting Traps: Before setting any rodent trap, check the trigger and adjust as necessary for proper sensitivity to closing. Bait the trap with a mixture of rolled oats and peanut butter. Mix the bait so that the flakes of rolled oats are dry and mostly not sticking together. Throw a small handful (large pinch) of bait into the traps in such a way that bait will concentrate in the rear but be scattered throughout the length of the trap and add a thin stream of bait out the door for several decimeters. Bait loss from birds and insects may require some daily bait replacement. Every couple of days, the bait needs to be removed and replaced from the traps that receive daily infusions of bait to prevent

accumulations under the trigger that prevent the trap from closing properly. Traps with animals in them need to have all bait dumped out before being reset. Check the trigger and adjust as necessary, before resetting any trap.

Checking Traps: Begin checking traps by 0900 hr. If trap mortality becomes a problem, set less traps and check twice a day.

Safety: Whenever handling rodents or working around contaminated gear, staff need to wear hantavirus protection. Handling precautions include wearing surgical gloves, high-volume particulate respirators, and eye protection (goggles or glasses). Respirators must not leak air and gloves must not have holes in them. Observers need to wear goggles and glasses if they are downwind of the rodent or anywhere within three meters of it. The inside of the toolbox, traps, and waste cotton from traps is always treated as contaminated unless it has been decontaminated with $\geq 15\%$ chlorox solution. Avoid contacting clothing with contaminated gloves. Plastic lab aprons or plastic sheets will be available for extra protection. These require care to assure that the same side faces away from the body and must be decontaminated after each use. When two people are available, the data should not be recorded by the handler to minimize contamination of data sheets. Cotton, gloves, and any other contaminated waste must be soaked in $\geq 30\%$ chlorox solution for 30 minutes or more to assure decontamination before it is disposed. Contaminated gear should be carried in containers in the bed of a pickup truck. If that is not possible, it can be securely tied to the outside of another vehicle. No contaminated rodent gear should be carried inside a vehicle sharing the same air as passengers. If it is necessary, the materials must be sealed in an airtight container that will not breath as elevation changes and it should be placed in the trunk if available.

Handling Procedures: While wearing safety gear, the handler dumps the captured rodent into a Zip-Lock freezer bag (27 x 30 cm) or clear plastic equivalent. This is done by wrapping the orifice of the bag securely around the mouth of the trap. Then pushing the door open through the bag keeping the finger tightly pressed to the trap door to minimize obstructing the captives removal. The animal (and sometimes the cotton) is extracted by holding the open end of the trap toward the earth and repeatedly thrusting downward with abrupt upward reversal at the bottom of the stroke (shaking the captive out of the trap). The handler then grabs the top to the bag to prevent escape. A piece of chord or vinyl is tied to the top of the bag to prevent escape. Immediately, obtain the species, weight (to the nearest gram), sex, age, and note if the rodent is marked. These are collected on every capture and recapture. Make sure the rodent has sufficient air. Minimize solar heating of the bag by using available shade, including use of your body to shade the bag. If you must be in the sun, monitor the bags environment closely. Ventilate the bag whenever the animal looks or acts stressed. Do this carefully to prevent escape. The rodent may need to be removed from the bag for tagging, measuring, or verifying the initial data. This should be done by carefully pinning the rodent and grasping it by the nape of the neck. Be careful that your hold is tight enough to prevent the rodent from biting you but loose enough that it is breathing normally. Look at the abdomen to determine that respiration is OK. Minimum measurements include ear notch, tail length, and hind foot length to the nearest millimeter. These are always done on the initial capture for mice and opportunistically thereafter. These measurements are desirable, but not required for live rats, squirrels, and chipmunks. If you have a dead animal, measure total length. Measurements may be done either in

the bag or while being held, whichever works best. Animals should be marked by placing a colored ink spot on the top of their head using indelible ink or equivalent. Rats, squirrels, and chipmunks can be handled by hand, but they present a greater risk of bite to the handlers than mice. Large rodents should be transferred to a handling cone for marking. Place the orifice of the bag tightly (as when it was placed over the trap) over the large end of the handling cone. As the rodent runs into the cone, briskly push the bag in behind the rodent to prevent it from having any room to move. Place several sticks (picked up in the plot), large nails, or other rod-like structures behind the bag to keep the animal securely in the cone. Make sure that all data is recorded properly and then release the rodent. The species and location should be recorded for shrews, lizards, birds and other non-target species that might wander into our traps; other data should be collected if time permits.

Species Identification: Normally species will be identified on-site. If a species is questionable, describe thoroughly and specify the uncertainty on the data sheet. If the animal cannot be identified with reasonable certainty in the field, prepare the specimen to be sent to the MVZ at Berkeley. While alive, assure the animal and its cage (normally the trap) is maintained at a comfortable comfort range at all times.

Climate Data: A high-low thermometer is located approximately 1.5 meters above the ground at a site that remains in the shade throughout the day. This instrument will be near the beginning of the plot's trap checking route. The high-low thermometer is reset when the traps are baited at the beginning of a trapping period. It is read and reset at the beginning of each trapping day.

Data: Record accurately. It is important facts be distinguished from educated guesses from speculation. Place a question mark by guesses and explain. Always identify date, location, and observer; sometimes time is also important. Data is expensive. Data sheets should be treated like large volumes of cash, protect it to the max. Make a hard copy backup on the xerox. Get data edited data on the computer as soon as practical and make a digital copy of the data which should be stored in a different building. Draw a free-hand map of the site showing landmarks, rough scale, and the approximate location of all traps by their number.

2. Serendipity Investigations of Mid-sized Mammals

Investigative Objective: Acquire inventory of mid-sized forest carnivores and other mammals of similar size.

Operational Objectives:

- Minimal data collected includes species captured, capture location, and capture date.
- Minimal habitat data include habitat and UTM location (or accurate map location).
- Investigators will cause minimal disturbance to habitat and monitored species.

Methods:

Plot Size: No formal plot exits. The habitats being surveyed (except riparian) should consist of at least 50 hectares of similar contiguous habitat. The habitat should be sufficiently extensive to

virtually eliminate captures of individuals that are not at least partially dependent on utilization of the habitat being sampled.

Trap Stations: One or more traps are distributed at sites that appear to be suitable (good access, good cover, away from visitors, etc) for setting traps with no specified spacing. Each trap site has a unique designation.

Traps: To capture mid-sized mammals, 81 x 26 x 41 cm Tom-A-Hawk live traps (107 x 40 x 52 cm Tom-A-Hawk traps when targeting larger mammals) are placed on firm substrate. If firm substrate is not available, use the most stable site available. The traps must not move when the animals enter them. The trap is either flat or the rear is slightly higher than the front of the trap. The bottom of the trap should be nearly flush with the surface of the ground. The trap should not sit below the surface of the earth. The trap is completely covered with burlap bags except for the entrance.

Bait/Setting Traps: Before setting any trap, check the trigger and adjust as necessary for proper sensitivity to closing. Bait the trap with fish-flavored cat food. Place a lump of bait (size of two walnuts) behind the trigger, and place a trail of bait (peanut-sized lumps) at about one decimeter intervals extending through the trap and about a meter out the door. Every couple of days, the bait needs to be replaced.

Checking Traps: Begin checking traps by 1400 hr.

Safety: Whenever handling traps with animals in them, be careful to avoid getting fingers or any other part of your body where they can bite or scratch you. Skunks will require use of plastic bags or other barrier for shielding against being sprayed.

Handling Procedures: Med-sized animals are not normally handled. Make sure that all data is recorded properly and then release the animal. If handling is required, it needs to be done by someone certified in restraint and immobilization.

Species Identification: Normally species will be identified on-site. If a species is questionable, describe thoroughly and specify the uncertainty on the data sheet. If the animal cannot be identified with reasonable certainty in the field, bring the specimen to the fish and wildlife ecologist or anyone else that can identify it. Assure the animal and its cage (normally the trap) is maintained at a comfortable comfort range at all times.

Data: Record accurately. It is important facts be distinguished from educated guesses from speculation. Place a question mark by guesses and explain. Always identify date, location, and observer. Data is expensive. Data sheets should be treated like large volumes of cash, protect it to the max. Make a hard copy backup on the xerox. Get data edited data on the computer as soon as practical and make a digital copy of the data which should be stored in a different building. Mark trap sites on a map.

A-II DESCRIPTION OF THE DATABASE

The data is stored in a Microsoft Access file named "Sequoia Kings Canyon NP Vertebrate Inventory Data 2003 revised 2-27-04.mdb". The file contains 15 tables. Three of the tables contain field data (capture data, site data, and trap data). The other 12 tables contain codes used in the field data (age, cover, habitat, microhabitat, moon, parasites, reproductive condition, sex, species, survey sites, traps, and vegetation types). The codes were done as separate tables rather than lookup tables embedded within the fields as a matter of author preference. Currently the data are stored on the author's C: drive (C:/Data/Field Data/Vertebrate Inventory/Sequoia Kings Canyon NP Vertebrate Inventory Data 2003 revised 10-25-04).

The table "capture data" contains the following fields:

recno - an unique number for each field

trap - a designation that distinguishes each trap on a specific trap line for a specific site

sitetlnday - a designation that distinguishes a specific day on a specific trap line at a specific site

site - a designation for a specific area where trapping occurred

year - year trap was checked

month - month trap was checked

day - day of month that trap was checked

tln - trapline number at a site

tnum - unique trap number at a site

catnum - unique catalogue number assigned to captured vertebrate. The "VIC" preceding stands for "vertebrate inventory crew"

spec - four-letter code for each vertebrate captured

sex - sex of vertebrate captured

age - age class of vertebrate captured

DNA - indicates whether a tissue sample was collected for potential DNA analysis

skin - indicates whether a skin was prepared to be a museum specimen

skull - indicates whether a skull was collected to accompany the skin as a museum specimen

recap - indicates whether the specimen collected was a known recapture

wt - weight in grams of the vertebrate captured

tot - total length in millimeters of the vertebrate captured

tail - tail length in millimeters of the vertebrate captured

hdft - hind foot in millimeters of the vertebrate captured

ear - ear notch in millimeters of the vertebrate captured

rc - reproductive condition of the vertebrate captured

par - external parasites observed on the vertebrate captured

co - comments

The table "site data" contains the following fields:

sitetlnday - a designation that distinguishes a specific day on a specific trap line at a specific site

vegtype - vegetation type characterizing a trap line

year - year trap was checked

month - month trap was checked

day - day of month that trap was checked

site - a designation for a specific area where trapping occurred

tln - trap line number at a site
stime - start time (24 hr clock) for checking traps on a trap line
etime - ending time (24 hr clock) for checking traps on a trap line
trapnts - number of trap nights using Sherman traps on the trap line
trapntt - number of trap nights using Tom-A-Hawk traps on the trap line
trapntp - number of trap nights using pit traps on the trap line
maxtp - maximum temperature for the site since sitting traps the previous day
mintp - minimum temperature for the site since sitting traps the previous day
precip - precipitation for the site since sitting traps the previous day
clcov - average cloud cover observed while checking traps
moon - moon phase with lunar cycle split into eight phases
obs - observers
comm - comments

The table “trap data” contains the following fields:

trap - a designation that distinguishes each trap on a specific trap line for a specific site
site - a designation for a specific area where trapping occurred
tln - trap line number at a site
tnum - unique trap number at a site
utme - UTM easting for Zone 11 using datum NAD27
utmn - UTM northing for Zone 11 using datum NAD27
elev - elevation above sea level using meters
epe - horizontal position error in meters
dop - dilution of position
yearr - year trap site data was collected
monthr - month trap site data was collected
dayr - day trap site data was collected
trapt - trap type
pmhab - primary habitat where trap was located
microhab - secondary habitat where trap was located
cover - cover class where trap was located
com - comments

Image data consists of 326 digital photographs (one file per photograph) in JPG format representing the trap sites, trap lines, some of the specimens captured, and crew activities. The set also includes 220 photographs (JPG and PSD formats) of museum skins taken at the Museum of Vertebrate Zoology at University of California, Berkeley. Currently these are stored on the author’s C: drive (C:/Data/ Imagery/Vertebrate Crew Photos 2003).

A-III DESCRIPTION OF SURVEY PLOTS

Site 1, South Side Redwood Mountain:

Trap Line 1 - very open mixed chaparral; large smooth granitic bedrock exposures; somewhat steep; grass on edges of shrubs and where some soil exists; shrubs by trap line included primarily oaks, manzanita, and some flannel brush

Trap Line 2 - mixed chaparral; very dense; shrubs by trap line included primarily manzanita, oaks, and some buck brush, mountain mahogany, bay, and hollyleaf redberry; moderately steep slopes

Trap Line 3 - mixed chaparral; very dense; shrubs by trap line included primarily manzanita and some oak; moderately steep slopes

Trap Line 4 - a closed-canopy forest of canyon live oak and bay trees; moderately steep slopes

Trap Line 5 - a foothill riparian woodland and upland adjacent to Redwood Creek; woody vegetation included California buckeye, bay, live oak, and willow; generally low gradient

Site 2, Siberian Outpost:

Trap Line 1 - a low-gradient subalpine meadow with numerous *Artemisia rothrockii*

Trap Line 2 - a low-gradient subalpine wet meadow

Trap Line 3 - a low to moderate-gradient foxtail-pine woodland

Trap Line 4 - a low-gradient lodgepole-pine forest

Trap Line 5 - a low-gradient subalpine wet meadow; a few of the traps on sand, but most on low herbaceous vegetation; abundant evidence of pocket gopher activity

Trap Line 6 - a moderate-gradient alpine area of rock and some sand; little vegetation

Site 3, Kearsarge Lakes:

Trap Line 1 - a rocky alpine area with a few whitebark pine; moderate to slightly-steep slope

Trap Line 2 - a moderate-gradient subalpine riparian area of willows and some gooseberry, heather, whitebark pine and lodgepole pine

Trap Line 3 - a low-gradient subalpine/alpine dry meadow

Trap Line 4 - a low to moderate-gradient lodgepole pine forest with heather and wet meadow along a stream

Trap Line 5 - a dense lodgepole-pine forest on somewhat moderately-steep slopes

Trap Line 6 - an open variable-gradient lodgepole-pine forest

Site 4, Devils Postpile National Monument:

Trap Line 1 - low-gradient montane meadow

Trap Line 2 - mixed-conifer forest on moderately-steep slopes

Trap Line 3 - open mixed-conifer forest on moderate to slightly-steep slopes

Trap Line 4 - low-gradient montane meadow along the river

Trap Line 5 - low-gradient montane meadow with willows within a conifer forest

Trap Line 6 - a low to moderate-gradient stand of willows and montane grasses surrounded by steep rocky terrain and mixed-conifer forest.

Trap Line 7 - low-gradient burned mixed-conifer forest

Site 5, Glacier Divide:

Trap Line 1 - low-gradient alpine wet meadow with willows and some small conifers; stream present

Trap Line 2 - low-gradient mixed conifer (especially lodgepole pine) with heather understory

Trap Line 3 - low to slightly-moderate gradient area of whitebark and lodgepole pine

Trap Line 4 - low to slightly-moderate gradient area of alpine wet meadow along a fast-moving stream; many boulders and some conifers present

Trap Line 5 - low to slightly-moderate gradient area of alpine dry meadow/fell field; some small conifers present

Trap Line 6 - low-gradient alpine wet meadow with many large boulders and adjacent a lake

Trap Line 7 - alpine dry meadow with whitebark and some lodgepole pine

Site 6, San Joaquin River:

Trap Line 1 - low-gradient open juniper woodland; dry montane area of graminoid vegetation, rocks and scattered junipers; some Jeffrey pine present

Trap Line 2 - variable-gradient montane riparian scrub and mixed conifer forest; overstory of primarily lodgepole and Jeffrey pine, white fir, and juniper; understory includes willows, chinquapin, manzanita, horsetails, and *Ribes*; sandy soil near river

Trap Line 3 - moderate-gradient montane chaparral of green-leaf manzanita and patches of rock, junipers, and graminoid vegetation; south facing; rocky substrate

Trap Line 4 - low-gradient montane riparian scrub and mixed-coniferous forest consisting of large willows, aspen, lodgepole pine, Jeffrey pine, and juniper; leaf litter abundant; many fallen logs

Trap Line 5 - low-gradient dry stream drainage on a south-facing slope; open canopy of Jeffrey and lodgepole pines, juniper, aspen with an understory of montane mixed chaparral dominated by green-leaf manzanita and including sagebrush, mountain mahogany, ferns, forbs and bunch grasses; much small rock

Trap Line 6 - low-gradient, dense mixed-conifer forest of lodgepole pine (dominant), red and white fir, and juniper; some shrubs (chinquapin, *Ribes*, and a small patch of red heather)

Trap Line 7 - low-gradient open mixed-conifer forest that includes Jeffrey pine, juniper, and aspen; understory of whitethorn and green-leaf manzanita; abundant thickets of willows

Trap Line 8 - montane meadow with an overstory of aspen (dominant), juniper, red and white fir, Jeffrey and lodgepole pine present; understory of bunch grasses and *Ribes* including some willows and sagebrush; fallen logs were present

Trap Line 9 - low-gradient dry meadow of sagebrush scrub(including dry graminoid vegetation, paintbrush, and a rabbitbrush) surrounded by aspen on all sides; other trees surrounding meadow included juniper, Jeffrey pine, lodgepole pine, red and white fir

Trap Line 10 - variable-gradient juniper woodland; large rock outcrops and patches of dry graminoid vegetation

Site 7, Kern Canyon:

Trap Line 1 - low-gradient montane meadow containing willows

Trap Line 2 - low-gradient forest of hardwoods and conifers; species include red fir black oak, and some cedar

Trap Line 3 - low-gradient river wash area of mixed-conifers, hardwoods, and herbaceous vegetation; species include black cottonwoods, red fir, cedar, lodgepole, and some willows

Trap Line 4 - low to slightly moderate-gradient mixed conifer forest of pines, fir, and cedar; understory of both needle mats and rocky/dry herbeceous vegetation; portions of transect near both meadows and boulder slopes

Site 8, South Side Redwood Mountain:

Trap Line 1 - moderate-gradient open mixed chaparral dominated by oak, manzanita, bay, and flannelbush

Trap Line 2 - moderate-gradient dense mixed-conifer dominated by manzanita, oak, and some buck brush

Trap Line 3 - low-gradient foothills riparian area; species include alder, live oak, poison oak, buckeye, willows, and mountain mahogany

Trap Line 4 - variable-gradient mixed chaparral/woodland dominated by oak, manzanita, and annual grasses

Trap Line 5 - moderate-gradient mixed-chaparral dominated by oak, manzanita, and some chamise, bay, and whitethorn

Trap Line 6 - moderate-gradient mixed-chaparral dominated by manzanita, oak, bear clover, and some hollyleaf redberry

Site 9, South Fork Kings Canyon:

Trap Line 1 - low-gradient montane meadow of cattails

Trap Line 2 - low-gradient mixed hardwood-conifer forest dominated by white fir, cedar, and black oak

Trap Line 3 - low-gradient montane meadow of cattails

Trap Line 4 - low to slightly moderate-gradient montane chaparral dominated by manzanita with some oak and pinyon pine; open patches of dry grasses

Trap Line 5 - low to slightly moderate-gradient forest of hardwoods (black oak) and conifers (pine and cedar); numerous boulders

Site 10, Dillonwood:

Trap Line 1 - low-gradient montane meadow

Trap Line 2 - low-gradient mixed chaparral of manzanita and whitethorn including cedar and white fir

Trap Line 3 - low to slightly moderate-gradient sequoia grove including white fir, whitethorn, and gooseberries

Trap Line 4 - low-gradient mixed-conifer forest; vegetation includes white fir, deer brush, giant sequoia, Jeffrey pine, several anthropogenic structures (cabins, chicken coop) were part of the trap line

A-IV MAMMAL, REPTILE, AND AMPHIBIAN STATUS LIST BY PARK

Order Family	Binomial Name	Common Name	SEQU	KICA Grant	KICA Other	DEPO
Amphibians						
Caudata Salamandridae	<i>Taricha torosa</i>	California newt	X	X	X	
Plethodontidae	<i>Batrachoseps gregarius</i>	gregarious slender salamander	X			
	<i>Batrachoseps kawia</i>	Sequoia slender salamander	X			
	<i>Batrachoseps regious</i>	Kings River slender salamander	X			
	<i>Ensatina eschscholtzi</i>	ensatina	X	X	X	
	<i>Hydromantes platycephalus</i>	Mount Lyell salamander	X		X	
Anura Bufonidae	<i>Bufo boreas</i>	western toad	X	X	X	
	<i>Bufo canorus</i>	Yosemite toad			X	
Hylidae	<i>Hyla regilla</i>	Pacific Treefrog	X	X	X	X
Ranidae	<i>Rana boylei</i>	foothill yellow-legged frog	E			
	<i>Rana muscosa</i>	mountain yellow-legged frog	X		X	
	<i>Rana catesbeiana</i>	bullfrog	I			
Reptiles						
Testudine Emydidae	<i>Clemmys marmorata</i>	western pond turtle	X			
Squamata Phrynosomatidae	<i>Phrynosoma coronatum</i>	coast horned lizard	E			
	<i>Sceloporus graciosus</i>	sagebrush lizard	X	X	X	X
	<i>Sceloporus occidentalis</i>	western fence lizard	X	X	X	X
	<i>Uta stansburiana</i>	side-blotched lizard	E			
Teiidae	<i>Cnemidophorus tigris</i>	western whiptail	X	X		
Scincidae	<i>Eumeces gilberti</i>	Gilbert's skink	X	X	X	
	<i>Eumeces skiltonianus</i>	western skink	?			
Anniellidae	<i>Anniella pulchra</i>	California Legless Lizard	E			
Anguillidae	<i>Elgaria coerulea</i>	northern alligator lizard	X	X	X	X
	<i>Elgaria multicarinata</i>	southern alligator lizard	X	X	?	
Boidae	<i>Charina bottae</i>	rubber boa	X	X	X	X
Colubridae	<i>Coluber constrictor</i>	racer	X			
	<i>Contia tenuis</i>	sharp-tailed snake	X	X	X	
	<i>Diadophis punctatus</i>	ring-necked snake	X	X		
	<i>Hypsiglena torquata</i>	night snake	X			
	<i>Lampropeltis getula</i>	common kingsnake	X		X	
	<i>Lampropeltis zonata</i>	California mountain kingsnake	X	X	X	
	<i>Masticophis lateralis</i>	striped racer	X		X	X
	<i>Pituophis melanoleucus</i>	gopher snake	X	X	X	
	<i>Rhinocheilus lecontei</i>	long-nosed snake	X			
	<i>Tantilla hobartsmithi</i>	southwestern black-headed snake	X			
	<i>Thamnophis couchii</i>	Couch's garter snake	X	X	X	
	<i>Thamnophis elegans</i>	western terrestrial garter snake	X	X	X	X
	<i>Thamnophis sirtalis</i>	common garter snake	X	?	?	
Viperidae	<i>Crotalus viridis</i>	western rattlesnake	X	X	X	X
Mammals						
Marsupialia Didelphidae	<i>Didelphis virginiana</i>	Virginia opossum	X	X	X	
Insectivora Soricidae	<i>Sorex monticolus</i>	montane shrew	X		X	X
	<i>Sorex ornatus</i>	ornate shrew	X		X	
	<i>Sorex palustris</i>	northern water shrew	X		X	X
	<i>Sorex trowbridgii</i>	Trowbridge's shrew	X	X	X	
Talpidae	<i>Scapanus latimanus</i>	broad-footed mole	X	X	X	
Chiroptera Vespertilionidae	<i>Antrozous pallidus</i>	pallid bat	X		X	
	<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	X			
	<i>Eptesicus fuscus</i>	big brown bat	X	X	X	X
	<i>Eudezema maculatum</i>	spotted bat	X	X	X	X
	<i>Lasionycteris noctivagans</i>	silver-haired bat		?	?	X

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Order Family	Binomial Name	Common Name	SEQU	KICA Grant	KICA Other	DEPO
	<i>Lasiurus blossevillii</i>	red bat	X		X	
	<i>Lasiurus cinereus</i>	hoary bat	X		X	X
	<i>Myotis californicus</i>	California myotis	X		X	
	<i>Myotis evotis</i>	long-eared myotis	X	X	X	X
	<i>Myotis lucifugus</i>	little brown bat	X	X	X	X
	<i>Myotis ciliolabrum</i>	small-footed myotis	X		X	
	<i>Myotis thysanodes</i>	fringed myotis	X		X	
	<i>Myotis volans</i>	long-legged myotis	X		X	X
	<i>Myotis yumanensis</i>	Yuma myotis	X		X	X
	<i>Pipistrellus hesperus</i>	western pipistrelle	X		X	
Molossidae	<i>Eumops perotis</i>	western mastiff bat	X		X	X
	<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	X		X	X
Carnivora Canidae	<i>Canis latrans</i>	coyote	X	X	X	X
	<i>Urocyon cinereoargenteus</i>	gray fox	X	X	X	
	<i>Vulpes vulpes</i>	red fox	X		?	
Ursidae	<i>Ursus americanus</i>	black bear	X	X	X	X
	<i>Ursus arctos</i>	brown bear	E		E	
Procyonidae	<i>Bassariscus astutus</i>	ringtail	X	X	X	
	<i>Procyon lotor</i>	raccoon	X	X	X	X
Mustelidae	<i>Gulo gulo</i>	wolverine	X	?	X	
	<i>Martes americana</i>	marten	X	X	X	X
	<i>Martes pennanti</i>	fisher	X	X	X	
	<i>Mustela erminea</i>	ermine	X	X	X	X
	<i>Mustela frenata</i>	long-tailed weasel	X	X	X	X
	<i>Taxidea taxus</i>	badger	X	X	X	
Mephitidae	<i>Mephitis mephitis</i>	striped skunk	X	X		
	<i>Spilogale putorius</i>	spotted skunk	X	X	X	
Felidae	<i>Puma concolor</i>	mountain lion	X	X	X	
	<i>Felis silvestris</i>	domestic cat	I			
	<i>Lynx rufus</i>	bobcat	X	X	X	
Artiodactyla Suidae	<i>Sus scrofa</i>	pig	I			
Cervidae	<i>Cervus elaphus</i>	wapiti	E		E	
	<i>Odocoileus hemionus</i>	mule deer	X	X	X	X
Bovidae	<i>Bos taurus</i>	domestic cattle	I	I	I	
	<i>Capra hircus</i>	goat (domestic)	EI			
	<i>Ovis canadensis</i>	bighorn sheep	X		X	
Rodentia Apodontaidae	<i>Aplodontia rufa</i>	mountain beaver	X	X	X	
Sciuridae	<i>Glaucomys sabrinus</i>	northern flying squirrel	X	X	X	
	<i>Marmota flaviventris</i>	yellow-bellied marmot	X	X	X	X
	<i>Sciurus griseus</i>	western gray squirrel	X	X	X	
	<i>Spermophilus beecheyi</i>	California ground squirrel	X	X	X	
	<i>Spermophilus beldingi</i>	Belding's ground squirrel			X	X
	<i>Spermophilus lateralis</i>	golden-mantled ground squirrel	X	X	X	X
	<i>Tamias alpinus</i>	alpine chipmunk	X		X	
	<i>Tamias merriami</i>	Merriam's chipmunk	X	X	X	
	<i>Tamias speciosus</i>	lodgepole chipmunk	X	X	X	X
	<i>Tamiasciurus douglasii</i>	Douglas' squirrel	X	X	X	X
Geomyidae	<i>Thomomys bottae</i>	Botta's pocket gopher	X	X	X	
	<i>Thomomys monticola</i>	mountain pocket gopher	X		X	X
Heteromyidae	<i>Chaetodipus californicus</i>	California pocket mouse	X	X	?	
Castoridae	<i>Castor canadensis</i>	beaver	X			
Muridae	<i>Peromyscus boylii</i>	brush mouse	X	X	X	X
	<i>Peromyscus californicus</i>	California mouse	X	X	X	
	<i>Peromyscus maniculatus</i>	deer mouse	X	X	X	X
	<i>Peromyscus truei</i>	pinyon mouse	X	X	X	
	<i>Reithrodontomys megalotis</i>	western harvest mouse	X			

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Order Family	Binomial Name	Common Name	SEQU	KICA Grant	KICA Other	DEPO
	<i>Microtus californicus</i>	California vole	X			
	<i>Microtus longicaudus</i>	long-tailed vole	X		X	X
	<i>Microtus montanus</i>	montane vole	X	?	X	
	<i>Neotoma cinerea</i>	bushy-tailed woodrat	X		X	
	<i>Neotoma fuscipes</i>	dusky-footed woodrat	X	X	X	
Dipodidae	<i>Zapus princeps</i>	western jumping mouse	X	X	X	
Erethizontidae	<i>Erethizon dorsatum</i>	porcupine	X	X	X	X
Lagomorpha Ochotonidae	<i>Ochotona princeps</i>	pika	X		X	
Leporidae	<i>Lepus californicus</i>	black-tailed jack rabbit	X			
	<i>Lepus townsendii</i>	white-tailed jack rabbit	X	X	X	
	<i>Sylvilagus audubonii</i>	desert cottontail	?			
	<i>Sylvilagus bachmani</i>	brush rabbit	X			
Primates Hominidae	<i>Homo sapiens</i>	human	X	X	X	X

SEQU Sequoia National Park; **KICA Grant** the portion of Kings Canyon National Park consisting of Grant Grove and Redwood Canyon; **KICA Other** the large portion of Kings Canyon National Park consisting of the south and middle forks of the Kings River and the south fork of the San Joaquin River; **DEPO** Devils Postpile National Monument; **I** introduced; **X** present; **?** Questionable record(s)

**A-V LIST OF MAMMALS, REPTILES, AND AMPHIBIANS
RECOMMENDED FOR CONTINUED SEARCH**

Order Family	Binomial Name	Common Name	SEQU	KICA Grant	KICA Other	DEPO
Amphibians						
Caudata Plethodontidae	<i>Batrachoseps gregarius</i>	gregarious slender salamander		S		
	<i>Batrachoseps regious</i>	Kings River slender salamander		S	S	
	<i>Batrachoseps relictus</i>	relictual slender salamander	S			
	<i>Batrachoseps robustus</i>	Kern Plateau salamander	S			
	<i>Batrachoseps sp.</i>	new species	S	S	S	S
	<i>Hydromantes platycephalus</i>	Mount Lyell salamander		S		S
Bufonidae	<i>Bufo canorus</i>	Yosemite toad				S
Ranidae	<i>Rana muscosa</i>	mountain yellow-legged frog				S
Reptiles						
Testudine Emyridae	<i>Clemmys marmorata</i>	western pond turtle		S	S	
Squamata Teiidae	<i>Cnemidophorus tigris</i>	western whiptail			S	
Scincidae	<i>Eumeces gilberti</i>	Gilbert's skink				S
	<i>Eumeces skiltonianus</i>	western skink	S	S		
Anniellidae	<i>Anniella pulchra</i>	California Legless Lizard	S	S	S	
Colubridae	<i>Elgaria multicarinata</i>	southern alligator lizard			S	
	<i>Coluber constrictor</i>	racer		S		
	<i>Hypsiglena torquata</i>	night snake		S		
	<i>Lampropeltis getula</i>	common kingsnake		S		
	<i>Lampropeltis zonata</i>	California mountain kingsnake				S
	<i>Masticophis lateralis</i>	striped racer		S		
	<i>Tantilla hobartsmithi</i>	southwestern black-headed snake		S		
	<i>Thamnophis sirtalis</i>	common garter snake		S	S	
Mammals						
Insectivora Soricidae	<i>Sorex monticolus</i>	montane shrew		S		
	<i>Sorex ornatus</i>	ornate shrew		S		
	<i>Sorex palustris</i>	northern water shrew		S		
	<i>Sorex trowbridgii</i>	Trowbridge's shrew				S
Talpidae	<i>Scapanus latimanus</i>	broad-footed mole				S
Chiroptera Vespertilionidae	<i>Antrozous pallidus</i>	pallid bat		S		
	<i>Corynorhinus townsendii</i>	Townsend's big-eared bat		S	S	
	<i>Lasionycteris noctivagans</i>	silver-haired bat	S	S	S	
	<i>Lasiurus blossevillii</i>	red bat		S		
	<i>Lasiurus cinereus</i>	hoary bat		S		
	<i>Myotis californicus</i>	California myotis		S		
	<i>Myotis ciliolabrum</i>	small-footed myotis		S		
	<i>Myotis thysanodes</i>	fringed myotis		S		
	<i>Myotis volans</i>	long-legged myotis		S		
	<i>Myotis yumanensis</i>	Yuma myotis		S		
	<i>Pipistrellus hesperus</i>	western pipistrelle		S		
	Molossidae	<i>Eumops perotis</i>	western mastiff bat		S	
<i>Tadarida brasiliensis</i>		Brazilian free-tailed bat		S		
Carnivora Canidae	<i>Urocyon cinereoargenteus</i>	gray fox				S
	<i>Vulpes vulpes</i>	red fox	V		S	S
Procyonidae	<i>Bassariscus astutus</i>	ringtail				S
Mustelidae	<i>Gulo gulo</i>	wolverine	V		V	
	<i>Martes pennanti</i>	fisher				S
	<i>Taxidea taxus</i>	badger				S
Mephitidae	<i>Mephitis mephitis</i>	striped skunk			S	
	<i>Spilogale putorius</i>	spotted skunk				S
Felidae	<i>Puma concolor</i>	mountain lion				S

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Order Family	Binomial Name	Common Name	SEQU	KICA Grant	KICA Other	DEPO
	<i>Lynx rufus</i>	bobcat				S
Artiodactyla Suidae	<i>Sus scrofa</i>	pig		S		
Rodentia Apodontaidae	<i>Apodonta rufa</i>	mountain beaver				S
Sciuridae	<i>Glaucomys sabrinus</i>	northern flying squirrel				S
Heteromyidae	<i>Thomomys monticola</i>	mountain pocket gopher		S		
	<i>Chaetodipus californicus</i>	California pocket mouse			S	
Castoridae	<i>Castor canadensis</i>	beaver			S	
Dipodidae	<i>Peromyscus truei</i>	pinyon mouse				S
	<i>Reithrodontomys megalotis</i>	western harvest mouse		S	S	S
	<i>Microtus californicus</i>	California vole		S		
	<i>Microtus longicaudus</i>	long-tailed vole		S		
	<i>Microtus montanus</i>	montane vole		S		S
	<i>Neotoma cinerea</i>	bushy-tailed woodrat		S		S
	<i>Zapus princeps</i>	western jumping mouse				S
Lagomorpha Leporidae	<i>Lepus americanus</i>	snowshoe hare			S	S
	<i>Lepus californicus</i>	black-tailed jack rabbit	V			
	<i>Lepus townsendii</i>	white-tailed jack rabbit				S
	<i>Sylvilagus audubonii</i>	desert cottontail	V	S		
	<i>Sylvilagus bachmani</i>	brush rabbit		S		

SEQU Sequoia National Park; KICA Grant the portion of Kings Canyon National Park consisting of Grant Grove and Redwood Canyon; KICA Other the large portion of Kings Canyon National Park consisting of the south and middle forks of the Kings River and the south fork of the San Joaquin River; DEPO Devils Postpile National Monument; S search for species; V species record(s) exist but need verification of continued existence