4.2 Wildlife

4.21) Fire Effects Monitoring

- Harold W. Werner, Fish and Wildlife Biologist, Science and Natural Resources Management, SEKI

Lead: H.Werner; Field crew: Barak Shemai and Alicia Bacci

EXECUTIVE SUMMARY

Wildlife fire effects monitoring was initiated in the East Fork Kaweah River drainage as part of the Mineral King Risk Reduction Project. The monitoring focused on rodents because of the large number of species present, their specificity to habitat structure and composition, and their importance to the ecosystem. In 2000, the monitoring concentrated on two components: 1) permanent monitoring plots to document long-term changes in rodent populations at a few of the most widespread or important habitats, and 2) serendipity surveys to determine the species and relative abundance of rodents in a majority of the drainage's major habitats for drainage-wide evaluation of fire effects.

One-hectare long-term monitoring plots were monitored in mature sequoia forest at Atwell Grove, in westside ponderosa pine forest, in Jeffrey pine forest, and in mixed chaparral. The 1,080 trapnights at the Atwell Plot produced 83 rodent captures. The population was estimated at 13 rodents. The 1996-1998 postburn increase in rodents began to decline in 1999. Sampling in 2000 showed the decline to be continuing. The lodgepole chipmonk (*Tamias speciosus*) has continued to increase its proportion of the rodent population and now is nearly codominant with deer mice (*Peromyscus maniculatus*). The only other rodent captures included a long-tailed vole (*Microtus longicaudus*).

The 2,098 trapnights at the Ponderosa Plot produced 148 rodent captures with a average population estimate of 19 rodents for the survey period. This was forty-six percent higher than the preburn population estimate. The preburn species composition changed from a nearly equal balance between deer mice (*P. maniculatus*) and brush mice (*Peromyscus boylii*) to a population that is predominantly deer mice (*P. maniculatus*). Lodgepole chipmunks (*T. speciosus*) immigrated to the plot and comprised forty-three percent of the individuals monitored in 2000. Other rodents present included a few captures of Botta's pocket gopher (*Thomomys bottae*) and long-tailed vole (*Microtus longicaudus*).

The Jeffrey plot in subalpine Jeffrey pine forest was a preburn resample to evaluate changes since the last survey in 1995. The 1,014 trapnights, produced 62 rodent captures. The estimated population of five rodents was about a quarter of the previous survey in 1997. The plot was dominated by deer mice (*P. maniculatus*) but also included lodgepole chipmunk (*T. speciosus*) and western flying squirrel (*Glaucomys sabrinus*).

The Traugers plot in mixed chaparral was a another preburn resample to evaluate changes since the last surveys in 1995 and 1999. The 420 trapnights, produced 62 rodent captures. The estimated population of 56 rodents was about the same as the previous survey in 1999. The species present in descending order of abundance were dusky-footed woodrats (*Neotoma fuscipes*), brush mice (*P. boylii*), California mice (*P. californicus*), pinyon mice (*P. truei*), California pocket mice (*Chaetodipus californicus*), and Merriam's chipmunk (*Tamias merriami*). This was the first observation of *T. merriani* within the plot.

Serendipity sampling was done in the following environments: mixed chaparral, mixed hardwood/conifer forest (recently burned and unburned), riparian area in sequoia grove (Deadwood Creek), mixed conifer forest, sagebrush/*Ribes* scrub, wet meadow, black cottonwood, Jeffrey pine, and chamise chaparral. Brush mice (*P. boylii*) dominated the mixed chaparral and mixed hardwood/conifer forest, but was also found in the mixed conifer. Deer mice (*P. maniculatus*) dominated the riparian area, but were also found

in the mixed conifer forest. The California mouse (*P. californicus*), California pocket mouse (*Chaetodipus californicus*) and dusky-footed woodrat (*N. fuscipes*) were only found in chamise chaparral. Lodgepole chipmunks (*T. speciosus*) were found primarily in mixed conifer forest, but also in Jeffrey pine and by Deadwood Creek. Long-tailed voles (*Microtus longicaudus*) were primarily found at the wet meadow, but also at Deadwood Creek. The western jumping mouse (*Zapus princeps*) was found in both the wet meadow and black cottonwood. Serendipity trapping for medium-sized mammals produced three captures of martin (*Martes americana*).

INTRODUCTION

This work was initiated to evaluate the effects of the Mineral King Risk Reduction Project (MKRRP) on selected fauna. There is considerable existing literature on fire effects on wildlife, and it demonstrates a broad range of responses from favorable to unfavorable for individual species. It is very likely that fire will cause changes in the small mammal community. To understand local responses, it is prudent to have local data under conditions typical of local burns. This report summarizes the sixth year of field surveys.

This work concentrated on small mammals for several reasons. a) First, the Mineral King area contains a relatively large number of sympatric native rodents. There are at least eleven species of rats and mice present. They range from generalists like *Peromyscus maniculatus* which occurs in a wide range of habitats and elevations to other species like *Chaetodipus californicus* which has much more specificity in its habitat requirements. b) Most rodents consume significant quantities of vegetation, and some are arboreal or otherwise dependent on plants for cover. This links them to floral composition and structure, two things that are normally affected by fire. c) Rodents do not have large home ranges. The species of rats and mice present in the East Fork Kaweah drainage typically have home ranges that are under 0.6 ha (Zeiner *et al.* 1990). Because the individuals do not roam far, rodent populations can be correlated to more discrete features of their environments than animals occupying larger areas. d) Rodents have short life histories with rapid development and maturation. Some of the species present in the MKRRP have been reported to be reproductive in about 50 days after birth, and most small mammals survive little more than a year in the wild (Orr 1976), some even less. Young disperse after being weaned. This all contributes to high potential for measurable adjustments to the rodent population structure as the habitat changes. e) Rodents are a major source of food for predatory birds, mammals, and reptiles. Rodent success or failure has a major influence on the success or failure of many larger animals. f) Finally, rodents are easy to trap, handle, and mark. It takes little time to become familiar with the local species, and there is an abundant literature on them. Until the recent discovery of hantavirus, their handling seemed to present little risk to the investigators.

Because fire can have significant effects to both the structure and vegetative composition of the habitat and because rodents present a diverse array of easy to handle respondents to habitat changes, they make good cost-effective, ecologically-significant animals for monitoring fire effects. Other major groups for which we would like to have local data, but which was not collected on this study for lack of resources include terrestrial amphibians, birds, and insects. Two of the these groups are represented by large numbers of species. Their documentation requires more observer skill, and larger plots are needed to monitor birds.

There are a number of smaller groups for which we have special interest. These include mountain beaver, forest carnivores (e.g. martin, fisher, ringtail, etc.), mule deer, bats, and brown-headed cowbirds. These represent a range of public and agency interests.

METHODS

Rodent populations were investigated from two perspectives: 1) long-term monitoring of select areas, and 2) serendipity surveys of the most common and unique habitats. The long-term monitoring is intended to document long-term changes in rodent populations and their habitat following fire under known conditions. Serendipity surveys inventory rodent species and their relative abundance within both common and unique environments to facilitate large-scale assessment of potential fire effects.

Three one-hectare permanent long-term monitoring plots were surveyed. The Atwell Plot was located in mature sequoia forest in Atwell Grove with plot center at UTM coordinates 4037147 northing and 349506 easting. The Ponderosa Plot was located in westside ponderosa pine forest with plot center at UTM coordinates 4035466 northing and 349415 easting. The Jeffrey Plot was located in a Jeffrey pine forest with plot center at UTM coordinates 4035456 northing and 355264 easting. The Traugers Plot was located in mixed chaparral with plot center at UTM coordinates 4033776 northing and 344925 easting. Plot locations and elevations were determined with a Rockwell AN/PSN-11 PLGR geographic positioning system (GPS) on averaging mode. The plots are 75 m by 135 m (flat distance) with 6 mm diameter steel stakes marking the trapping grid at 15 m intervals. Each plot contains 60 trap stations with one Sherman live trap (Model LFATDG, 7.6 x 8.9 x 22.9 cm, except at the Traugers Plot where the crew used Model XLK, 7.6 x 9.5 x 30.5 cm) normally within one meter of each station stake. The traps were normally run four nights per week. The Atwell Plot was run 18 nights from June 19, 2000 through July 21, 2000 (1,080 trapnights). The Jeffrey Plot was run for a total of 17 nights from August 28, 2000 through October 6, 2000 (1,014 trapnights). The Ponderosa Plot was run for a total of 35 nights from July 31, 2000 through September 29, 2000 (2,098 trapnights). The Traugers Plot was run for a total of eight nights from October 20, 2000 through November 9, 2000 (480 trapnights). The traps were baited with a dry mixture of rolled oats and peanut butter. A high-low thermometer was located in each plot at a shady location about 1.5 m above the ground, and a rain gage was located nearby.

Captured rodents were marked with numbered self-piercing 1 monel ear tags (Style # 1005-1 from National Band and Tag Company). Captured rodents were ear tagged, and recorded information included tag number, species, sex, age (adult, subadult), weight, hind foot length, ear notch length, tail length, and general comments. The handlers wore respirators, rubber gloves, and eye protection for hantavirus protection (Mills *et al.* 1995).

Plot populations were estimated using a modified Jolly-Seber Method (Buckland 1980). Data was stored in dBase III$^+$ files.

Serendipity trapping for rodents was done in eleven areas in the Mineral King drainage: 1) mixed chaparral near Redwood Creek surveyed for ten nights (91 trapnights, UTM coordinates 4034590 northing, 347340 easting, May 24 - June 9, 2000), 2) a patch of mixed hardwoods/conifer forest was surveyed for nine nights (68 trapnights; UTM coordinates 4035180 northing, 347740 easting, May 24 - June 8, 2000), 3) a riparian herbeceous community along a perennial stream (Deadwood Creek) in a sequoia grove for ten nights (100 trapnights; UTM coordinates 4036800 northing, 351020 easting, May 24 - June 9, 2000), 4) the mixed conifer forest near Silver City for ten nights (110 trapnights; UTM coordinates 4036630 northing, 352740 easting, May 24 - June 9, 2000), 5) sagebrush/*Ribes* scrub for one night (4 trapnights; UTM coordinates 4034870 northing, 356850 easting, May 25-26, 2000), 6) meadow for nine nights (77 trapnights; UTM coordinates 4034950 northing, 356900 easting, May 25 - June 9, 2000), 7) a stand of black cottonwood for eight nights (52 trapnights; UTM coordinates 4035240 northing, 356150 easting, May 29 - June 9, 2000), 8) Jeffrey pine for eight nights (80 trapnights; UTM coordinates 4035230 northing, 355840 easting, May 29 - June 9, 2000), 9) a recently burned stand of mixed conifer/hardwood forest for seven nights (70 trapnights; UTM coordinates 4035200 northing, 348520 easting, July 3-13, 2000), 10) an unburned stand of mixed conifer/hardwood forest for seven nights (70 trapnights; UTM coordinates 4035110 northing, 348470 easting, July 3-13, 2000), and 11)

chamise chaparral for six nights (72 trapnights; UTM coordinates 4032760 northing, 342100 easting, October 23 - November 2, 2000)

Sherman live traps were scattered loosely through these sites at approximately 15 m intervals (not measured). Serendipity surveys were conducted between May 24, 2000 and November 2, 2000 for a total of 794 trapnights in the Mineral King drainage. Catch per unit effort (captures/ trapnight) was used as a measure of relative abundance among sites. An ink spot on the fur was used to recognize recaptures.

Serendipity surveys also included some trapping for medium-sized mammals (e.g. forest carnivores) using mid-sized Tomahawk traps baited with meat and covered with burlap bags. This sampling was done from June 1, 2000 through August 24, 2000.

RESULTS AND DISCUSSION

Permanent Plots:

Atwell Plot: The Atwell Plot was located in a mature giant sequoia forest. The plot was burned on or about November 20, 1995. The plot's location, topography, preburn vegetation (trees only), preburn rodent population, and duff/litter consumption is described in Werner (1996). The postburn condition is described in Werner (1997). Since 1997, the herbaceous vegetation empirically resembles the preburn condition except that the tree density is 56% less (Werner 2000).

Eighteen nights of trapping (1,080 trapnights) produced 83 rodent captures (28 different individuals) and one capture of non-rodents (*Sorex* sp.). The mean population estimate for the Atwell Plot during the survey period was 13 individuals (95% CI = 12-15 individuals) during the early summer sampling. This estimate is about half of the population estimate from late-spring/early-summer sampling the previous year (P = 0.004) and similar to the preburn condition (Figure 4.21-1). This is the second year in a row of declining rodent populations at the Atwell Plot. The cause of the decline is unknown, but it was typical of other trapping efforts in the forested region of the East Fork Kaweah throughout the summer.

While the total plot population is similar to the preburn condition (15 rodents, Werner 1996), the species composition is different. Ninety-one percent of the preburn captures were *Peromyscus maniculatus*. During the early summer sampling in 2000, *P. maniculatus* comprised only fifty-three percent of the captures (54% of the individuals). During the last year, *P. maniculatus* have shown a steady decline in the portion of the rodent community they occupy (Table 4.21-1). Concurrently, *Tamias speciosus* has exhibited a

Table 4.21-1. Species composition of rodents captured at the Atwell Plot during 1999.

Species	Percent of Individuals	Percent of Captures
Late Spring/Early Summer Sampling in 1999		
Peromyscus maniculatus	83	94
Tamias speciosus	10	2
Glaucomys sabrinus	2	3
Peromyscus boylii	0	1
Fall Sampling in 1999		
Peromyscus maniculatus	61	65
Tamias speciosus	26	23
Glaucomys sabrinus	6	4
Microtus longicaudus	7	8
Early Summer Sampling in 2000		
Peromyscus maniculatus	54	53
Tamias speciosus	43	46
Microtus longicaudus	4	1

steady increase from insignificant to nearly codominant. During 2000 sampling, *T. speciosus* comprised forty-six percent of the captures (43% of the individuals). The other species sampled are summarized in Table 4.21-1.

Catch rates for the three rodent species were 0.041, 0.035, and 0.004 captures/trapnight for *P. maniculatus*, *T. speciosus*, and *M. longicaudus*, respectively. The catch rate for *P. maniculatus* decreased from 0.226 captures/ trapnight in 1999 to 0.041 captures/ trapnight in 2000. Meanwhile *T. speciosus* remained similar at 0.035 captures/trapnight in 2000 comparted to 0.041 captures/trapnight in 1999.

The sex ratio for *P. maniculatus* sampled was nearly equal for the individuals sampled (female = 45%, male = 55%, n = 38). Sex ratios for other species included: *T. speciosus* (female = 41%, male = 59%, n = 32), and the sex of the one *M. longicaudus* was not recorded.

Fifty-seven percent of the *P. maniculatus* and all of the *T. speciosus* captured were adults (n = 35 and 34, respectively). Age was not identified for the one *M. longicaudus.*

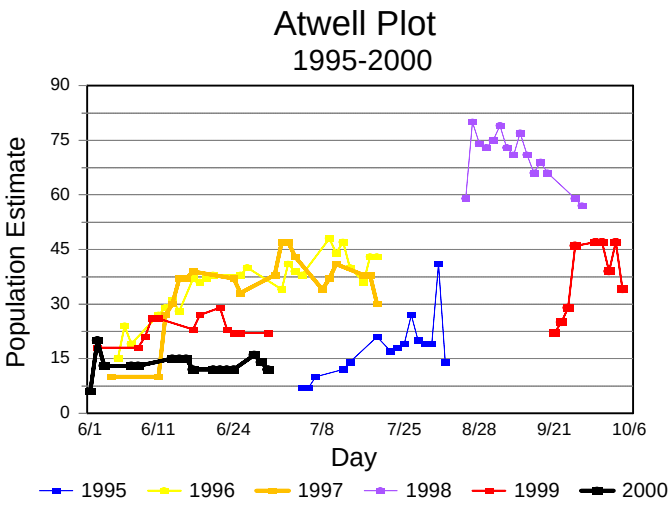

Figure 4.21-1. Population estimates at Atwell Plot, 1995 (preburn) through 2000.

Ponderosa Plot: The Ponderosa Plot was located in westside ponderosa forest. The plot was burned during the week of November 2, 1997. The plot's location, topography, preburn vegetation (trees and shrubs only), and the preburn rodent population are described in Werner (1997). In 1998, the vegetation was very different from the preburn condition. In 1998, the crew counted 24 live trees (Live is defined here as having green leaves in the preburn canopy.) in this plot which I estimated to have 1,456 trees and shrubs in 1996 (preburn; Werner 1997). Those live trees included 24 *Calocedrus decurrens*, 17 *Pinus ponderosa*, and eight *Quercus kelloggii*. Many of the oaks appeared to be regrowing from stump sprouts. The immediate postburn condition of the plot is described in Werner (1998). During the 1999 and 2000 sampling period, the forest continued to look denuded except for the sprouts around the base of oaks and the twenty-four trees that retained green canopies. The soil was covered by dense shrubs and herbaceous vegetation.

Thirty-five nights of trapping (2,098 trapnights) produced 148 rodent captures (53 different individuals). The mean population estimate during the survey period was 19 individuals (95% CI = 15 - 23 individuals). This is about half of the 1999 population estimate (41 individuals, Werner 2000; P = 0.00004) and similar (Figure 4.21-2) to the first summer post-burn (20 individuals, Werner 1999) as well as the early preburn population (28 individuals; Figure 4.21-2).

The postburn response observed at the Ponderosa Plot was the change in species composition. Prior to the burn, both *Peromyscus boylii* and *P. maniculatus* were codominant species. Since the burn, *P. maniculatus* has dominated the rodent community. However, as at the Atwell Plot, dominance by *P. maniculatus* has been declining (80 % of the individuals in 1998, 68 % in 1999, and 54% in 2000) while *Tamias speciosus* has become more abundant. *Tamias speciosus* first appeared in 1999 at which time it represented eighteen percent of the individuals surveyed. In 2000, *T. speciosus* increased to forty-three percent of the individuals surveyed (46% of captures). *Microtus longicaudus* (4 % of individuals) and *Thomomys bottae* (2 % of individuals) continued to have a minor presence on the plot.

Catch rates for the five rodent species were 0.042 captures/trapnight for *P. maniculatus*, 0.028 captures/trapnight for *T. speciosus*, 0.005 captures/trapnight for *P. boylii*, and 0.001 captures/trapnight for both *M. longicaudus* and *T. bottae*. There were two captures of a juvenile *Peromyscus* that was too young for identification to species.

The sex ratio for the sampled population of *P. maniculatus* was skewed toward males (female = 42 %, male = 58 %, n = 85). The sex ratio for the other species include: *P. boylii* (female = 62 %, male = 38 %, n = 8), *T. speciosus* (female = 45 %, male = 55 %, n = 31), *M. longicaudus* (female = 100 %, n = 2), and *T. bottae* (female = 100 %, n = 1) .

Sixty-six percent of the *P. maniculatus* captured were adults, twenty-three percent were subadults, and eleven percent were juvenile (n = 86). For the other species surveyed, *P. boylii* was forty-four percent adult (n = 9) with the balance for both species being subadults (22%) and juveniles (33%). All *T. speciosus* (n = 33), *M. longicaudus* (n=2), and *T. bottae* (n=1) were adults. The *Peromyscus* were much younger than the previous year (87% adult *P. maniculatus* and 93% adult *P. boylii* in 1999). The smaller populations and younger age of the captured mice suggest populations either recovering from a population crash or increased natality as a response to sustained higher mortality. Because capture rates and population estimates seemed to remain low throughout the summer, I suspect the latter postulate. The population estimates for 2000 (Figure 4.21-2) show the population as very low at the beginning of the summer, building up, and then crashing again.

Jeffrey Plot: The Jeffrey Plot was located in a Jeffrey pine forest classified as xeric conifer forest on vegetation maps used in the Mineral King Risk Reduction Project. The plot is described in Werner (1998). The plot was sampled to update the preburn data and to assess comparability to the previous sampling.

Seventeen nights of trapping (1,014 trapnights) produced 19 rodent captures (10 individuals). The mean population estimate during the survey period was 5 individuals (95% CI = 3-7 individuals). *Peromyscus maniculatus* dominated the sampled rodent population with seventy percent of the individuals (though only 42% of the captures). Other species included *Tamias speciosus* with twenty percent of the individuals, but fifty-three percent of the captures. The least frequently encountered species was *Glaucomys sabrinus* (10% of the individuals, 5% of the captures). Two species captured in low numbers in 1997, *Peromyscus boylii* and *Neotoma cinerea*, were not found in 2000.

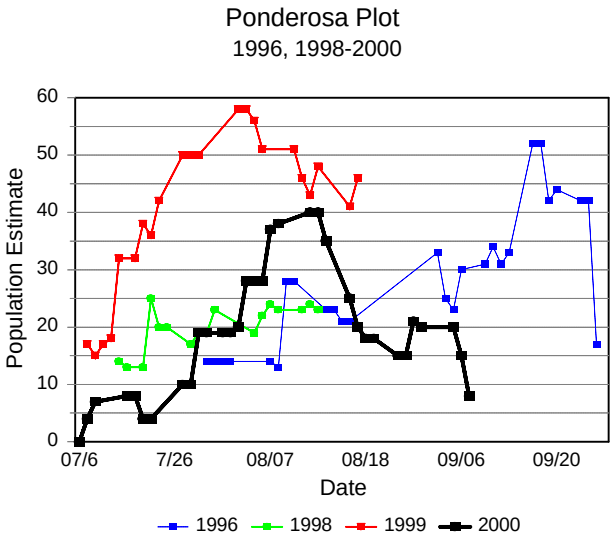

Figure 4.21-2. Population estimates at Ponderosa Plot, 1996 (preburn), 1998, 1999, and 2000.

The rodent population estimates for 2000 are only a quarter of what was present when the plot was sampled on 1996 (P = 0.001). Since then, the habitat has not been burned or subjected to any other obvious perturbation. Habitat tends to change little in the subalpine regions without a catastropic event like fire or avalanche. The decline appears to be entirely biological (e.g. disease) rather than a response to ecological change.

Catch rates for the three species of rodents were 0.008 captures/trapnight for *P. maniculatus*, 0.010 captures/trapnight for *T. speciosus*, and 0.001 captures/trapnight for *G. sabrinus.* Overall, trap success was unusually low compared to the Mineral King basin in general.

The sex ratios for the sampled population was predominately female (71%, n=14). Sex ratios for individual species are: *P. maniculatus* (female = 50%, male = 50%, n = 8), *t. speciosus* (female = 100 %, n=6), and the sex of the one *G. sabrinus* was not reported.

Most of the rodents captured were adults. This includes seventy-one percent of the *P. maniculatus* (21% subadults, 7% juveniles, n=8) and all of the *T. speciosus* and *G. sabrinus*.

Traugers Plot: The Traugers Plot was located in mixed chaparral. A description of the vegetation and topgraphy can be found in Werner (1996). This plot has not been burned since it was established in 1995. This sampling was done to update the preburn data and to assess comparability to the previous sampling. These data provide an indication of preburn variability. Empirically, the plot looked the same as in 1995.

Eight nights of trapping (420 trapnights) produced 62 rodent captures (41 individuals). The mean population estimate for the Traugers Plot during the survey period was 56 individuals (95 % CI = 33 - 78 individuals). This was about the same (P = 0.344) as when the plot was surveyed in 1999 (52 individuals; 95 % CI = 39 - 65 individuals). This was the only plot that did not appear to have unusually low population estimates in 2000.

In declining order of frequency, catch rates for the six rodent species were 0.062, 0.045, 0.024, 0.012, 0.002, and 0.002 captures/trapnight for *Neotoma fuscipes, Peromyscus boylii, Peromyscus californicus, Peromyscus truei, Chaetodipus californicus*, and *Tamias merriami*, respectively.

Table 4.21-2. Serendipity trapping results in the East Fork Kaweah River drainage.

Site Description	Species Capture Rate (captures/trapnight)								
	CHCA	**MILO**	**NEFU**	**PEBO**	**PECA**	**PEMA**	**TASP**	**ZAPR**	**ALL**
Mixed Chaparral				0.088					0.088
Mixed Hardwood/Conifer									0
Deadwood Creek		0.020				0.100	0.010		0.130
Mixed Conifer				0.009		0.027	0.045		0.082
Sagebrush/*Ribes*									0

Wet Meadow		0.078						0.065	0.143
Black Cottonwood								0.077	0.077
Jeffrey Pine							0.025		0.025
Mix Hard/Conifer Unburn				0.086					0.086
Mix Hard/Conifer Burned				0.014	0.011				0.014
Chamise Chaparral	0.014		0.028	0.028					0.153

CHCA = Chaetodipus californica, MILO = *Microtus longicaudus*, NEFU = *Neotoma fuscipes*, PEBO = *Peromyscus boylii*, PECA = *Peromyscus californicus*, PEMA = *Peromyscus maniculatus*, TASP = *Tamias speciosus*, ZAPR = *Zapus princeps*

The sex ratio for the rodents was predominantly female (64%, n=61). Sex ratios for individual species are: *N. fuscipes* (female = 76%, male = 24%, n = 25), *P. boylii* (female = 67 %, male = 33%, n=18), *P. californicus* (female = 56%, male = 44%, n = 9), *P. truei* (female = 20%, male = 80%, n = 5), *C. californicus* (unk=100%, n = 1), and *Tamias merrrami* (♂ = 100%, n = 1).

Of the predominate rodents, eighty-eight percent of the *Neotoma fuscipes* captured were adults and twelve percent were subadults (n=25. Ninety-four percent of the *P. boylii* captured were adults and six percent were subadults (n = 18). For the other species surveyed, *P. californicus* was seventy-eight percent adult (n = 9), *P. truei* were eighty percent adult (n = 5), *Tamais merrami* was adult (n=1), and the age class of the *Chaetodipus californicus* was not recorded (n = 1). The balance of the captured *P. californicus* and *P. truei* were Subadult.

Serendipity Surveys:

Rodents: The results of serendipity surveys for rodents in the East Fork Kaweah drainage are summarized in Table 4.21-2. In addition, there was a capture of *Sorex* sp. at Deadwood Creek and at the mixed conifer site. Mid-sized Mammals: The results of trapping mid-sized animals resulted in three captures of *Martes americana*. Two were at Deadwood Creek (June 2 and 6, 2000), and one was in the manzanita Jeffrey pine ecotone east of the Mineral King Ranger Station.

PLANS FOR 2001

1. Conduct postburn survey of the Atwell and Ponderosa Plots.
2. Depending on when the Traugers Plot is likely to burn, conduct preburn and immediate postburn sampling.
3. Conduct serendipity surveys in Sierra juniper and other high-elevation sites.
4. Continue development of guide to wildlife fire environments.
5. Continue postburn sampling of the Kaweah Fire if time permits.

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