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Exposure Parameters for the Deer Mouse and Rock Wren at Lawrence Livermore National Laboratory Site 300

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Environmental Restoration Department

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Executive Summary

A baseline ecological risk assessment (BERA) is being conducted for the Building 812 Operable Unit, Lawrence Livermore National Laboratory Site 300, by the United States Department of Energy (DOE) and Lawrence Livermore National Laboratory (LLNL). A baseline risk assessment work plan (BRAWP) was prepared by DOE/LLNL and approved by the United States Environmental Protection Agency, the California Department of Toxic Substance Control and the California Central Valley Regional Water Quality Control Board (collectively known as the regulatory agencies) in January 2012 (Carlsen et al. 2012). As described in the BRAWP, the deer mouse (*Peromyscus maniculatus*) and the rock wren (*Salpinctes obsoletus*) were selected as representative species for the Building 812 BERA (Section 3.1.6 of the BRAWP). As described in Sections 3.3.4.3 and 3.3.4.4 of the BRAWP, modeling will be conducted to evaluate rock wren and deer mouse exposure to uranium and other heavy metals in surface and subsurface soil.

The level of detail of the planned exposure modeling is dependent on the availability and quality of biological and natural history data for the rock wren and deer mouse. Therefore, a literature review was conducted to evaluate the available natural history and biological data, and to develop exposure parameters for the deer mouse (*Peromyscus maniculatus*) and the rock wren (*Salpinctes obsoletus*) exposure modeling from the available information. This document describes the results of the literature review, and the development of the exposure parameters.

Tables EX-1 and EX-2 shows the exposure parameters developed from the literature review for the deer mouse and rock wren, respectively. The data in these tables will be used in the following manner during the exposure modeling. Home range for each species will be mapped onto appropriate habitat at the Building 812 operable unit. For the deer mouse, home ranges for individual mice will be mapped, where as for the rock wren, home ranges for a pair will be mapped. In addition, breeding territories for the rock wren will be mapped. Exposure to uranium and heavy metals from food consumption and incidental soil consumption will be modeled for each home range and breeding territory over a time period of 1 year, representing the average life span for a deer mouse, and half the average life span for the rock wren. For the deer mouse, food intake and body weight will be adjusted for females during times of pregnancy and lactation. For the rock wren, food intake and body weight for both genders will be adjusted during periods of fledging, and for females during periods of egg incubation. For the deer mouse, food items will be adjusted during the year based on the season. Specific equations for the exposure modeling are under development, and will be provided to the regulatory agencies for review, along with the home range and breeding territory maps, prior to the commencement of exposure modeling.

Table EX-1. Deer mouse exposure parameters that will be used in the exposure modeling for the Building 812 baseline ecological risk assessment.

Exposure Parameter	Description	Primary Citations
Life span	1 year	Brown and Zeng 1989, Storer 1944, McCloskely 1972.
Home range	0.5 hectare per individual, no overlap	MacMillen 1964, Brandt 1964.
Number of Litters	4 per year, occurring in Jan-Feb (winter); Mar-Apr (spring), May-Jun (spring), and Sept-Nov (fall)	CWHRS 2010, Kritzman 1973, Merserve 1979b, MacMillen 1964.
Gestation Time	22 d	CWHRS 2010, Schreiber 1979, Millar 1982.
Time to Weaning	25 d	CWHRS 2010, Schreiber 1979, Millar 1982, Stebbins 1977.
Body Weight	Male: 20.8 g_{bw} Female (non-pregnant): 19.5 g_{bw} Female (pregnant): 23.0 g_{bw} Female (lactating): 26.2 g_{bw}	MacMillen 1964, Millar 1982, Stebbins 1977.
Daily Dry Matter Intake per unit body weight	Male: 0.15 g_{dm}/ d/g_{bw} Female (non-pregnant): 0.15 g_{dm}/ d/g_{bw} Female (pregnant): 0.17 g_{dm}/ d/g_{bw} Female (lactating): 0.30 g_{dm}/ d/g_{bw}	Schreiber 1979, Millar 1982, Stebbins 1977.
Daily Dry Matter Intake	Male: 3.3 g_{dm}/d Female (non-pregnant): 3.1 g_{dm}/d Female (pregnant): 3.9 g_{dm}/d Female (lactating): 7.9 g_{dm}/d	Schreiber 1979, Millar 1982, Stebbins 1977.

	Dietary Fraction (DF) by Food Type			
Season	Green plant material	Seed/Fruits	Invertebrate	Incidental Soil Ingestion (% dry matter intake)
Winter (Dec-Feb)	0.60	0.25	0.15	2
Spring (Mar-Jun)	0.20	0.20	0.60	2
Summer (July-Aug)	0.20	0.50	0.30	1
Fall (Sept-Nov)	0.25	0.25	0.50	2
Overall	0.31	0.30	0.39	2

Notes:

d = Day.
g = Gram.
CWHRS = California Wildlife Habitat Relationship System.
bw = Body weight.
dm = Dry Matter.

Table EX-2. Rock wren exposure parameters that will be used in the exposure modeling for the Building 812 baseline ecological risk assessment.

Exposure Parameter	Description	Primary Citations
Life span	2 years	Lowther et al. 2000, Merola 1995.
Breeding territory	4 hectare per pair, no overlap	Medin 1987, Szaro 1986, Hensley 1954.
Home range	20 hectare per pair, some overlap allowed in the periphery	Medin 1987, Szaro 1986, Hensley 1954.
Number of Nests	Two per year, first nest in mid-April, second nest in mid-May	Lowther et al. 2000, Merola 1995, Oberholser 1974, Tramontano 1964.
Incubation Time	15 d	Oppenheimer 1995, Oppenheimer and Morton 2000.
Time to Fledging	13 d	Oppenheimer 1995, Oppenheimer and Morton 2000.
Body Weight	Both sexes: 16.5 g Females nest building and egg-laying: 18 g	Lowether et al. 2000, Merola 1995, Smyth and Bartholomew 1966.
Daily Dry Matter Intake (g) per unit body weight (g) per day (d)	Both sexes (non-breeding period): 0.236 g/g/d Both sexes (fledging period): 0.267 g/g/d Female (incubation period): 0.267 g/g/d	Nagy 2001, El-Wailly 1966.
Daily Dry Matter Intake (g) per day (d)	Both sexes (non-breeding period): 3.9 g/d Both sexes (fledging period): 4.4 g/d Female (incubation period): 4.8 g/d	Nagy 2001, El-Wailly 1966.
Dietary Fraction by Food Type (all seasons)	Invertebrates: 0.99 unitless Seeds/Fruits: 0.01 unitless	Knowlton and Harmston 1942, Tramontano 1964.
Incidental Soil Ingestion	10% of dry matter intake	Beyer et al. 1994.

Notes:

d = Day.
g = Gram.
CWHRS = California Wildlife Habitat Relationships System.

Literature Search

A literature search was initially conducted to identify papers with relevant natural history and biological attributes on the deer mouse and rock wren for review. The literature search consisted of searching the following five databases: 1) Web of Science, 2) BioSciences Information Service of Biological Abstracts (BIOSIS) Previews, 3) Elton B. Stephens Company (EBSCO) Academic Complete, 4) National Technical Reports Library, and 5) Journal Storage (JSTOR). These database covered citations primarily from 1970 to present, although some older papers were represented. Older citations were primarily obtained from the reference lists of reviewed papers. The following key words/phrases were used in the literature search for each species:

- Activity patterns (seasonal, daily, and timing of reproduction).
- Life span.
- Reproductive attributes (i.e. number of litters/nests per year, number of young per litter/nest, generation time).
- Density.
- Home range.
- Body size.
- Water usage.
- Daily food intake.
- Food sources.

The results of the literature search and the subsequent literature review is described below for each species.

Deer Mouse

The initial literature search conducted for the deer mouse identified over 5,000 citations. To reduce the number of abstracts to review, the search was limited to grassland habitats, which reduced the number of abstracts to 393. However, upon review of these abstracts it was clear that most of the papers dealt with the general ecology of deer mice. Therefore, specific searches were conducted on *Peromyscus maniculatus* and the following words without habitat limitation: 1) home range, 2) density, 3) stomach contents, 4) diet, and 5) energy requirements. This search resulted in an additional 481 abstracts. The total number of abstracts reviewed were:

Abstracts from original search: 393.

Abstracts on density: 255.

Abstracts on diet: 107.

Abstracts on energy: 38.

Abstracts on home range: 64.

Abstracts on stomach contents: 17.

Total number of abstracts reviewed: 874.

Over 200 papers were obtained and reviewed (this number includes papers identified in reference lists and bibliographies in addition to the literature search). Relevant data was extracted from over 90 papers. These data are described and analyzed below. From the analysis of these data, the natural history and biological attributes shown in Tables DM-1 and DM-2 were selected for use in the Building 812 baseline ecological risk assessment.

The deer mouse is abundant or common throughout California in virtually all habitats, and is the most ubiquitous and abundant mammal in California and North America (California Wildlife Habitat Relationship System [CWHRS] 2010a). Because of its large range, the species is divided into over 60 subspecies, thought to be a series of intergrading populations (Hall 1981). Subspecies are identified primarily through geography, as many subspecies inhabit a variety of habitats in their geographic range. The taxonomy is continually being updated and many of the subspecies listed in older papers are no longer recognized. In addition, not all papers list the subspecies, although it can often be inferred by the habitat. The following subspecies were represented in the literature review:

- *P. maniculatus artemisiae*: sagebrush and forest habitats in Wyoming.
- *P. maniculatus bairdii*: short grass and tall grass prairie habitats in western and Mid-western states.
- *P. maniculatus blandus*: mesquite association, New Mexico.
- *P. maniculatus borealis*: Northwest Territories, Canada.
- *P. maniculatus gambelli*: grassland, sage scrub, shrub-steppe, and forest habitats of California, Oregon and Washington.
- *P. maniculatus gracillis*: hardwood forests of Michigan.
- *P. maniculatus labecula*: montane, boreal and coniferous forests of the Sierra Chincua in Mexico.
- *P. maniculatus nebrascensis*: Michigan.
- *P. maniculatus noveboracensis*: Forested and wooded areas in Kansas.
- *P. maniculatus nubiterrae*: mixed deciduous forests in Virginia.
- *P. maniculatus osgoodi*: grassland and forest habitats in Colorado.

The subspecies most likely to occur at Site 300, *P. maniculatus gambelii*, occurs throughout much of Washington, Oregon, California, and Baja California, and is found in a remarkably wide variety of habitats in each of these regions (MacMillen 1964). Grinnell (1933, cited in MacMillen 1964) states that it is the most abundant and widespread single mammal in California.

Natural history and biological attributes can vary substantially even within a given subspecies depending upon the type of habitat. Much of this variation is due to differences in the climate and productivity of the habitat, even for populations of the same subspecies. The presence of snow and below freezing temperatures often controls breeding and seasonal activity patterns. The productivity of the habitat often controls population density, home range, body weight, and food choices. Table DM-3 shows primary productivity of several habitat types. The habitat of the Building 812 area is primarily annual and native California grassland with very low quantities of standing biomass, with some coastal sage scrub in isolated areas. Standing biomass in the Building 812 area in early May of 2012 ranged from 32 to 110 grams (g) per square meter (m^2). Its primary productivity is most likely below that of the chaparral/coastal sage scrub but above the yucca/agave desert scrub.

In as far as possible, natural history and biological attributes were derived from papers on *P. maniculatus gambelli* or closely related subspecies found throughout the west, with a focus on lower productivity scrublands and grasslands, although high productivity forested habitats were considered as necessary.

Activity Patterns

The deer mouse is generally active year round in most western climates and habitats (CWHRS 2010a, Brown and Munger 1985, Kritzman 1974, Schreiber 1979, Seabloom et al. 1994, Stinson 1977, O'Farrell 1974, MacMillen 1964, Storer 1944). Kritzman (1974) and O'Farrell (1974) suggested that deer mice may estivate during the hottest months of the summer on the desert floor in the shrub-steppe region of eastern Washington and in the sagebrush desert of central Nevada (respectively). This was used to explain the lower activity observed during the summer, although estivation was not directly observed. MacMillen (1964) also suggested the possibility of summer estivation of *Pm. gambelli* in southern California semi-desert scrub vegetation based on observed density data. In central Nevada, deer mice were the only species active when snow was present, and the highest number of captures occurred in November through May (O'Farrell 1974). *Pm. gambelli* was also active during snow months at Bass Lake (Sierra Nevada transition zone at an elevation of approximately 4500 feet), and was trapped in snow in February and taken regularly in the autumn and winter up to January. Kenagy and Barnes (1988) also found deer mice not to hibernate in the Cascade Mountains of Washington, although winter torpor was reported for a population in Colorado (Merritt and Merritt 1980). *Pm. gambelli* is almost certainly active year round in the generally moderate climate (mild winters and warm to hot summers) of Site 300, although activity may be somewhat reduced during the warmest summer months.

Deer mice are generally nocturnal and crepuscular (most active during the twilight of dawn and dusk), although some diurnal activity can occur (CWHRS 2010, Schreiber 1979, Kritzman 1974). *Pm. gambilli* was frequently observed in the early morning or late afternoon in eastern Washington (Krizman 1974). Schreiber (1979) suggested diurnal activity may increase in the colder months.

Populations of *Pm. gambelli* in habitats and climates most similar to Site 300 appear to breed year round with a slight dip in breeding during the warmest months of the summer, consistent with the activity patterns described above. Meserve (1976b) found a constant addition of juveniles and subadults to a population of *Pm. gambelli* in upland coastal sage scrub near Irvine, California due to year round reproduction. There were large increases in the population in March, and some evidence of reduced reproduction from October through December. MacMillen (1964) found strong breeding in winter and spring in a population of *Pm. gambelli* in semi-desert scrub vegetation northeast of Clairmont, California, but there was insufficient data to determine summer and fall breeding. Populations of *Pm. gambelli* occurring in mountain climates that experience snow in the winter exhibit stronger seasonality in reproduction, although most populations even in these climates have some reproduction year round (Seabloom et al. 1994, Ginnett et al. 2003, Merritt and Merritt 1980, Jameson 1953, Storer 1944). Reproductive peaks as measured by the percentage of pregnant females occurred in January and August through October in a population of *Pm. gambelli* at Tule Lake National Wildlife Refuge in Siskiyou County, California, an area that experiences warm summers and snowy/cold winters (Seabloom et al. 1994, Ginnett et al. 2003). Jameson (1953) observed spring and autumn peaks in reproductive activity in populations of *Pm. gambelli* occurring between 3,500 and 5,000 feet in the northern Sierra Nevada of California. Consistent with increased reproductive activity in the spring and autumn in this area of the Sierra Nevada, Storer (1944) observed peaks in the population of juveniles in July through August and again October through November. In the higher elevations of the Hanford Reservation in Washington, Kritzman (1974) found the highest percentage of pregnant females in January and February, with breeding occurring through August. Populations occurring on the desert floor were restricted to breeding from October through February (Kritzman 1974, presumably due to the high temperatures that occur during the summer months. Similar spring and fall peaks in breeding activity have been observed in deer mice in the mountains of Oregon (Feldhammer 1979a), Utah (Cramer and Chapman 1992), and Montana (Metzgar 1979). Merritt and Merritt (1980) found that maximum breeding intensity of a deer mouse population on the eastern slope of the front range in the Rocky Mountains of Colorado peaked during snowmelt, and tapered off through the summer, with most activity ceasing by September.

Life Span

Few researchers actually measured life span in the field. Brown and Zeng (1989) observed a maximum longevity of 19 months in the Chihuahuan Desert of southeastern Arizona, and speculated that deer mice may live up to 2 to 3 years in the field. Conversely, Cramer and Chapman (1992) found survivorship to be around 6 months in the northern cold desert of the Bonneville Basin in northern Utah. Similarly, Wood et al. (2010) found a life span of 65 days for females and 90 days for males in the sagebrush steppe in the west Tintic Mountains in Juab County, Utah. Storer (1944) on the other hand, caught older adults in April in the northern Sierra Nevada transition zone that had been marked the year before. McCloskely (1972) measured an average month to month survivorship of *Pm. gamebelli* in coastal sage scrub in Orange County, California of 54%, with a maximum of 86%. It is likely that *Pm. gambelli* lives at least a year in the moderate climate of Site 300.

Reproductive Attributes

The review described in CWHRS (2010a) reported the following: 1) deer mice are solitary nesters that can have between two to four litters per year, 2) litter size averages 3.5 young with a range of 1-9, 3) gestation time is 22-25 days, 4) the young are raised by the mother and weaned at 22-37 days, and 5) sexual maturity occurs at about 50 days. This is consistent with values reported in reviewed literature. In a population of *Pm. gambelli* in the Sierra Nevada, Jameson (1953) found that sexual maturity was reached as early as 32 to 35 days for females and 40 to 45 days for males, and litter size ranged from 4.2 to 5.4. Also in the Sierra Nevada, Storer (1944) found new litters to occur in the spring about every 30 days. It is possible that the compressed breeding cycle that deer mice experience in mountain climates favor shorter generation times than in more moderate climates. Kritzman (1974) found *Pm. gambelli* females could produce 4 litters per year under favorable conditions in the higher elevations of the Hanford Reservation in Eastern Washington. Also on the Hanford Reservation in the northern Great Basin of Washington, Schreiber (1979) observed an average of 1.37 litters per year, with a mean number of young of 4.7. Weaning took place at 25 days. In the Cascades of Washington, Kenagy and Barnes (1988) observed up to three litters a year, with an average litter size of 4.6.

For the purposes of the Building 812 baseline ecological risk assessment, the important reproductive attributes are the number and timing of litters per year, gestation time, and the number of days to weaning. These attributes will determine the amount of daily food intake by the female, as well as the types of food eaten. For the Building 812 baseline ecological risk assessment, it will be assumed that four litters per year are produced by each female. These litters will occur in January through February, March through April, May through June and September through November, or two litters in the spring, one in the fall and one in the winter. For each of these time periods, it will be assumed that gestation time is 22 days and that the female will be lactating for 25 days. The amount of food consumer per day by the female for each of these time periods, as well as the type of food consumed, is discussed below under Food Quantity and Food Type.

Density and Home Range

While a number of papers were identified that discussed the density of *P. maniculatus*, evaluating density is complicated by the numerous methods used, the variety of habitats studied, and differing time frames and seasons. In addition, determining absolute density (that is, number of unique individuals per unit area) is time and labor intensive, typically requiring mark and recapture techniques conducted over a long period of time. Thus, many researchers report relative density, that is, the number of individuals caught for unit of trapping effort. Typical trapping effort units are 100 trap nights (the number of nights that traps were out multiplied by the number of traps out each night), or the percent trap success (the number of individuals/number of traps multiplied by 100). If percent trap success is for a single night, it is roughly equivalent to 100 trap nights.

Table DM-4 summarizes the absolute and relative density data obtained from the literature for a variety of habitats. If the paper reported the subspecies, it is identified in Table DM-4, otherwise no subspecies is listed. Generally, density increases with the productivity of the habitat, with desert habitats having the lowest density of deer mice (ranging from approximately 0.5 to 2 per hectare [ha]), followed by coastal sage scrub, alpine meadows and California annual grasslands (ranging from approximately 1 to 13 per ha), with coniferous and mixed-deciduous forests having the highest density (ranging from approximately 10 to 100 per ha). Some unusual habitats exhibited very high population densities. Extremely high densities (up to 462 per ha) were observed in populations on several Santa Barbara Islands (Drost and Fellers 1991). Densities of populations on islands in Mono Lake were also quite high (62.5 per ha), although populations found on the mainland were more in line with that expected for the habitat (6.4 per ha, Morrison et al. 1992). Deer mice living in the weedy, disturbed vegetation at the Tule Lake National Wildlife Refuge in Siskiyou County, California were found to have densities up to 1500 per ha (Seabloom et al. 1994). The density of deer mice found in Tilden Park near Berkeley, California during a multi-year study was quite low, averaging of 0.8 per ha (Brandt

1962). The density of deer mice in coastal sage scrub in Southern California ranged from 4 to 13 per ha (Meserve 1979b, McCloskey 1972, and MacMillen 1964). Densities varied seasonally in most habitats, generally following the reproductive and activity patterns described above, with a time lag of about month between increased reproductive activity and increased density as a result of juveniles being recruited into the population.

A small mammal study was conducted at Site 300 in the spring of 2002 (West 2002). Three nights of trapping with 100 traps each night was conducted in the following habitats: 1) the native grasslands between Buildings 801 and 812 both before and after the spring burn, 2) the spring/seep between Buildings 801 and 812 both before and after the burn, and 3) annual grasslands north of Buildings 812 and 801. Captures of marked animals were too low to estimate density. Captures per 100 trap nights were very low, with the native grasslands before the burn having the lowest capture rate (0.33 captures per 100 trap nights), and the annual grasslands north of Building 812 having the highest capture rate (2.67 captures per 100 trap nights). This capture rate is even lower than that reported for Tilden Park, which had a capture rate of 7.28 captures per 100 trap nights, and an estimated population density of approximately 1 per ha (Brandt 1962). Capture rates reported by Feldhammer (1979b) were in the range of 1 to 3 in marsh, sagebrush and greasewood habitat in Oregon, which yielded population density estimates of approximately 7 to 18. The grassland habitat in this study had a very low capture rate (0.02 captures per 100 trap nights), which yielded a population density estimate of less than one per hectare. It is known that capture rates can increase with increased number of traps and increased number of trap nights, so care must be taken in comparing capture rates. The relatively low number of traps and short trapping interval may have underestimated the capture rate for the Site 300 deer mouse population. However, given the available data, a population density estimate of 2 to 4 individuals per hectare is reasonable. Given the low primary productivity observed at Building 812, for the purposes of the Building 812 baseline ecological risk assessment, 2 individuals per hectare will be assumed.

As with density, there are a variety of methods available to estimate home range size, ranging from measuring the length of distance traveled through mark and recapture techniques to radio-telemetry. Table DM-5 lists the average distance travelled in meters and the average home range in hectares for a variety of habitats. If the paper only reported maximum distance traveled or home range, it is listed in **boldface** in Table DM-5. Radio-telemetry and intensive trapping studies have shown that deer mice home ranges tend to be elliptical or rectangular, rather than circular (O'Farrell 1978, Allred and Beck 1973, Wolf 1985). Therefore, if only average distance travelled was reported, home range was estimated based on a rectangle with the shorter side half the distance of the longer side.

Home range in deer mice is generally related to density, with the size of the home range decreasing with increasing density. As density increases with the productivity of the habitat, high productivity habitats can sustain a relatively large population, with individuals within that population maintaining relatively small home ranges. Individuals in desert habitats maintained home ranges up to almost 4 ha (Ghiselin 1969), where as individuals in forest habitats maintained home ranges as small as 0.03 ha (Cranford, 1984). *Pm. gambelli* home range in the Sierra Nevada was estimated to be around 0.1 ha (Storer et al. 1944). The home range of *Pm. gambelli* was around 0.4 ha in coastal sage scrub (MacMillen 1964), where as it ranged from 0.65 to 1.16 ha in grasslands in Tilden Park in Berkeley (Brandt 1964). Home ranges can change seasonally, often contracting in the winter months in snowy climates (Cranford 1984, Storer et al. 1944). The boundaries of the home range can change from month to month, but are relatively stable over long periods (Storer et al. 1944). Males can have larger home ranges than females (O'Farrell 1978, Brandt 1962), although this is not always the case (Storer et al. 1944, MacMillen 1964).

Deer mice are generally tolerant of intraspecific neighbors and will tolerate a large degree of home range overlap at high densities (O'Farrell 1980, MacMillen 1964). Males rarely exhibit aggressive behavior (MacMillen 1964), though females may defend territory during the breeding season (Storer et al. 1944). Wolf (1985) found deer mice in the mixed deciduous forest of Virginia to defend the core of their home range, and was tolerant of over lap along the periphery Although deer mice tolerate home range overlap, home ranges tend not to overlap (Wolf 1985).

For the purposes of the Building 812 baseline ecological risk assessment, a non-overlapping home range of 0.5 ha will be assumed. This is consistent with the assumed population density of 2 animals per hectare discussed above.

Water Usage

CWHRS (2010a) reports that deer mice probably search out free water sources but also obtains water from food and dew. At the Hanford Reservation in Washington, *Pm. gambelli* populations occur in areas of the reservation in which there is no rainfall in the summer and no permanent running water (Kritzman 1974). The authors conclude the primary source of water is green plant material and arthropods. Standing water is also seldom present in the semi-desert scrub of Southern California studied by MacMillen (1964), leading the author to conclude that food is the likely source of water. Laboratory studies on *Pm. gambelli* from this habitat showed vegetation to be the most important source of water (MacMillen). While Building 812 does have a permanent water source in Spring 6, it is likely that only deer mice in the immediate vicinity take advantage of this water source. For the purposes of the Building 812 baseline ecological risk assessment, it will be assumed that deer mice obtain water from their food.

Body Weight and Daily Food Intake

Table DM-6 shows the body weight of deer mice in a variety of habitats. Body weight tends to vary with habitat and density. Individuals in high productivity habitats with high population densities tend to have lower body weights than those found in lower productivity habitats. Although there is generally more food available in high productivity habitats, the higher densities and smaller home ranges probably limit the food available to individual animals, resulting in slightly lower body weight. Body weights of non-gravid females tend to be lower than that of males. The body weight of *Pm. gambelli* in semi-desert scrub vegetation in Southern California was reported to be 19.5 g for females and 20.8 g for males (MacMillen 1964). These weights will be used in the Building 812 baseline ecological risk assessment.

Table DM-7 summarizes data on the daily food intake of deer mice. Most of the information comes from laboratory studies using standard laboratory rat chow. The few studies evaluating the food intake of wild populations show these populations to consume less per unit of body mass than laboratory animals (Schreiber 1979, Hintgen and Clark 1984). Laboratory studies in which animals were fed food found in their natural habitats (seeds and seed/insect mixtures) show similar results (Anderson 1986, Reid and Brooks 1994, Lobo and Millar, Drickamer 1970). This is generally a result of the lower caloric content of most rat chow compared to wild foods.

The caloric content of rat chow ranges from 4 to 4.5 kilocalories per gram (kcal/g) (Stebbins 1997, Millar 1982). The average caloric content of the diet of *Pm. gambelli* in the northern Great Basin of Washington was 5.75 kcal/g (Schreiber 1979). The caloric content of arthropods, seeds and green vegetation in reclaimed short grass prairie in northeastern Wyoming was 5.67, 5.25 and 4.88 kcal/g, respectively (Hingtgen and Clark 1984). However, seed from some habitats have lower caloric contents, resulting in greater consumption to obtain the required amount of energy. Mice fed a mixture of sunflower seed/lepidopteran larvae ate less when compared to standard rat chow, but mice ate twice as much when fed just sunflower seeds (Reid and Brooks 1994). Mice fed lodgepole pine or white spruce seeds ate less than when fed rat chow, but ate more when fed the lower protein content subalpine fir seeds (Lobo and Millar 2011). *Pm. bardii* fed a mixture of sunflower, corn, and multiflora rose also were able to eat less per unit body mass (Drickamer 1970).

Both Hingtgen and Clark (1984) and Schrieber (1979) found reproducing females to consume more food per unit of body mass than males. Millar (1982) and Stebbins (1977) conducted laboratory studies that showed lactating females consumed additional food during lactation in direct proportion to the weight of the young they were suckling. While the energy requirements of pregnant females increased only moderately, similar to that described by Hingtgen and Clark (1984) and Schreiber (1979), energy requirements during lactation roughly doubled. The weight of females also increased from non-breeding through lactation. Female weight increased roughly 18% during pregnancy compared to non-breeding females, and increased 34% during lactation compared to non-breeding females (Millar 1982).

Therefore, for the purposes of the Building 812 baseline ecological risk assessment, the assumed female body weight of 19.5 g from MacMillen (1964) will be increased by 18% during pregnancy (23 g) and 34% during lactation (26.2 g). For both males and non-pregnant females, the dry matter intake of 0.15 g dry matter/g body mass/d from Schreiber (1979) will be used. The dry matter intake for pregnant females, 0.17 g dry matter/g body mass/d from Schreiber (1979) will also be used. The dry matter intake for non-pregnant females will be doubled to 0.30 g dry matter/g body mass/d for lactating females.

Food Sources

Table DM-8 summarizes *P. maniculatus* food sources in habitats with winter snow. Table DM-9 summarizes *P. maniculatus* food sources in habitats with no winter snow. Deer mice are omnivorous. Primary food sources are seeds/fruits, green vegetative matter and invertebrates. Unlike voles, which can consume up to 20% of their diet in roots, ingestion of roots by deer mice is insignificant (Witmer et al. 2007). The percentage of the diet these food sources comprise can vary between habitats and between seasons. Typically, *P. maniculatus* will take advantage of the most readily available food source, although some preferences have been reported.

In areas where winter snow occurs, *P. maniculatus* appears to increase invertebrate intake in the late spring and into summer, while relying on seed and green vegetative matter in the fall and winter (Jameson 1952, Flake 1973, Hingtgen and Clark 1984, Stapp 1997). Invertebrate consumption can go as high as 98% of the diet, although more typically invertebrate consumptions is around 50-60% in these habitats during spring/early summer seasons. Average year round consumption of invertebrates in these habitats is generally around ~40%. Although insects are likely available throughout the spring, summer and autumn months, seeds become more available in the late summer and fall, and thus insect consumption drops when seed availability is high. Seed and green vegetative matter are probably cached as food sources for the winter months. When seeds are readily available, they appear to be the preferred food source. Sieg et al. (1986) showed the drop in invertebrate consumption in sagebrush grasslands in Montana was due to increase seed availability, not a drop in invertebrate availability. Seed consumption made up the majority of the diet of deer mice in subalpine meadows in Colorado between May and September, ranging from 34 to 80% of the diet (Vaughan 1994). In a *Pm. gambelli* population living in a weedy, disturbed area of the Tule Lake Refuge in Siskikyou County in California, plant and seed consumption was very high, being 85 to 95% of the diet in the winter of 1991 through the summer of 1992, although invertebrate consumption did spike to 78% in the previous summer (Ginnett et al. 2003). In a no-till cropping area near Pullman, Washington, grain plants were 75 to 84% of the diet, with invertebrates no more than 12% (Witmer et al. 2007). Conifer seeds made up the majority of the spring and August diet of *P. maniculatis* occurring in subalpine forest in Colorado (Merritt and Merritt 1980). Conifer seeds also made up the majority of the deer mice diet in clear-cut areas in conifer forests in the Cascades (Gunther et al. 1983), however arthropods comprised the majority of the diet in mature forests in September, a time period when conifer seeds should have been readily available.

P. maniculatus will take advantage of very high invertebrate availability, whether from disturbance, artificial introduction of invertebrates, lack of available vegetation, or invertebrate migration dynamics. Arthropod consumption was 84 to 96% of the June-August diet in a *P. maniculatus* population in the Piceance Basin of Colorado (Haufler and Nagy 1984). The authors attributed this to the large amount of slash in the area, which provided favorable invertebrate habitat. In addition, the diet was determined by fecal analysis, which the authors showed to overestimate invertebrate consumption. The stomach contents of a single mouse trapped after a burn in a clear-cut area in the Cascades contained 100% invertebrates (Haufler and Nagy 1984). Arthropod consumption slightly dropped after a May burn in sagebrush scrub in southeastern Idaho (Halford 1981), although was still 92% of the diet. Arthropods were the majority of the diet of deer mice living in low stabilized sand dunes near Mono Lake California (Harris 1986), comprising 72 to 90% of the spring through fall diet. This is likely due to the reduced availability of seed and plant material in this habitat type. *Pm. labecula* has been shown to heavily feed on migrating monarchs in Mexico (Bower et al. 1985). Gall fly larvae, used to control invasions of spotted knapweed, can comprise 85% of the stomach contents of deer mice in prairie grasslands east of Missoula, Montana from January to April with the larvae are available (Pearson et al. 2000). Range caterpillars can comprise up to 78% of deer mice diets in July in the short grass prairie of New Mexico during periods of peak caterpillar abundance (Bellows et al. 1982).

There is much less information about the diet of *P. manicuatus* in areas with more coastal climates and no winter snow. Table DM-9 summarizes the available data for these habitats. In general, *P. maniculatus* relies much less heavily on invertebrates in more coastal climates than in continental climates. Meserve (1979b) found invertebrate consumption to average only 13% in the coastal sage scrub near Irvine, California, with the lowest consumption rates in the winter and summer, and the highest consumption rates in the spring and fall. Stapp and Polis (2003) found seed and plant materiel to comprise between 43 and 72% of the May to June diet in deer mice living on islands off the coast of Baja California, Mexico. Although limited data presented by Pitts and Barbour (1979) showed relatively low arthropod consumption by deer mice in beach and dune habitat at Point Reyes, populations of deer mice on sparsely vegetated dunes in Northern California (Osborne and Sheppe 1971) consumed arthropods at a high rate similar to that observed in the dunes near Mono Lake (Harris 1986).

Although invertebrate choices varied by habitat, invertebrates primarily consumed by deer mice include adult coleopterans (beetles), adult orthopterans (crickets and grasshoppers), and larval lepidopeterans (butterfly caterpillars). Spiders and ants were also frequently consumed.

Deer mice may also incidentally ingest soil as a consequence of consuming food items. Beyer et al. (1994) experimentally related the amount of soil ingested to the acid-insoluble ash content of scat. They then estimated soil ingestion rates for a number of species by analyzing the acid-insoluble ash and using the experimentally-derived relationship. The white-footed mouse, a close relative to the deer mouse with a very similar omnivorous diet (Stancampiano and Caire 1994, Wolf et al. 1985, Maser and Maser 1987, Drickamer 1970, Whitaker 1966) was found to consume <2% of its diet as soil. This is consistent with the 0.6 to 2.1% sand observed in the diet of *Pm. gambelli* in upland coastal sage scrub (Meserve 1976b).

It is likely that the highest arthropod consumption at Building 812 is during the spring, with a small increase in the fall with the onset of cooler temperatures and greening of the perennial vegetation. Substantial seed and vegetation caches have been observed in Site 300 deer mice (Woollett 2012). Seed and green vegetative material are probably cached in the spring to provide food during the dry summer months. The annual flora at Site 300 has a major spring bloom composed of primarily grasses and spring wild flowers, and a secondary fall bloom when the summer shrubby dicots become dominant (gum plants, tar plants, etc). The summer flora will provide substantial green plant material and seeds for the deer mice population to feed on and cache for the winter. In addition, green vegetative material likely provides a substantial component of the deer mice diet during the winter months as a result of the fall/winter germination of the annual flora. Given the data discussed in Tables DM-8 and DM-9 and consideration of the Building 812 flora and climate, the food sources shown in Table DM-2 will be used for the Site 300 Building 812 baseline ecological risk assessment.

Rock Wren

Unlike the deer mouse, there is little published information on the rock wren, and much of the information is anecdotal. The literature search identified 24 abstracts, all of which were reviewed. All scientific papers were obtained and reviewed, and an additional 25 citations were identified. Many of these citations were for large bird anthologies, such as "The Birds of Southern California" (Garrett and Dunn 1981, 408 pages), or "The Distribution of Birds in California" (Grinnell and Miller 1944, 608 pages). The treatment of the rock wren in these volumes tended to be brief, and focused on distribution and characteristics used by bird watchers to identify the bird (coloring, calls, etc.), with some information on breeding biology. Much of the relevant data from these earlier anthologies, as well as from the available scientific literature, was reviewed in detail in the most recent edition of the "Birds of North America" (Lowther et al. 2000), available on-line for a subscription fee (http://bna.birds.cornell.edu/bna/species/486). A total of 31 papers/treatments on the rock wren were reviewed from which relevant data were extracted. These data are described and analyzed below. From the analysis of these data, the natural history, biological and dietary attributes shown in Table RW-1 were selected for use in the Building 812 baseline ecological risk assessment.

Activity Patterns

The rock wren is found through out California, typically in areas with rock outcrops, although it occasionally occurs in non-rocky areas (Lowther et al. 2000). Although it is considered a neo-tropical migrant (Gutzwiller and Barrow 2008), it is a year round resident in much of California. In California, populations at higher elevations may move downslope in winter, and northern populations may move southward to southern California coastal areas and coastal islands (DeSante and Ainley 1980, Garrett and Dunn 1981). It is likely a year round resident of Site 300 (Lowther et al. 2000).

The rock wren is active year round. It is diurnal, foraging throughout the day in open areas with low cover (California Wildlife Habitat Relationships System [CWHRS] 2010b, Lowther et al. 2000). It is primarily terrestrial, often running while feeding using a combination of rapid steps and hops to move rapidly over and between rocks of various sizes and through the base of woody plants, as well as open spaces between rocks or plants (CWHRS 2010b, Verner and Boss 1980, Bent 1948). It can hop vertically from the ground to capture flying insects, and when it does fly, flights are usually short, quick and jerky (Lowther et al. 2000). Members of a breeding pair foraged at different distances from the nest in mainland California (Lowther et al. 2000). Crevices and cavities within talus, rock outcrops, or rough, earthen banks provide refuge and foraging sites.

Rock wrens generally exhibit monogamous breeding behavior, with the pairs remaining together throughout the breeding season (Lowther et al. 2000, Merola 1995). Rock wrens can have two or more broods per year under favorable conditions. In areas without winter snow, mated pairs have been observed to begin nest building activity by mid-March, with the first brood appearing in late April to May, and the second brood around mid-June (Lowther et al. 2000, Merola 1995, Tramontano 1964). In areas with winter snow, the first broods typically occur around June, with a second clutch around mid-July (Lowther et al. 2000, Walsh and Bock 1997). In some areas with winter snow, such as near Tioga Pass in the Sierra Nevada, no second brood attempts were observed (Oppenheimer and Morton 2000). The first egg of the second clutch is often laid within a day of the fledging of young within the first clutch (Merola 1995), and in some cases a day before the young of the first clutch have fledged (Walsh and Bock 1997). Both parents are active in nest building, often creating a paved walk way to the nest, the purpose of which is not completely known (Oppenheimer and Morton 1995, Merola 1995), and which is not always present (Tramontano 1964). Nest sites may be reused from year to year but only rarely reused within a single year (Merola 1995). Most reports indicate only the female incubates the clutch, with the male observed to feed the female sporadically (Oppenheimer and Morton 2000, Walsh and Bock 1997, Merola 1995), although at least one report suggests both parents incubate the clutch (CWHRS 2010b). Both parents feed the young (Walsh and Bock 1997).

For the purposes of the Building 812 ecological risk assessments, two broods during the spring months will be assumed. It is unlikely that invertebrates will be available in sufficient quantities during the summer months to sustain a third brood. This first clutch will occur in mid-

April, and the second clutch in mid-May, immediately after the young have fledged from the first clutch (see below).

Life Span

No information could be found concerning the life span of the rock wren. There was only four year to year recoveries of previously banded birds out of 430 rock wrens banded from 1955 to 1997 (Lowther et al. 2000). Merola (1995) indicated that two nest sites were reused by the same pair the following year, while three sites were used by a new pair. Thus it appears likely that rock wrens live at least 2 years.

Reproductive Attributes

Incubation time ranged from 14-16 days with an average of 15 days in rock wren populations in southern California (Oppenheimer 1995) and the Sierra Nevada (Oppenheimer and Morton 2000). Incubation time ranged from 12 to 14 days in two rock wren pairs observed west of Albuquerque, New Mexico (Merola 1995). Incubation time is measured from the appearance of the first egg to the hatching of the first egg.

Rock wren young fledged at about 13 days in both southern California and in the Sierra Nevada populations (Oppenheimer 1995, Oppenheimer and Morton 2000). Merola (1995) found young in New Mexico left the nest between 14 and 16 days.

Clutch size can range from 4-10 eggs, but is generally around 4 to 6 (Lowther et al. 2000, CWHRS 2010). Rock wren in both southern California and the Sierra Nevada had a mean clutch size of 5.6 eggs (Oppenheimer 1995, Oppenheimer and Morton 2000). Merola (1995) observed two pairs of rock wrens in New Mexico, both of which laid 5 eggs at the rate of 1 per day. Although no specific information on egg formation is available on rock wrens, in poultry a single egg typically takes one day to form from ovulation to the laying of the egg (Latour et al. 1998). The mean mass of each egg 2.27 grams (g) (range 1.84–2.73, Lowther et al. 2000). The mean weight of hatchlings in southern California are about 1.5 g (Oppenheimer 1995).

Density and Home Range

Little data is available on rock wren density, breeding territory or home range, but the data that are available show these attributes to be related. Breeding territories are formed when a breeding pair mates up for breeding and are typically defended during the breeding season, but not during non-breeding periods (Medin 1987). Home range, on the other hand, is usually larger than the breeding territory, and can be viewed as the overall area used for foraging. Density can be thought of the number of individuals foraging in a given area. Table RW-2 lists available rock wren density data for a number of habitats. As can be seen, density is typically very low, ranging from 0.06 to 0.6 birds per hectare (ha). Typically, two to eight breeding pairs are found within 40 ha. This suggests a home range size of 5 to 20 ha per pair. Defended breeding territories have been shown to be about 20% of home range size, or about 1 to 4 ha (Medin 1987, Marshall and Horn 1973).

Anecdotal observations at Building 812 suggest that likely only a single breeding pair resides in the area. It is unknown where the pair is nesting. Rock outcrops suitable for rock wren nesting occur both east and west of the Building 812 Canyon drainage. The low productivity at

Building 812 will most likely result in fairly large breeding territories and home ranges. For the purposes of the Building 812 baseline ecological risk assessment, it will be assumed that four breeding pairs reside within the 20 ha surrounding the Building 812 complex, resulting in a density of 0.4 birds per hectare. It will also be assumed that each breeding pair has a 4 ha breeding territory and a 20 ha home range. Breeding territories will be located in rock outcrops suitable for nesting, two on each side of the Building 812 Canyon. Breeding territories will not be allowed to overlap, but overlap will be allowed on home ranges. Each pair will obtain 50% of its food from its breeding territory during breeding season, with the remainder coming from the home range. During non-breeding season, rock wrens will be allowed to forage equally from throughout its home range.

Water Usage

Rock wrens are not known to drink free water. Birds kept in captivity with water available did not drink (Smyth and Bartholomew 1966). Birds were also not observed to drink water in the field in Riverside County, California, even within 10 meters (m) of water (Smyth and Bartholomew 1966). Birds in the Upper Carrizo Spring on the eastern edge of San Jacinto Mountains in Riverside County, CA were not observed to drink even at temperatures up to 40 Celsius (Smyth and Coulombe, 1971).

Body Weight and Daily Food Intake

Data on the body weight of rock wrens is sparse. Lowther et al. (2000) reported an average body weight of both sexes to be 16.5 g, based on 31 observations reported in Dunning (1984). Merola (1995) reported one female to weigh 18 g at the time of nest construction. Smyth and Bartholomew (1966) reported a range of 15 to 16 g for five adults taken from the Tununga Wash in Los Angeles County, California. Although there is no information on weight gain of females during egg laying in rock wren, a slight increase in the weight of females was observed in finches during the nest building and egg laying process (El-Wailly 1966). For the purposes of the Building 812 baseline ecological risk assessment, a weight of 16.5 g for both sexes will be assumed, with a weight of 18 g for females during nest building and egg laying.

No information was found on daily food intake for the rock wren. Therefore, the allometric equation developed by Nagy (2001) for insectivorous birds was used (dry matter intake in grams per day=0.540*body weight in grams$^{0.0705}$). This yielded a daily dry matter intake of 3.9 g, or 0.236 g dry matter intake/g body weight/d for a body weight of 16.5 g. El-Wailly (1966) found the energy needs of females to increase 13% during egg laying and incubation. There was no significant difference in energy needs between these two periods. It is also likely that energy needs would increase during the fledging period, as both parents must expend energy to feed both themselves and their young. The amount of increased energy requirements is not known, but will be assumed to be the same as nest building and egg laying for the female (13%). For the purposes of the Building 812 baseline ecological risk assessment, the daily dry matter intake values given in Table RW-1 will be assumed for the rock wren.

Food Sources

Information on the food sources of the rock wren came from two primary sources, Knowlton and Harmston (1942), and Tramontano (1964). Table RW-3 summarizes the data from these sources. Knowlton and Harmston (1942) examined 88 stomachs from rock wrens captured throughout Utah between 1934 and 1941. Tramontano (1964) evaluated stomachs collected from rock wrens taken from the Molino Canyon in the Santa Catalina Mountains of southeastern Arizona between January 1963 and July 1964. Knowlton and Harmston (1942) provided some evidence that rock wren will preferentially feed on insects in high abundance, as evidenced by the high number of leaf hoppers observed in stomachs during a time period of high leaf hopper abundance, as well as the high number of grasshoppers observed in stomachs during a period of high grasshopper abundance.

Neither paper looked at the volume of each food source within the stomach, but rather tabulated the number of each kind of taxa from all of the stomach examined. For example, in Knowlton and Harmston (1942), a total of 3,191 individual invertebrates were identified from 88 stomachs collected throughout Utah from 1935 to 1942, with 37.4% of these invertebrates from the bug order Hemiptera, and 36.7% from the ant order Hymenoptera. Insects from the orders Hemiptera (bugs), Hymenoptera (ants) and Coleoptera (beetles) were frequently consumed by rock wren. Most insects consumed were ground insects, although a few flying forms (butterflies, flies) were also consumed. A low percentage of seeds are also commonly observed in the stomachs of rock wrens. For the purposes of the Building 812 baseline ecological risk assessment, it will be assumed that invertebrates make up 99% of the rock wren diet, with seeds making up 1% of the diet for all seasons (Table RW-1).

Rock wrens may also incidentally ingest soil as a consequence of consuming food items. Beyer et al. (1994) experimentally related the amount of soil ingested to the acid-insoluble ash content of scat. They then estimated soil ingestion rates for a number of species by analyzing the acid-insoluble ash and using the experimentally derived relationship. The American woodcock, an invertivorous bird species, was found to have 10.4% soil in its diet. American woodcocks eat primarily earthworms, which have a very high soil content. Rock wrens, on the other hand, primarily eat hard bodies insects that likely have a much lower soil content. However, for the purposes of the Building 812 baseline ecological risk assessment, the rock wren will assume to consume 10% of its diet as soil.

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Deer Mouse Tables

Deer Mouse

List of Tables

Table DM-1. Deer mouse exposure parameters that will be used in the Building 812 baseline ecological risk assessment and supporting natural history information.

Attribute	Description	Primary Citations
Exposure Parameters		
Life span	1 year	Brown and Zeng 1989, Storer 1944, McCloskely 1972.
Home range	0.5 hectare per individual, no overlap	MacMillen 1964, Brandt 1964.
Number of Litters	4 per year, occurring in Jan-Feb (winter); Mar-Apr (spring), May-Jun (spring), and Sept-Nov (fall).	CWHRS 2010a, Kritzman 1973, Merserve 1979b, MacMillen 1964.
Gestation Time	22 d	CWHRS 2010a, Schreiber 1979, Millar 1982.
Time to Weaning	25 d	CWHRS 2010a, Schreiber 1979, Millar 1982, Stebbins 1977.
Body Weight	Male: 20.8 g_{bw} Female (non-pregnant): 19.5 g_{bw} Female (pregnant): 23.0 g_{bw} Female (lactating): 26.2 g_{bw}	MacMillen 1964, Millar 1982, Stebbins 1977.
Daily Dry Matter Intake per unit body weight	Male: 0.15 g_{dm}/ d/g_{bw} Female (non-pregnant): 0.15 g_{dm}/ d/g_{bw} Female (pregnant): 0.17 g_{dm}/ d/g_{bw} Female (lactating): 0.30 g_{dm}/ d/g_{bw}	Schreiber 1979, Millar 1982, Stebbins 1977.
Daily Dry Matter Intake	Male: 3.3 g_{dm}/d Female (non-pregnant): 3.1 g_{dm}/d Female (pregnant): 3.9 g_{dm}/d Female (lactating): 7.9 g_{dm}/d	Schreiber 1979, Millar 1982, Stebbins 1977.
Supporting Natural History Information		
Seasonal Activity Pattern	Active year round with some reduction in activity during warmest summer months.	Kritzman 1973, Schreiber 1979, O'Farrell 1974, MacMillen 1964, Storer 1944.
Daily Activity Pattern	Nocturnal and crepuscular with limited periods of diurnal activity.	Kritzman 1973, Schreiber 1979.
Reproduction Timing	Year round reproduction with a drop in activity between July and August.	Meserve 1979b, MacMillen 1964.
Density	2 individuals per hectare	West 2002, Meserve 1979b, Feldhammer 1979a, McCloskey 1972, MacMillen 1964, Brandt 1964.
Water usage	Obtains water from food	CWHRS 2010a, Krizman 1973, MacMillen 1964.

Notes:

d = Day.
g = Gram.
CWHRS = California Wildlife Habitat Relationship System.
bw = Body weight.
dm = Dry Matter.

Table DM-2. Deer mouse dietary fraction by food type that will be used in the Building 812 baseline ecological risk assessment.

	Dietary Fraction (DF) by Food Type			
Season	Green plant material	Seed/Fruits	Invertebrate	Incidental Soil Ingestion (% dry matter intake)
Winter (Dec-Feb)	0.60	0.25	0.15	2
Spring (Mar-Jun)	0.20	0.20	0.60	2
Summer (July-Aug)	0.20	0.50	0.30	1
Fall (Sept-Nov)	0.25	0.25	0.50	2
Overall	0.31	0.30	0.39	2

Table DM-3. Primary productivity of representative habitats as presented by Mueller and Diamond 2001.

Habitat Type	Productivity, g C per m^2 per year
Lower Sonoran desert	48
Yucca/agave desert scrub	67
Chaparral/coastal sage scrub	340
Deciduous woodland/meadow	600
Mixed deciduous-coniferous forest	604

Notes:

g = Gram.
C = Carbon.
m^2 = Square meter.

Table DM-4. Summary of density data for the deer mouse.

Maximum Density (ind/ha)	Captures/ 100 trap nights	Species	Habitat	Citation	Notes
0.5	NR	*P. maniculatus*	AZ: Chihuahuan Desert southeastern AZ.	Brown and Munger 1985	Season not specified.
2	NR	*P. maniculatus*	AZ: Chihuahuan Desert southeastern AZ.	Brown and Zeng 1989	Average of 0.28 individuals per hectare, but fluctuated up to 2/ha over the 4 year study. Peak in October, low in June.
9.6	NR	*P. maniculatus*	AZ: Ponderosa pine forest in northern Arizona and New Mexico.	Converse et al. 2006	Density range 0 to 9.6 individuals per hectare in July and August.
34.9	81.3	*P. maniculatus*	BC: Forest, clear cut, and clear cut burned sites in west central British Columbia.	Sullivan et al. 1999	Range for all sites, 6.7 to 34.9 individuals per hectare. Collected over 2-4 week intervals from May through October in 1988 through 1992. Relative density data is percent trap success.
0.8	7.28	*P. maniculatus gambelii*	CA: Tilden Regional Park near Berkeley, CA. Annual grasses and forb predominate, with perennial grasses (*Elymus*), coyote bush scrub and salix in moister areas.	Brandt 1962	Density range of 0.1 to 0.8 individuals per hectare. Weekly trapping from December 1950 to June 1952. Densities lowest in spring (0.25 to 0.5 per acre). Increasing in summer 1.25 per acre, and peaking in fall (over 2 per acre) before decreasing again in winter.
4	NR	*P. maniculatus gambelii*	CA: Irvine Ranch, San Joaquin Hills of Orange County, coastal sage scrub association	M'Closkey 1972	Density Ranges 0 to 4 individuals per hectare. Trapping at one month intervals from July 1968 to October 1970.
6.17	NR	*P. maniculatus gambelii*	CA: Semidesert scrub vegetation. Northeast of Clairmont, Los Angelos County.	MacMillen 1964	Density range 0 to 6.17 individuals per hectare. High in January through April, lower in summer and fall months.
12	NR	*P. maniculatus*	CA: Mixed conifer forest, juniper woodland and Shrub-Steppe: Eagle Lake Biological Field Station, Susanville, Lassen County.	Gillespie et al. 2008	Trapped in September 1996-2004. Captures per 100 trap nights range from 0 to 12. Hightest in Juniper woodland, lowest in mixed conifer. Abundance consistently positive relationship with annual precipitation in juniper woodland and with summer precipitation in the shrub-steppe, but exhibited little evidence of any relationship in mixed conifer forest. All three had significant variation in abundance between years.
13	NR	*P. maniculatus gambelii*	CA: San Joaquin Hills. Upland coastal sage scrub near Irvine, CA.	Meserve 1976b	Range of 3.9 to 13 individuals/ha. Peak in December through June, low in July through August.
35	NR	*P. maniculatus*	CA: Coastal coniferous forest.	Pitts and Barbour 1979	Density range of 10 to 35 cited by Pitts and Barbour 1979. Season not specified.
40	12	*P. maniculatus*	CA: Beach and dune at Point Reyes	Pitts and Barbour 1979	Range of 14 to 40 individual per hectare estimated by authors using data from January 1975 to April 1976, but capture/recapture rate very low and authors thought density to be considerably lower. Maximum in January-February.
42	NR	*P. maniculatus*	CA: Bass lake, transition zone, 4500 feet.	Storer, 1944	Range of 14.8 to 42 individuals/ha. Low in December and June, high in July through August.
113	NR	*P. maniculatus*	CA: Four types of coniferous forests: white fir, red fir, mixed-fir and pine-cedar in the Sierra Nevada.	Wilson et al. 2008	Density ranges from 0.7 to 7.3 individuals per hectare in 2003 to 86-113 individuals. Monthly trapping May to October. Increase in population between 2003 and 2004 coincided with increased cone/seed production.
462	NR	*P. maniculatus*	CA: Santa Barbara Island in Southern California.	Drost and Fellers 1991	Extreme density fluctuations of 2 to 462 individuals per hectare. Fluctuates on 3-4 year cycles. Cyclic increase follows winters with high rainfall, decrease after winters of low rainfall. Peak and early decline almost complete cessation of breeding and high predation by barn owls.
1500	141	*P. maniculatus gambelii*	CA: Tule Lake National Wildlife Refuge, Siskiyou County. Primarily weedy vegetation.	Seabloom et al. 1994	Exceedingly high density. Season not specified. Monthly trapping September 1982 to August 1983 to collect relative density data.

Table DM-4. Summary of density data for the deer mouse. (Continued)

Maximum Density (ind/ha)	Captures/ 100 trap nights	Species	Habitat	Citation	Notes
NR	0.33	*P. maniculatus*	CA: Site 300, native grassland, south of Route 3 in between 801 and 812 before burn.	West 2002	May of 2002, three nights of 100 traps each night.
NR	1	*P. maniculatus*	CA: Elk Hills region of the southern San Joaquin Valley.	Cypher 2001	Live trapped 20 sites, 5 in each of four regions. September 1993-1996. Capture rates ranged from 0.1 to 1. Capture rates did not vary significantly by year, but was highest in the north hilly region.
NR	1.00	*P. maniculatus*	CA: Site 300, spring/seep, south of Route 3 in between 801 and 812 after burn.	West 2002	June of 2002, three nights of 100 traps each night.
NR	1.00	*P. maniculatus*	CA: Site 300, spring/seep, south of Route 3 in between 801 and 812 before burn.	West 2002	May of 2002, three nights of 100 traps each night.
NR	1.33	*P. maniculatus*	CA: Site 300, native grassland, south of Route 3 in between 801 and 812 after burn.	West 2002	June of 2002, three nights of 100 traps each night.
NR	2.67	*P. maniculatus*	CA: Site 300, annual grassland, north of 801 and 812.	West 2002	June of 2002, three nights of 100 traps each night.
NR	6.4	*P. maniculatus*	CA: Mainland of of Mono Lake.	Morrison et al. 1992	Trapping May to June.
NR	62.5	*P. maniculatus*	CA: Paoha Island, Negit Island in Mono Lake.	Morrison et al. 1992	Trapping May to June for Paoha, and August for Negit. Individuals per 100 trap nights highest on Negit Island (62.5), lower on Paoha (14.2).
NR	65	*P. maniculatus gambelii*	CA: Tule Lake National Wildlife Refuge, Siskiyou County. Primarily weedy vegetation.	Ginnett et al. 2003	Trapping success lowest in fall and highest in spring and summer. Trapping from May through October, 1988 through 1992.
NR	NR	*P. maniculatus*	CA: Northern Sierra Nevada between 3500 and 5000 feet in Plumas County.	Jameson 1952	Trapping success in coniferous forest generally lowest in February. In brushfields, peak in autumn. Some lull in summer/early autumn in non-mast years.
3.1	NR	*P. maniculatus*	CO: Subalpine meadows of Northern Co. Rabbit Ears Pass, Grand County Colorado.	Vaughan 1974	Range of 2.5 to 3.1 individuals per hectare. Sampling in summer from end of snow melt to early September.
3.7	NR	*P. maniculatus*	CO: Wet aspen in Colorado.	Merritt and Merritt 1980	Mid-Summer.
11.3	NR	*P. maniculatus*	CO: Subalpine aspen forest in Colorado.	Merritt and Merritt 1980	Autumn.
11.6	NR	*P. maniculatus*	CO: Dry aspen in Colorado.	Merritt and Merritt 1980	Mid-Summer.
17.9	NR	*P. maniculatus*	CO: Limber pine burn in Colorado.	Merritt and Merritt 1980	Mid-Summer.
22.7	NR	*P. maniculatus*	CO: Semiarid, pygmy forest of juniper and pinyon pice with big sage and greasewood in Piceance Basin of western Colorado.	Douglass 1989	Density range from 12.7 to 22.7 individuals per hectare. Monthly trapping between 1980 and 1982 showed density peaks in autumn and spring, and lows in summer and winter.
26.7	NR	*P. maniculatus*	CO: Eastern slop of the front range in the Rocky Mtns of Colorado.	Merritt and Merritt 1980	Range of 2.5 individuals/ha in June to 26.7 individuals/ha in September.
29.6	NR	*P. maniculatus*	CO: Festuca meadow near Gothic County, Colorado.	Merritt and Merritt 1980	Summer.
58.3	NR	*P. maniculatus*	ID: Waste burial site at INEL, sagebrush steppe and crested wheatgrass/Russian thistle.	Groves and Keller 1983	Density ranges 41.2 to 58.3. May 1978 through July 1979. Population densities peaked in Autumn.

Table DM-4. Summary of density data for the deer mouse. (Continued)

Maximum Density (ind/ha)	Captures/ 100 trap nights	Species	Habitat	Citation	Notes
NR	8	*P. maniculatus*	ID: Sagebrush scrub in southeastern Idaho.	Halford 1981	May.
27.5	NR	*P. maniculatus*	MT: University of Montana Arboretum, some open pine, mainly with a dense understory of wild rose and alder.	Metzgar 1979	Density range of 3.9 to 27.5 individuals per hectare. Monthly trapping from July 1970 to June 1972. Peaked in June to October of 1971 and again March to April of 1972.
NR	7.9	*P. maniculatus*	MX: Mainland coast of Baja California, Mexico.	Stapp and Polis 2003a	May and June 1997.
NR	25.6	*P. maniculatus*	MX: Islands off the coast of Baja California, Mexico with sparse vegetation dominated by perennial shrubs and cacti.	Stapp and Polis 2003a	May and June 1997.
7.78	NR	*P. maniculatus*	NV: Big sagebrush-shadscale, shadscale, big sagebrush, greasewood and marsh-meadow habitats in Whirlwind Valley, Eureka and Lander Counties, Nevada.	O'Farrell and Clark 1986	Density range of 0 to 7.78 individuals per hectare. Seasonal trapping, May, July, September and January, 1983.
6.17	NR	*P. maniculatus*	OR: Douglas fir forest in west central Oregon	Gashwiler 1959	Range from 0 to 6.7 individuals per hectare. Trapping from May to November in 1954 and 1955.
7.3	1.04	*P. maniculatus*	OR: Marsh habitat at the Malheur National Wildlife Refuge in Harney Basin, Harney County, Oregon.	Feldhammer 1979a	Range from 0 to 7.3 individuals per hectare. Trapping done in July-September 1973, June-August 1974, September-November 1974 and April-June 1975. No season in which density was consistently highest, although generally lower in the summer.
13.6	1.86	*P. maniculatus*	OR: Sagebrush habitat at the Malheur National Wildlife Refuge in Harney Basin, Harney County, Oregon.	Feldhammer 1979a	Range from 0.9 to 13.6 individuals per hectare. Trapping done in July-September 1973, June-August 1974, September-November 1974 and April-June 1975. No season in which density was consistently highest, although generally lower in the summer. Feldhammer 1979b reported that homerange size negatively correlated with density in sagebrush.
18.2	2.98	*P. maniculatus*	OR: Greasewood habitat at the Malheur National Wildlife Refuge in Harney Basin, Harney County, Oregon.	Feldhammer 1979a	Range from 1.8 to 18.2 individuals per hectare. Trapping done in July-September 1973, June-August 1974, September-November 1974 and April-June 1975. No season in which density was consistently highest, although generally lower in the summer.
<1	0.02	*P. maniculatus*	OR: Grassland habitat at the Malheur National Wildlife Refuge in Harney Basin, Harney County, Oregon.	Feldhammer 1979a	Trapping numbers too low to estimate density. Trapping done in July-September 1973, June-August 1974, September-November 1974 and April-June 1975.
22.4	NR	*P. maniculatus*	UT: Two subalpine sites in the Wasatch Mountain Range of Utah.	Cranford 1984	2.2 to 22.4 per ha. Trapped every three weekds from May to October, and every six weeks during snow season. Lowest in November-February. Peaked in October and steadily declined until the onset of breeding in late April and early May.
50	NR	*P. maniculatus*	UT: Sagebrush steppe with juniper. West Tintic Mountains, Juab Co, Utah.	Wood et al. 2010	Season of trapping not specified, but assumed to be similar as homerange estimation. Authors discussed that homerange often contracts with density.
4	6.9	*P. maniculatus nubiterrae*	VA: Mountain Lake Biological Station in southwestern Virginia, oak and maple forest.	Wolff and Durr 1986	Same density in November and April.
57	NR	*P. maniculatus nubiterrae*	VA: Mixed deciduous forest in Giles County, Virginia.	Wolff 1985	April through November in 1981 and 1982. Combined data for *P. maniculatus* and *P. leucopus*. Density range of 6 to 57 individuals per hectare. As density increased, home range decreased only slightly. Defended core, overlap in periphery.

Table DM-4. Summary of density data for the deer mouse. (Continued)

Maximum Density (ind/ha)	Captures/ 100 trap nights	Species	Habitat	Citation	Notes
66	NR	*P. maniculatus*	VA: Mountain Lake Biological Station in southwestern Virginia, oak and maple forest.	Clotfelter et al. 2007	Density range 3 to 66 individuals per ha, with an average of 25.5 per ha over 23 years. Trapping done April to October. Density positively related to oak mast with a one year delay, the mast from the previous autumn having the most impact.
103	NR	*P. maniculatus (nubiterrae)*	VA: Mountain Lake Biological Station in southwestern Virginia, oak and maple forest.	Wolff 1994	Season not specified. Densities ranged from 50 to 103 individuals per hectare.
NR	0.97	*P. maniculatus*	WA: Northern Great Basin, Washington Hanford Reservation. Artemisia-Poa association.	Schreiber 1979	September-November 1969, March-May 1970 and June to May 1971. Very low capture rate, but taken at all times of year.
NR	2.3	*P. maniculatus*	WA: Clear cut conifer forest in Western Cascade Mountains.	Gunther et al. 1983	July through September.
NR	1	*P. maniculatus*	WA: Northern Great Basin. Artemisia-Poa association.	Schreiber 1979	Percent trap success for monthly trapping from September and November 1969, March, April and May of 1970, and June 1970 to May 1971.
NR	4	*P. maniculatus gambelii*	WA: Hanford Reservation, shrub-steppe region of eastern Washington. Desert floor (152 meters)	Kritzman 1974	April to September.
NR	28	*P. maniculatus gambelii*	WA: Hanford Reservation, shrub-steppe region of eastern Washington. Top of Rattlesnake Mountain (1097 meters).	Kritzman 1974	April to September.
7.9	NR	*P. maniculatus*	WY: Alpine meadow in Jackson Hole Valley in northwestern Wyoming.	Merritt and Merritt 1980	Summer.
8.4	NR	*P. maniculatus*	WY: Aspen in Jackson Hole Valley in northwestern Wyoming.	Merritt and Merritt 1980	Summer.
14	NR	*P. maniculatus*	WY: Reclaimed short grass prairie in north eastern Wyoming.	Hingtgen and Clark 1984	June-Sept. Not much variation over sampling period.
14.8	NR	*P. maniculatus*	WY: Sage in Jackson Hole Valley in northwestern Wyoming.	Merritt and Merritt 1980	Summer.
34.6	NR	*P. maniculatus*	WY: Spruce-fir-pine in Jackson Hole Valley in northwestern Wyoming.	Merritt and Merritt 1980	Summer.
12	NR	*P. maniculatus*	Yukon: Kluane region of the Yukon, Canada, boreal forest	Krebs et al. 2010	Density ranges from 0 to 12 individuals per hectare. Average for 1997-2009 1.5 per hectare. Berry crop in cached to provide overwinter survival. Predicted density based on berry crop very closely matched observed density.

Notes:

AZ = **Arizona.**
BC = **British Columb**
CA = **California.**
CO = **Colorado.**
ha = **Hectare.**
ID = **Idaho.**
ind = **Individual.**
INEL = **Idaho National Engineering Laboratory.**
MT = **Montana.**
MX = **Mexico.**
NR = **Not reported.**
NV = **Nevada**
OR = **Oregon.**
UT = **Utah.**
VA = **Virginia.**
WY = **Wyoming.**
WA = **Washington.**

Table DM-5. Summary of home range data for the deer mouse.

Avg (*max*) distance (m)	Avg (*max*) Home range (ha)	Gender	Species	Habitat	Citation	Notes
NR	0.04	Both	*P. maniculatus*	AK: Immature oak-pine forests in Jefferson County.	Redman and Sealander 1958	
NR	1.18	Male	*P. maniculatus*	AL: Kananaskis Valley, Coniferous forest in Alberta Canada.	Ribble and Millar 1996	
116	0.67	Both	*P. maniculatus*	AZ: Chihuahuan Desert of southeastern Arizona.	Brown and Zeng 1989	Dispersal limited to juviniles. Adults move to find better food, den sites or mating opportunities. *Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
32	0.05	Both	*P. maniculatus*	CA: Beach and dune at Point Reyes.	Pitts and Barbour 1979	*Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
117	0.085	Female	*P. maniculatus*	CA: Bass lake, Sierra Nevada transition zone.	Storer et al. 1944	Females may defend home range during breeding season.
104	0.1	Male	*P. maniculatus*	CA: Bass lake, Sierra Nevada transition zone.	Storer et al. 1944	Boundaries are elastic month to month, but stable over long periods. Overlap occurred occasionally when food abundant. Changes in home range occurred in winter.
NR	0.4	Both	*P. maniculatus gambelii*	CA: 3 miles northeast of Clairmont, Los Angeles County. Semidesert scrub vegetation.	MacMillen 1964	Home ranges between males and females not significantly different. Of animals catured during a period of high population density, homeranges of males overlapped broadly while those of the females practically not at all.
114	0.65	Female	*P. maniculatus gambelii*	CA: Tilden Regional Park near Berkeley, CA. 600 to 1200 feet. Annual grasses and forb predominate, with perennial grasses, coyote bush scrub and salix in moister areas.	Brandt 1962	Weekly grid live trapping for 15 mo. *Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
152	1.16	Male	*P. maniculatus gambelii*	CA: Tilden Regional Park near Berkeley, CA. 600 to 1200 feet (see above).	Brandt 1962	Weekly grid live trapping for 15 mo. *Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
NR	***1.2***	NR	*P. maniculatus*	ID: INEL sagebrush desert of southeastern Idaho.	Halford 1981	Range of 0.1 to 1.2 ha.
NR	0.30	Both	*P. maniculatus*	KA: Kansas.	MacMillen 1964	From Fitch (1958), cited in MacMillen (1964).
NR	0.25	Female	*P. maniculatus bairdii*	MI: Pairie deer mouse in Southern Michigan.	MacMillen 1964	From Blair (1940), cited in MacMillen (1964) and Blair (1942).

Table DM-5. Summary of home range data for the deer mouse. (Continued)

Avg (*max*) distance (m)	Avg (*max*) Home range (ha)	Gender	Species	Habitat	Citation	Notes
NR	0.31	Male	*P. maniculatus bairdii*	MI: Pairie deer mouse in Southern Michigan.	MacMillen 1964	From Blair (1940), cited in MacMillen (1964) and Blair (1942).
NR	0.56	Female	*P. maniculatus gracilis*	MI: Woodland deer mouse in hardwood forest Alger County.	Blair 1942	August 25 through September 22, 1940.
NR	0.94	Male	*P. maniculatus gracilis*	MI: Woodland deer mouse in hardwood forest Alger County.	Blair 1942	August 25 through September 22, 1940.
NR	0.2813	Both	*P. maniculatus*	MT: Antelope bitterbrush habitat near Anaconda.	Douglass et al. 2006	Determined through radiotracking.
NR	0.3	Female	*P. maniculatus*	MT: University of Montana Arboretum, some open pine, mainly with a dense understory of wild rose and alder.	Metzgar 1979	July 1970 through June 1972 monthly trapping.
NR	0.9	Male	*P. maniculatus artemesii*	MT: University of Montana Arboretum, some open pine, mainly with a dense understory of wild rose and alder.	Metzgar 1979	July 1970 through June 1972 monthly trapping.
100	0.785	Both	*P. maniculatus*	NM: Four sites in New Mexico.	Abramson et al. 2006	Calculated based on a circular home range by author.
NR	1.60	Female	*P. maniculatus blandus*	NM: Mesquite association.	Feldhammer 1979b	From Blair (1943), cited in Feldhammer (1979b).
NR	1.77	Both	*P. maniculatus blandus*	NM: Mesquite habitat.	Abramson et al. 2006	From Stickel (1968), cited in Abramson et al. (2006). Single observation during the summer. Range of 0.67 to 4.02 ha.
NR	1.89	Male	*P. maniculatus blandus*	NM: Mesquite association.	MacMillen 1964	From Blair (1943), cited in MacMillen (1964).
101	0.51	Female	*P. maniculatus*	NV: Nevada Test Site, Nye County.	Allred and Beck 1963	Home ranges shown graphically, more eliptical or rectangular than circular. *Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
160	1.28	Male	*P. maniculatus*	NV: Nevada Test Site, Nye County.	Allred and Beck 1963	Home ranges shown graphically, more eliptical or rectangular than circular. *Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
185	1.71	Female	*P. maniculatus*	NV: Upper Sonoran desert of Central Nevada, little greasewood/shadescale association.	Ghiselin 1969	*Home range estimated based on a rectangle with shorter side 1/2 of longer side.*

Table DM-5. Summary of home range data for the deer mouse. (Continued)

Avg (*max*) distance (m)	Avg (*max*) Home range (ha)	Gender	Species	Habitat	Citation	Notes
NR	1.9	Both	*P. maniculatus*	NV: Sagebrush desert of western Nevada. North of Sparks.	O'Farrell 1978	Range of 0.4 ha to between November and December and 1.9 between February and March. Females tended to have a slightly smaller home range.
NR	2	Female	*P. maniculatus*	NV: Unspecified desert habitat.	O'Farrell 1978	From Jorgensen and Hayward (1965), cited in O'Farrell (1978), which stated that It appears a large home range is maintained in desert habitats possibly due to a scattered distrubution of food. Males exhibited longer movements than females.
NR	2.8	Male	*P. maniculatus*	NV: Unspecified desert habitat.	O'Farrell 1978	From Jorgensen and Hayward (1965), cited in O'Farrell (1978), which stated that It appears a large home range is maintained in desert habitats possibly due to a scattered distrubution of food. Males exhibited longer movements than females.
279	3.89	Male	*P. maniculatus*	NV: Upper Sonoran desert of Central Nevada, little greasewood/shadescale association.	Ghiselin 1969	*Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
NR	0.0371	Male	*P. maniculatus*	OR: Malheur National Wildlife Refuge, Harney County, sagebrush and greasewood.	Feldhammer 1979b	Summer 1974, fall 1974, spring 1975. No difference in either gender by season. Males and females no difference in sagebrush, but was different in greasewood, males with a larger range. Males no difference in the two habitats. Male home range size negatively correlated with density in sagebrush.
NR	0.0392	Female	*P. maniculatus*	OR: Malheur National Wildlife Refuge, Harney County, sagebrush and greasewood.	Feldhammer 1979b	Summer 1974, fall 1974, spring 1975. Female home range significantly larger in sagebrush than greasewood. Home range size both genders combined negatively correlated with density in sagebrush.
NR	0.026	Female	*P. maniculatus*	UT: Two subalpine sites in the Wasatch Mountain Range.	Cranford 1984	
NR	0.039	Male	*P. maniculatus*	UT: Two subalpine sites in the Wasatch Mountain Range.	Cranford 1984	Difference between males and females only during the snow free period when males occupied significantly larger homeranges. Both had smaller home ranges in winter.
NR	0.5868	Both	*P. maniculatus*	UT: Sagebrush steppe with juniper. West Tintic Mountains, Juab County.	Wood et al. 2010	June to September 2006. Did not alter home range significanlty over time.
NR	0.059	Both	*P. maniculatus nubiterrae*	VA: Mixed deciduous forest in Giles County.	Wolff 1985	April through November in 1981 and 1982, Home range by radiotelemetry and trapping. As density increased, home range decreased only slightly. Defended core, overlap in periphery.

Table DM-5. Summary of home range data for the deer mouse. (Continued)

Avg (*max*) distance (m)	Avg (*max*) Home range (ha)	Gender	Species	Habitat	Citation	Notes
45	0.10	Both	*P. maniculatus*	WA: Waste burial site at INEL, sagebrush steppe and crested wheatgrass/Russian thistle.	Groves and Keller 1986	May 1978 through July 1979. *Home range estimated based on a rectangle with shorter side 1/2 of longer side.*
178	1.58	Both	*P. maniculatus*	WA: Rocky flat, Northern Yakima County.	Broadbooks 1961	Range of 104 to 232 meter. *Home range estimated based on a rectangle with shorter side 1/2 of longer side.*

Notes:

Avg = Average.
AK = Arkansas.
AL = Alabama.
AZ = Arizona.
CA = California.
ha = Hectare.
ID = Idaho.
INEL = Idaho National Engineering Laboratory.
m = Meter.
Max = Maximum.
MI = Missouri.
MT = Montana.
NM = New Mexico.
NR = Not Reported.
NV = Nevada.
OR = Oregon.
UT = Utah.
VA = Virginia.
WA = Washington.

Table DM-6. Summary of body weight data for the deer mouse.

Body Weight (g)	Gender	Species	Habitat	Citation	Notes
21.4	NR	*P. maniculatus*	AZ: Chihuahuan Desert of southeastern Arizona.	Brown and Zeng 1989	
21.7	NR	*P. maniculatus*	AZ: Chihuahuan Desert of southeastern Arizona.	Brown and Munger 1985	
16.4 – 20.5	Male	*P. maniculatus*	BC: Forest, clear cut, and clear cut burned sites in west central BC.	Sullivan et al. 1999	Body weight similar across sites.
17.7 – 21	Female	*P. maniculatus*	BC: Forest, clear cut, and clear cut burned sites in west central BC.	Sullivan et al. 1999	Body weight similar across sites. Likely included gravid females.
20.4	Both	*P. maniculatus gambelii*	CA: 3 miles northeast of Clairmont, Los Angeles County. Semi-desert scrub.	MacMillen 1964	
19.5	Female	*P. maniculatus gambelii*	CA: 3 miles northeast of Clairmont, Los Angeles County. Semi-desert scrub.	MacMillen 1964	
20.8	Male	*P. maniculatus gambelii*	CA: 3 miles northeast of Clairmont, Los Angelos County. Semi-desert scrub.	MacMillen 1964	
16.9 – 18.9	Female	*P. maniculatus*	CA: Coreposis dominated habitat on Santa Barbara Island.	Drost and Fellers 1991	Autumn weights for 1986 – 1988. Significantly different by year.
17.9 – 20.5	Male	*P. maniculatus*	CA: Coreposis dominated habitat on Santa Barbara Island.	Drost and Fellers 1991	Autumn weights for 1986 – 1988. Significantly different by year.
15.8 – 18.1	Female	*P. maniculatus*	CA: Grassland habitat on Santa Barbara Island.	Drost and Fellers 1991	Autumn weights for 1986 – 1988. Significantly different by year.
18.1 – 18.9	Male	*P. maniculatus*	CA: Grassland habitat on Santa Barbara Island.	Drost and Fellers 1991	Autumn weights for 1986 – 1988. Significantly different by year.
14.8 – 18.2	NR	*P. maniculatus*	CA: Juniper Woodland: Eagle Lake Biological Field Station, Susanville.	Gillespie et al. 2008	Weight lower with below average precipitation.
20	NR	*P. maniculatus*	CA: Low semi-stabilized sand dunes northeast of Mono Lake, 2000 meters.	Harris 1986	
18.8	Male	*P. maniculatus*	CA: Mainland near Mono Lake.	Morrison et al. 1992	
19.9	Female	*P. maniculatus*	CA: Mainland near Mono Lake.	Morrison et al. 1992	Excludes pregnant females.
15.0 – 17.5	NR	*P. maniculatus*	CA: Mixed conifer, Eagle Lake Biological Field Station, Susanville.	Gillespie et al. 2008	Weight lower with below average precipitation.
17.2	Male	*P. maniculatus*	CA: Mono Lake, Paoha Island.	Morrison et al. 1992	
18.1	Female	*P. maniculatus*	CA: Mono Lake, Paoha Island.	Morrison et al. 1992	Excludes pregnant females.
15.4 – 20.6	NR	*P. maniculatus*	CA: Shrub-Steppe: Eagle Lake Biological Field Station, Susanville.	Gillespie et al. 2008	Weight lower with below average precipitation.
17.0 – 23	Female	*P. maniculatus gambelii*	CA: Tule Lake National Wildlife Refuge, Siskiyou County. Weedy vegetation.	Ginnett et al. 2003	Weight highest in the fall, lowest in the summer. Likely included gravid females.
17.7 – 20.5	Male	*P. maniculatus gambelii*	CA: Tule Lake National Wildlife Refuge, Siskiyou County. Weedy vegetation.	Ginnett et al. 2003	Weight highest in the fall, lowest in the summer.
13.5	Female	*P. maniculatus*	CO: Eastern slope of the front range in the Rocky Mtns, Subalpine forest.	Merritt and Merritt 1980	September 1974.
14.6	Male	*P. maniculatus*	CO: Eastern slope of the front range in the Rocky Mtns, Subalpine forest.	Merritt and Merritt 1980	September 1974.
16.3	Female	*P. maniculatus*	CO: Eastern slope of the front range in the Rocky Mtns, Subalpine forest.	Merritt and Merritt 1980	May 1974. Trend is to increse weight through winter peaking in summer.
20.3	Male	*P. maniculatus*	CO: Eastern slope of the front range in the Rocky Mtns, Subalpine forest.	Merritt and Merritt 1980	May 1974. Trend is to increse weight through winter peaking in summer.
18.4 – 21.5	Both	*P. maniculatus*	CO: Subalpine meadows near Rabbit Ears Pass, Grand County. Perennial grasses and annual/perennial forbs.	Vaghan 1974	Range for three years (1965 – 1967).
18.3	Both	*P. maniculatus labecula*	MX: Sierra Chincua, Michoacan; montane, boreal, confierous forest.	Bower et al. 1985	

Table DM-6. Summary of body weight data for the deer mouse. (Continued)

Body Weight (g)	Gender	Species	Habitat	Citation	Notes
17.3	Male	*P. maniculatus labecula*	MX: Sierra Chincua, Michoacan; montane, boreal, confierous forest.	Bower et al. 1985	
20.2	Female	*P. maniculatus labecula*	MX: Sierra Chincua, Michoacan; montane, boreal, confierous forest.	Bower et al. 1985	Some likely gravid.
22	Both	*P. maniculatus*	MX: Islands off the coast of Baja California, Sparse vegetation of perennial shrubs and cacti.	Stapp and Polis 2003a	
18.4	Both	*P. maniculatus*	NV: Sagebrush desert of western Nevada.	O'Farrell 1978	
24.5	Both	*P. maniculatus*	OR: Eight Dollar Mountain in Josephine County.	Oswald 2004	Weight did not differ between serpentine and non-serpentine areas.
20.48	Female	*P. maniculatus*	UT: Northern cold desert of the Bonneville Basin in Northern Utah.	Cramer and Chapman 1992	
16.2	Male	*P. maniculatus*	WA: Cascade Mountains of Washington.	Kenagy and Barnes 1988	
16.9	Female	*P. maniculatus*	WA: Cascade Mountains of Washington.	Kenagy and Barnes 1988	Non-gravid.
17.5	Both	*P. maniculatus*	WA: Northern Great Basin. Artemisia-Poa association.	Schreiber 1979	Mean weight of males and non-gravid females.
16.83	Female	*P. maniculatus*	WA: Northern Great Basin. Artemisia-Poa association.	Schreiber 1979	Non-gravid.
19.17	Male	*P. maniculatus*	WA: Northern Great Basin. Artemisia-Poa association.	Schreiber 1979	
18.4	Male	*P. maniculatus*	WY: Reclaimed short grass prairie in north eastern Wyoming.	Hingtgen and Clark 1984	
19	Female	*P. maniculatus*	WY: Reclaimed short grass prairie in north eastern Wyoming.	Hingtgen and Clark 1984	Non-gravid.
15.7	Male	*P. maniculatus bardii*	Prairie deer mice lab study.	Cronin and Bradley 1988	General population.
18.8	Male	*P. maniculatus bardii*	Prairie deer mice lab study.	Cronin and Bradley 1988	Reproductively proven.
14.3	Female	*P. maniculatus bardii*	Prairie deer mice lab study.	Cronin and Bradley 1988	General population.
18.9	Female	*P. maniculatus bardii*	Prairie deer mice lab study.	Cronin and Bradley 1988	Reproductively proven.

Notes:

AZ = Arizona.
BC = British Columbia.
CA = California.
CO = Colorado.
g = Gram.
MX = Mexico.
NV = Nevada.
OR = Oregon.
UT = Utah.
WA = Washington.
WY = Wyoming.

Table DM-7. Summary of food intake data for the deer mouse.

Body Weight (g)	Total Daily Food Intake (g)	Daily food intake (g food/ g body wt/d)	Gender	Species	Habitat	Citation	Notes
19.17	2.9	0.15	Males	*P. maniculatus*	WA: Northern Great Basin. Artemisia-Poa association.	Schreiber 1979	Based on males requiring 6080 kcal/yr and females 5891 kcal/yr. Average caloric value of diet for this habitat was 5.75 kcal/g.
16.83	2.9	0.17	Reproducing female	*P. maniculatus*	WA: Northern Great Basin. Artemisia-Poa association.	Schreiber 1979	
18.4	3	0.16	Male	*P. maniculatus*	WY: Reclaimed short grass prairie in north eastern Wyoming.	Hingtgen and Clark 1984	Caloric content of arthropods, seeds and green vegetation matter 5.67, 5.25 and 4.88 kcal/g respectively. Assumed male required 14.2 kcal/d and female 20.4 kcal/d. Average percentage of plant material consumed over 2 years was 66%, of which 35% was seed. Arthropod consumption decreased when seed availability incresed, although arthropods were still readily available.
19	4.27	0.22	Reproducing Female	*P. maniculatus*	WY: Reclaimed short grass prairie in north eastern Wyoming.	Hingtgen and Clark 1984	
20	1.9	0.095	NR	*P. maniculatus*	North Plains.	Schreiber 1979	From Groepper (1970), cited in Shreiber (1979).
NR	NR	0.101 – 0.123	NR	*P. maniculatus*	Lab study.	Anderson 1986	Ebersole and Wilson (1980), cited in Anderson (1986). Exclusively consuming sunflower seeds.
19	2.6	0.14	NR	*P. maniculatus*	Lab study. Trapped from sugar maple hard wood forests in Ontario, Canada.	Reid and Brooks 1994	Sunflower seed/lepidopteran larvae mixture. Data originally in 8 hour, converted to 16 hour.
19	6	0.32	NR	*P. maniculatus*	Lab study. Trapped from sugar maple hard wood forests in Ontario, Canada.	Reid and Brooks 1994	Sunflower seed only. Data originally in 8 hour, converted to 16 hour.
19	3.2	0.17	NR	*P. maniculatus*	Lab study. Trapped from sugar maple hard wood forests in Ontario, Canada.	Reid and Brooks 1994	Lab rat chow. Data originally in 8 hour, converted to 16 hour.
19	3.2	0.17	Male	*P. maniculatus*	Lab study. Trapped from deciduous woodland/meadow near Ann Arbor, MI.	Mueller and Diamond 2001	Diet of rat chow. Presented as digestable dry matter intake.
18.8	4.1	0.22	Male	*P. maniculatus bardii*	Lab study. Outbred laboratory colony.	Cronin and Bradley 1988	Fed AgWay lab chow. Reproductively proven males.
18.9	3.5	0.19	Female	*P. maniculatus bardii*	Lab study. Outbred laboratory colony.	Cronin and Bradley 1988	Fed AgWay lab chow. Reproductively proven females.
16.88	3.3	0.20	Male	*P. maniculatus bardii*	Lab study. Outbred laboratory colony.	Hogg et al. 1992	Agway ProLab 3000 chow.
14.7	2.3	0.16	Female	*P. maniculatus bardii*	Lab study. Outbred laboratory colony.	Hogg et al. 1992	Agway ProLab 3000 chow.
18.0 – 18.25	2.9 – 3.92	0.161 – 0.182	Male	*P. maniculatus bardii*	Lab study. First laboratory generation from parents captured in the vicinity of East Langsing, MI.	Jaeger 1982	Wayne Mouse Breeder food.
22.2	4.7	0.19	Female	*P. maniculatus nebrascensis*	Lab study. Fourth or fifth generation from wild stock.	Perrigo 1987	Food pellet from P.J. Noyes Company, Lancaster, New Hampshire; Formula A: 24% protein, 6% fat, 53% carbohydrate.
19.2	NR	0.15	Female, non-breeding	*P. maniculatus borealis*	Lab study. Captured at Heart Lake, North West Territories.	Millar 1982	Purina rat pellets, 4.5 kcal/g dry wt.
22.7	6.3	0.278	Female, 0 d post-partum	*P. maniculatus borealis*	Lab study. Captured at Heart Lake, North West Territories.	Millar 1982	Purina rat pellets, 4.5 kcal/g dry wt.

Table DM-7. Summary of food intake data for the deer mouse. (Continued)

Body Weight (g)	Total Daily Food Intake (g)	Daily food intake (g food/ g body wt/d)	Gender	Species	Habitat	Citation	Notes
24.4	8.9	0.364	Female, 6 d post-partum	*P. maniculatus borealis*	Lab study. Captured at Heart Lake, North West Territories.	Millar 1982	Purina rat pellets, 4.5 kcal/g dry wt.
25.8	10.1	0.363	Female, 12 d post-partum	*P. maniculatus borealis*	Lab study. Captured at Heart Lake, North West Territories.	Millar 1982	Purina rat pellets, 4.5 kcal/g dry wt.
24.5	9.7	0.394	Female, 18 d post-partum	*P. maniculatus borealis*	Lab study. Captured at Heart Lake, North West Territories.	Millar 1982	Purina rat pellets, 4.5 kcal/g dry wt.
21	NR	0.19	Female, non-lactating	*P. maniculatus borealis*	Lab study. Captured near Lethbridge Alta, Canada.	Stebbins 1977	Purina mouse chow, 4.085 kcal/g. Gross daily energy requriements increase only moderately during pregancy but roughly double during lactation. Combine weight of females and all young food intake similar to non-suckling females. Females increase food consumption in direct proportion to weight of young.
29	NR	0.42	Female, 21 d post-partum	*P. maniculatus borealis*	Lab study. Captured near Lethbridge Alta, Canada.	Stebbins 1977	
NR	NR	0.2	Female, 28-42 d post partum	*P. maniculatus borealis*	Lab study. Captured near Lethbridge Alta, Canada.	Stebbins 1977	
NR	NR	0.16	Female plus weight of young	*P. maniculatus borealis*	Lab study. Captured near Lethbridge Alta, Canada.	Stebbins 1977	
24	3.8	0.16	Both	*P. maniculatus*	Lab study. Mice from Alberta, Canada.	Lobo and Millar 2011	Females were non-pregnant and non-lactating. Fed rodent chow. Reported as dry mass intake. 23.9% protein content.
21	2.3	0.11	Both	*P. maniculatus*	Lab study. Mice from Alberta, Canada.	Lobo and Millar 2011	Females were non-pregnant and non-lactating. Fed logdepole pine seeds. Reported as dry mass intake. 33% protein content.
23	2.5	0.11	Both	*P. maniculatus*	Lab study. Mice from Alberta, Canada.	Lobo and Millar 2011	Females were non-pregnant and non-lactating. Fed white spruce seeds. Reported as dry mass intake. 25.1% protein content.
23	5	0.22	Both	*P. maniculatus*	Lab study. Mice from Alberta, Canada.	Lobo and Millar 2011	Females were non-pregnant and non-lactating. Fed subalpine fir seeds. Reported as dry mass intake. 11.4% protein content.
14.78	1.97	0.13	Both	*P. maniculatus bardii*	Lab study. Trapped from the Rose Lake Wildlife Experiment Station in Bath, MI.	Drickamer 1970	Mixture of sumflower, corn, and multiflora rose, with some wheat, elm, maple and lespedeze seeds eaten over 3 weeks.

Notes:

d = **Day.**
g = **Gram.**
kcal = **Kilocalorie.**
MI = **Michigan.**
WA = **Washington.**
wt = **Weight.**
WY = **Wyoming.**

Table DM-8. Summary of diet composition data for the deer mouse living in areas with winter snow.

Citation	Habitat	Food Item	Winter			Spring			Summer			Fall			Means	Notes
			Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	as Reported	
Jameson 1952 Likely *P. maniculatus gambelli*	Sierra Nevada Brushfields in 1949 in California.	N	54	9	6	10	19	24	20	0	20	33	49	31	275 (total)	Stomach contents for 275 stomachs in 1949 and 503 stomachs in 1950. Each month reprsents between 6 and 54 stomachs combined for the two habitats. Reported as volumetric percentages. Annual mean as reported in the paper. Source of the diet information for CWHRS (2010). Spiders, caterpillars and heteroptrans were most frequently recognized, as well as a large cutworm, *Protorthodes rufula*. The proporations of each changed over the two years.
		Seeds	59	80	27	60	0	–	6	–	30	55	0	30	35	
		Fruits	2	0	0	30	0	–	0	–	24	14	100	47	22	
		Arthropods	20	10	30	0	80	–	89	–	33	31	0	19	31	
		Leaves	15	10	1	10	20	–	2	–	13	0	0	3	7	
		Fungi	3	0	0	0	0	–	0	–	0	0	0	0	0	
		Misc	1	0	42	0	0	–	3	–	0	0	0	1	5	
	Sierra Nevada Coniferous Forest in 1949.	Seeds	76	60	–	50	68	36	18	–	22	64	62	68	53	
		Fruits	0	7	–	20	0	4	2	–	2	0	3	0	4	
		Arthropods	19	32	–	14	18	38	80	–	58	26	10	25	32	
		Leaves	3	1	–	16	7	18	0	–	11	8	10	0	7	
		Fungi	1	0	–	0	0	0	0	–	0	2	8	0	1	
		Misc	1	0	–	0	7	4	0	–	7	0	7	7	3	
	Sierra Nevada Brushfields in 1950.	N	34	31	35	47	47	29	39	48	39	72	35	47	503 (total)	
		Seeds	0	48	67	38	42	28	33	12	45	34	47	19	34	
		Fruits	0	19	0	14	0	0	0	22	0	6	15	0	6	
		Arthropods	57	9	23	19	7	43	47	58	48	43	25	47	36	
		Leaves	10	18	2	20	32	13	3	7	6	10	2	19	12	
		Fungi	18	0	0	0	0	0	0	0	0	0	0	10	2	
		Misc	15	6	8	9	19	16	17	1	1	7	11	5	10	
	Sierra Nevada Coniferous Forest in 1950.	Seeds	14	81	81	73	80	59	35	27	49	62	29	26	51	
		Fruits	0	0	0	0	0	0	0	2	0	0	0	0	0	
		Arthropods	29	16	11	18	16	21	27	58	31	25	25	30	26	
		Leaves	3	3	7	4	0	19	20	6	7	8	5	1	7	
		Fungi	26	0	0	0	0	0	0	5	0	0	14	43	7	
		Misc	28	0	1	5	4	1	18	2	13	5	27	0	9	

Citation	Habitat	Food Item	Jan-Feb 1970 N=97	Mar-Apr 1970 N=108	May-Jun 1969 N=123	Jul-Aug 1969 N=92	Sep-Oct 1969 N=102	Nov-Dec 1969 N=134	As Reported 656 (total)	Notes
Flake 1973 Likely *P. maniculatus bardii*	Short-grass prairie in northeastern Colorado.	Arthropods								Stomach contents estimated by volume and ranked. 656 animals analyzed. May 1969 through April 1970. Concluded deer mice are highly opportunistic, eating the particular types of animal and plant material most available. This leads to substantial regional variation in diet and perhaps reflects their adaptability and broad distribution (see however Seig et al. 1986 below).
		Coleoptera adults	4.8	11	10.9	10.8	9.8	7.6		
		Coleoptera larvae	0.1	3.6	24.4	1.4	1.1	0.2		
		Grasshoppers	2.5	6.4	2.6	5.7	7.7	5.1		
		Leaf Hoppers	7	13.3	0.1	3.4	1.7	2.1		
		Lepidopteran larvae	0.5	2.3	2.1	4.4	1.3	0.2		
		Lepidopteran adults	1.3	19.4	17.6	1.3	1	0.5		
		Spiders	0.3	2.6	2.8	2.5	2.4	2.5		
		Total Arthropods	16.5	58.6	60.5	29.5	25	18.2	38.7	
		Seeds	65.4	22.5	11.4	40.3	47.8	65.7	39	

Table DM-8. Summary of diet composition data for the deer mouse living in areas with winter snow. (Continued)

Citation	Habitat	Food Item	Winter		Spring				Summer				Fall		Means	Notes
Flake 1973		Vegetative Matter														
Likely *P.*		Total Forbs	4.3	4.7			9.5			10.4		4.8		6.3	7.8	
maniculatus		Total grasses/sedges	4.8	4			1.7			3.5		4.3		1.3	3.4	
bardii		Total shrubs	2.6	3.8			1.7			1.1		0.9		0.6	2.2	
(continued)		Total Vegetative Matter	11.7	12.5			12.9			15		10		8.2	13.4	
		Mosses/Lichens/Fungi													1.6	
		Vertebrate tissue													0.8	
		Other (not reported)													6.5	
Hingtgen and Clark 1984	1981: 2 years since reclamation short grass prairie, Wyoming.					May		Jun			Aug					Stomach content analysis. Decrease in arthropod consumption not related to measured availability, but increase in seed availability. Of vegetative material, forbs consumed at highest rate, followed by shrubs, then grasses. On reclaimed land, ate more vegetative material and fewer seeds. Plants species most often consumed were Sainfoin, fireweed summercypress, common russianthistle, mustards, fourwing saltbush, alfalfa-sweetclover and wheatgrass.
		Arthropods				79.9		62.7			41.5					
		Seeds				2.2		32.1			2.7					
		Vegetative				15.1		3.3			55.3					
	1981: 3-5 years since reclamation short grass prairie.	Arthropods				61.3		63.2			26.3					
		Seeds				0.9		21.9			21.7					
		Vegetative				35.6		15.2			44.2					
	1981-Combined	Plant Matter													45.3 (N=68)	
	1980-Combined	Plant Matter													83.2 (N=62)	
Stapp 1997	Short grass prairie in the Central Plains Experimental Range in north-central Colorado.							Jun	Jul		Aug					Effects of removing kangaroo rat on deer mice. Trapped pre-removal (7-15 June), 4 week post removal (6-15 July) and 7 week post removal (1-11 Aug). Fecal pellet analysis reported as percentage composition by volume. No difference between removal and control sites, so results were averaged. Coleopterans, Orthopterans, various larvae, and a small amount of Araneae made up arthropods consumed.
		N						8	8		8					
		Arthropods						85.4	65.8		56.3					
		Vertebrate						0.2	1.5		0					
		Seeds						6	27.1		37.9					
		Plant Tissues						7	6.1		6					
		Fungus						2.6	0		0					
Sieg et al. 1986	Sagebrush grasslands and bentonite mine spoils in south-eastern Montana-1979.	Arthropods			35				68				47		52 ± 3.1	Fecal pellets collected from freshly trapped animals from May through October in 1979 and 1980. Arthropod consumption was higher in 1980 than in 1979, although arthropod captures substantiall declined in 1980. Adult coleopterans and hymentopterans most frequently consumed. Arthropod consumption was negatively correlated with arthropod availability. Seed and forb consumption was correlated with availability, and forb consumption incrased with drought. Some specific arthopod and plant preferences were noted. Crickets widely available but not frequently consumed. Spiders also not frequently consumed. Arthropod consumption increased when seeds were not as plentiful.
		Seeds			55				18				35		34.5 ± 2.8	
		Grasses													2.1 ± 0.3	
		Forbs			9				4				3		4.1 ± 0.3	
		Shrubs													2.6 ± 0.3	
		Algae													1.4 ± 0.8	
		Fungi													2.9 ± 0.9	
	Sagebrush grasslands and bentonite mine spoils in south-eastern Montana-1980.	Arthropods			55				86				66		75.0 ± 2.8	
		Seeds			5				4				18		9.1 ± 0.5	
		Grasses													0.7 ± 0.1	
		Forbs			33				3				6		11.0 ± 0.6	
		Shrubs													2.0 ± 0.2	
		Algae													0.9 ± 0.4	
		Fungi													1.6 ± 0.7	

Table DM-8. Summary of diet composition data for the deer mouse living in areas with winter snow. (Continued)

Citation	Habitat	Food Item	Winter	Spring	Summer				Fall	Means	Notes
Vaughan 1974	Subalpine meadows of Rabbit Ears Pass, Grand County, Colorado. Supported perennial grasses and annual and perennial forbs.			May	Jun	Jul	Aug	Sep		Summer	Half acre quadrats surrounded by electric fences. Sampling in summer, from end of snow melt to early September. Stomach content analysis by microscopic examination reported as relative density of each item (percentage of diet for each item). N is the number of individual stomachs examined. Unidentifed insects and cutworms the largest percentage, with <3% spiders. Overall pattern was one of heavy use of favorite foods, seeds and arthropods, throughout midsummer, and utlization of alternate foods, particularly leaves and fungus, when the favorite items were not abundant.
		1965 N			20	33	11	17		Mean	
		Seeds			62.1	41.7	51.6	73.5		57.2	
		Arthropods			31.8	39.8	45.8	22.7		35	
		Flowers			1.4	13.9	2.1	0.4		4.5	
		Leaves			4.8	1.9	0.5	0.4		1.9	
		1966 N		21	51	46	30	13			
		Seeds		34	43.5	77.7	80	66.4		60.3	
		Arthropods		27.4	40.7	20.5	12	11.8		22.4	
		Leaves		14.1	6.1	1.3	2.5	17.1		8.2	
		Fungi		21.5	5.5					5.4	
		Flowers			2.1			3.3		1.1	
		Fruit					5			1	
Ginnett et al. 2003 *P. maniculatus gambelli*	Tule Lake National Wildlife Refuge, Siskiyou County, California. Weedy vegetation. Summer cyprus, tansy mustard, tumble mustard, giant wild rye, lamb's quarters, and nettle.			Spring 91 (N=20)		Summer 91 (N=20)			Fall 91 (N=20)		Investigated the repeatable annual formation of gallstones. Stomach content analysis. Thought to be from increaed fiber (plant material) in diet. Plant and seed consumption significantly correlates with gallstone formation when 3 month phase advanced. Drought conditions during study period lend support to the hypothesis that the high fiber diets present during xeric conditions contribute to gallstone formation.
		Plant		55		16			41		
		Seed		25		4			12		
		Arthropods		20		78			46		
		Other				2			1		
			Winter 91-92 (N=20)	Spring 92 (N=20)		Summer 92 (N=20)					
		Plant	65	55		56					
		Seed	32	40		29					
		Arthropods	1	5		14					
		Other	2			1					
Whitmer et al. 2007	Adjacent no-till cropping areas at the Palouse Conservation Field Station, Pullman, Washington.		Sep 2001	Apr 2002				Sep 2002			Collections made Sept 2001, April 2002 and Sept 2002. Frequency of occurrence (as a percentage) of food items in stomachs. 10 randomly selected sub-samples of stomachs per crop per collection period.
		Grain plants	74.6	76.9				84.3			
		Grasses (Poa, Festuca)	0.6	1.7				0.7			
		Dicots (thistle, pigweed)	14.4	11.7				2			
		Root material	0	0.4				0.1			
		Insects	10.1	8.9				12.1			
Merritt and Merritt 1980	Eastern slop of the front range in the Rocky Mtns of CO. Subalpine forest.			Spring			Aug				21 months of trapping in 1974 and 1975. Stomach content analysis expressed as volumetric percentage. Low number of stomachs secured. Paper did not indicate which year stomachs came from.
		N		4			3				
		Seeds of spruce and fir		78			59				
		Insects		17			11				
		Flowers					12				
		Leaves and stems					11				
		Fungi					5				

Table DM-8. Summary of diet composition data for the deer mouse living in areas with winter snow. (Continued)

Citation	Habitat	Food Item	Winter	Spring	Summer			Fall	Means	Notes
Gunther et al. 1983	Mature conifer forest in Western Cascade Mountains, Washington.				Jul '80	Sep '80	Sep '80	Sep '80		Percent relative frequeny of stomach fragments from deer mice from clear cut trapped in July (CJ); forest (F), burned clear cut (B), and unburned clear cut (CS) trapped in September. In late summer, many insects enter pupal and larval stages within the soil and are more accessible and conifer seeds disseminate and become more abundant on the ground.
		Treatment			CJ	F	CS	B		
		N			43	7	16	1		
		Fungi, Lichen			22	9	27			
		Conifer seed			45	21	28			
		Shrub, herb, leaf, reproductive part			1	9	1			
		Grass leaf, seed			3	1	27			
		Invertebrate			23	59	1	100		
		Other			5					
Haufler and Nagy 1984	Piceance Basin, Colorado composed of upland sage-brush, pinyon juniper, mixed mountain shrub communities.	1977 Fecal			Jun	Jul-Aug				24 composite fecal samples from 3 deer mice. Sampled July-August 1977. Reported as Percent relative density. Believed the fecal analysis overestimated arthropods, and stomach contents more accurate. Also speculated that large amount of slash contributed to the availability of insects. The high percentage of Coleoptera and Formicidae consumed support this conclusion. Lepidoptera also consumed in large amounts. Orthopetera and Araneida consumed in much smaller amounts. In June of 1978, stomach analysis from 43 deer mice and 62 composite fecal samples from 3 deer mice.
		Grasses				0				
		Forbs				1.1 ± 0.6				
		Woody Vegetation				3.4 ± 0.3				
		Lichen				0				
		Moss				1.7 ± 0.4				
		Seed				0				
		Arthropods				90.8 ± 1.5				
		1978 Fecal N			62					
		Arthropods			95.8 ± 1.0					
		Seeds			1.6 ± 0.9					
		1978 Stomach N			43					
		Arthropods			83.8 ± 2.4					
		Seeds			14.5 ± 2.4					
Halford 1981	Burned sagebrush scrub in south-eastern Idaho.			May 1976						300 hectare burned in 1974. Gastrointestinal tracts from traps in May 1976. Data as relative percent density. Total population data summarized here. Mainly lepidoptera larva and coleoptera adults consumed. Ants, crickets and grasshoppers were 9% of control diet. Authors conclude sampling conducted when insects were most abundant.
		N		129	65					
		Treatment		Control	Burn					
		Arthropods		97.5	92					
		Plants		1	8					
		Seeds		0.2	0					
Harris 1986	Semi-stabilized sand dunes north-east of Mono Lake, California.			Spring	Summer			Fall		Fecal pellets analysis. Deer mice were virtually absent in 1979, rare in 1980. Authors indicate that arthropods were the most important prey in this study, in sharp contrast to previous studies of desert rodents. Lepidopteran larvae (Spring), June beetles (Summer) and lygaeid bugs (Fall) most frequently consumed.
		1978 N		0	25			20		
		Arthropods			89			90		
		Vegetation			0			0		
		Seeds			11			10		
		1981 N		40	31			24		
		Arthropods		81	84			72		
		Vegetation		19	0			3		
		Seeds		0	16			25		

Notes appear on the following page.

Table DM-8. Summary of diet composition data for the deer mouse living in areas with winter snow. (Continued)

Notes:

N =	**Number.**
Jan =	**January.**
Feb =	**February.**
Mar =	**March.**
Apr =	**April.**
May =	**May.**
Jun =	**June.**
Jul =	**July.**
Aug =	**August.**
Sep =	**September.**
Oct =	**October.**
Nov =	**November.**
Dec =	**December.**

Table DM-9. Summary of diet composition data for the deer mouse in habitats with no winter snow.

Citation	Habitat	Food Item		Winter			Spring			Summer			Fall		Means	Notes
Meserve 1976	San Joaquin Hills.		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Calculated	Fecal analysis. Aug '70 to Aug '71. Feces collected from live traps. Food reported by volume. Adapted from Table 4, which provides detailed identification of plants consumed. Haufler and Nagy (1984) found fecal analysis to overestimate arthropod content. Arthropods consisted primarily of mature unidentified insects. Some lepidopteran larvae.
P. maniculatus	Upland coastal sage scrub near	N	16	13	15	13	27	9	12	8	8	7	11	10		
gambelli	Irvine, California.	Year	1970	1971	1971	1971	1971	1971	1971	1971	1971	1970	1970	1970		
		Vegetative	74.8	84.6	66.8	67.1	47.6	53.1	57.7	60.2	76.3	67.3	58.9	67.6	64.4 ± 10.3	
		Seeds	14	11.3	10.8	14.7	29	29.4	28.6	21.8	10.8	15.3	17.4	9.7	18.3 ± 7.5	
		Arthropods	8.6	1.7	20.4	11.5	16.4	10.3	9.5	15.7	9.3	12.5	21.0	18.6	13.0 ± 5.4	
		Other	0.5	0.3		1.0	0.9	0.5	0.3	0.2			0.5	1.4	0.6 ± 0.4	
		Sand	1.9	1.0	1.4	1.4	1.4	1.5	1.0	0.6	1.0	2.1	1.7	2.1	1.5 ± 0.5	
		Bait	0.2	1.1	0.6	4.3	4.7	5.2	2.9	1.5	2.6	2.8	0.5	0.6	2.3 ± 1.7	
Stapp and								May-Jun								Islands of the coast of Baja California, Mexico with sparse vegetation dominated by perenial shrubs and cacti. Work done between May and June 1997. Feces and stable istope analysis. Feces contained a mixture of plant and animal material. Some differences between islands. Authors indicate feces provide dietary analysis from 1 to a few meals. Isotopic signatures suggested littoral prey important for both inland and coastal populations. Highly digestable items are underestimated in fecal analysis.
Polis 2003	Coronadito Coast	All invertebrates						27.7 ± 10.9 (N=9)								
	Baja California,	All Plants						71.8 ± 10.7 (N=9)								
	Mexico	Seeds						65.2 ± 13.6 (N=9)								
	Coronadito Inland	All Invertebrates						36.9 ± 9.1 (N=12)								
	Baja California,	All Plants						62.5 ± 9.3 (N=12)								
	Mexico	Seeds						53.8 ± 10.9 (N=12)								
	Ventana Coast	All Invertebrates						56.9 ± 8.6 (N=10)								
	Baja California,	All Plants						43.1 ± 8.6 (N=10)								
	Mexico	Seeds						24.5 ± 10.5 (N=10)								
	Ventana Inland	All Invertebrates						54.9 ± 8.6 (N=12)								
	Baja California,	All Plants						45.1 ± 8.6 (N=12)								
	Mexico	Seeds						24.3 ± 7.6 (N=12)								
Pitts and Barbour 1979	Beach and dune at Point Reyes, California.	Stomach Content		Feb		Apr										1 hectare study plot. Trapping three week intervals from Nov '74 to Jun '76. Nine animals taken for stomach analysis adjacent to study plot in Feb and April of 1976. Feb to Jun, 16 animals used in feeding trials. In stomach analysis, microscope field area used to estimate plant and animal natter. Of 36 areas, 20 were plant, 12 were arthropod, and 4 undetermined. Coleopteran larave and adults observed. In feeding trials, seeds, fruits and herbage all eaten by deer mice.
		Presence/Absence		7		2										
		Herbage		4 of 7		0										
		Seed Coat Material		6 of 7		2 of 2										
		Immature Insects		5 of 7		2 of 2										
		Adult Insects		0		2 of 2										
		Microscopic Analysis %			36 samples											
		Plant			56											
		Arthropod			33											
		Other			11											
Osborne and Sheppe 1971	Sparsley vegetated dunes, northern coast of California, Samoa, Humboldt County.						Apr-May 1966									Stomach contents examined microscopically and percent volume estimated. Diptera, Staphylinid beetles, aphids, and centipedes were identified, but most arthropods were unidentified arthropod chiten or viscera. Plant matter consisted of vegetative *Abronia* or *Cakile* (succulent leaves), with 1.5% *Fragaria* seeds.
		N					30									
		Plant Matter					18									
		Animal Matter					82									
		Hair					Obs in all									
		Sand					Obs in all									
		Bait					Obs in 24									

Notes:

N =	**Number.**	**Jul =**	**July.**
Jan =	**January.**	**Aug =**	**August.**
Feb =	**February.**	**Sep =**	**September.**
Mar =	**March.**	**Oct =**	**October.**
Apr =	**April.**	**Nov =**	**November.**
May =	**May.**	**Dec =**	**December.**
Jun =	**June.**		

Rock Wren Tables

Rock Wren

List of Tables

Table RW-1. Rock wren exposure parameters that will be used in the Building 812 baseline ecological risk assessment and supporting natural history information.

Attribute	Description	Primary Citations
Exposure Parameters		
Life span	2 years	Lowther et al. 2000, Merola 1995.
Breeding territory	4 hectare per pair, no overlap	Medin 1987, Szaro 1986, Hensley 1954.
Home range	20 hectare per pair, some overlap in the periphery	Medin 1987, Szaro 1986, Hensley 1954.
Number of Nests	Two per year, first nest in mid-April, second nest in mid-May.	Lowther et al. 2000, Merola 1995, Oberholser 1974, Tramontano 1964.
Incubation Time	15 d	Oppenheimer 1995, Oppenheimer and Morton 2000.
Time to Fledging	13 d	Oppenheimer 1995, Oppenheimer and Morton 2000.
Body Weight	Both sexes: 16.5 g Females nest building and egg-laying: 18 g	Lowether et al. 2000, Merola 1995, Smyth and Bartholomew 1966.
Daily Dry Matter Intake (g) per unit body weight (g) per day (d)	Both sexes (non-breeding period): 0.236 g/g/d Both sexes (fledging period): 0.267 g/g/d Female (incubation period): 0.267 g/g/d	Nagy 2001, El-Wailly 1966.
Daily Dry Matter Intake (g) per day (d)	Both sexes (non-breeding period): 3.9 g/d Both sexes (fledging period): 4.4 g/d Female (incubation period): 4.8 g/d	Nagy 2001, El-Wailly 1966.
Dietary Fraction by Food Type (all seasons)	Invertebrates: 0.99 unitless Seeds/Fruits: 0.01 unitless	Knowlton and Harmston 1942, Tramontano 1964.
Incidental Soil Ingestion	10% of dry matter intake	Beyer et al. 1994.
Supporting Natural History Information		
Seasonal Activity Pattern	Year round resident of Site 300, active year round.	CWHRS 2010b, Lowther et al. 2000.
Daily Activity Pattern	Diurnal.	CWHRS 2010b, Lowther et al. 2000.
Reproduction Timing	Up to two broods per year.	Lowther et al. 2000, Merola 1995, Oberholser 1974, Tramontano 1964.
Density	0.4 birds per hectare	Medin 1987, Szaro 1986, Hensley 1954.
Water usage	Water obtained from food	Smyth and Bartholomew 1966, Smyth and Coulombe 1971.

Notes:

d = Day.
g = Gram.
CWHRS = California Wildlife Habitat Relationships System.

Table RW-2. Summary of density data for the rock wren.

Reported Density	Estimated number of birds per ha	Habitat	Citation	Notes
5 and 8 breeding pairs per 40 ha	0.25-0.40	AZ: Coconino National Forest, south of Flagstaff, AZ.	Szaro 1986	May and July 1973 through 1975.
5-8 pairs per 40 ha	0.25-0.40	CA: Colorado Desert of California. Western aspect of the Sonoran desert.	Hensley 1954	Hutchinson and Hutchinson (1941) and Hutchinson and Hutchinson (1942) cited in Hensley (1954).
0.38 birds per ha	0.38	CO: large sized cliffs in Jefferson County, CO.	Rossi and Knight 2006	May and June of 1998 and 1999.
1-5 territories within 31.25 ha	0.06-0.32	CO: Pinyon-juniper woodland site in Arches National Park, Grand Co., UT.	Lowther et al. 2000	From 1989 through 1995.
5 nesting pairs per 40 ha	0.25	MT: Missouri River "Breaks" between Fort Benton and Fort Peck Reservoir, Montana.	Walcheck 1970	June 25-30, 1968.
0.2 birds per ha	0.2	MT: Scoria outcrops in ponderosa pine savannah in Eastern Montana.	Rumble 1987	May through June, 1985-1985. Not all suitable habitat was occupied.
1-1.7 breeding pairs/20 ha	0.1-0.17	NV: Bald Mtn in Great Basin National Park, 62 km southeast of Ely.	Medin 1987	Between 20 June and 21 July from 1981 to 1983. Breeding territories much smaller, about 4 ha.
25 breeding males per 40 ha	0.625	OR: Juniper-sage upland in eastern Oregon.	CWHRS 2010	Anderson et al. (1972) cited by CWHRS (2010).

Notes:

NR = Not reported.
CWHRS = California Wildlife Habitat Relationships System.
ha = Hectare.
AZ = Arizona.
CA = California.
CO = Colorado.
MT = Montana.
NV = Nevada.
OR = Oregon.

Table RW-3. Summary of food sources for the rock wren.

Taxa	Common Name	Number of items found	Life stage	Percent of time item found	Notes
Knowlton and Harmston 1942					
Stomach collected Timpie, Tooele County, Utah on October 6, 1934 (season of unusual leaf hopper abundance):					
Eutettix tenellus	Sugar beet leaf hopper	59	adult		
Stomach collected at Timpie on September 11, 1937:					
Nysius ericae	false chinch bug	53	adult	61.63	Hemiptera order, Lygaeidae family (Big eyed bugs)
Nysius ericae	false chinch bug	11	nymphal	12.79	
Eutettix tenellus	Sugar beet leaf hopper	16	adult	18.60	Hemiptera order, Cicadellidae family (leafhoppers)
Lygus hesperus	plant or leaf bug	2	adult	2.33	Hemiptera order, Family Miridae (plant or leaf bugs)
Coleoptera	beetle	1	larvae	1.16	Order
Hymenoptera	ants	2	adult	2.33	Order, ants observed
Lepidoptera	butterflies and moths	1	larvae	1.16	Order
Total Number of Items:		86			
1940, with grasshoppers abundant 22 of 26 stomachs had:					
Orthoptera	grasshoppers	51	mostly adults		
One stomach had:					
Hymenoptera	winged ants	658	adults	99.25	
Orthoptera	grasshopper	1	adult	0.15	
Aphididae	aphid	1	adult	0.15	Order Hemiptera, suborder Homoptera, Aphididae family
Coleoptera	beetle	1	adult	0.15	
Scutelleridae	scutellerid bug	1	adult	0.15	Hemiptera order, Scutelleridae family
Eutettix tenellus	beet leaf hopper	1	adult	0.15	Hemiptera order, Cicadellidae family (leafhoppers)
Total Number of Items:		663			
88 stomachs collected throughout Utah from 1935 through 1941:					
Thysanura	Silverfish and firebrats	1	adult	0.03	
Colembola	Springtails	10	adult	0.31	
Orthoptera	grasshoppers, crickets, locusts	104	of these:	3.26	Recognized grasshopper species: *Melanoplus mexicanus*, *Canmula pellucida*, *Chorthippus curtipennis*, *Trachyrhachis kiowa*, and *Trimeritropus* spp.
	grasshoppers	(92)	adult		
	grasshoppers	(3)	nymphal		
Isoptera	termites	4	adult	0.13	Order
Odonata	dragonflys	3	adult	0.09	Order
Neuroptera	lacewings, mantidflies, antlions	5	adult	0.16	Order, included larval antlions and 1 Raphidiidae
Trichoptera	sedge-flies or rail-flies	11	adult	0.34	

Table RW-3. Summary of food sources for the rock wren. (Continued)

Taxa	Common Name	Number of items found	Life stage	Percent of time item found	Notes
Knowlton and Harmston 1942 (continued)					
Hemiptera	true bugs	418	of these:	13.10	
Nysius ericae	false chinch bug	(268)	adult		Hemiptera order, Lygaeidae family (Big eyed bugs)
Nysius ericae	false chinch bug	(51)	nymphal		Hemiptera order, Lygaeidae family (Big eyed bugs)
Geocoris decoratus	big eyed bug	(5)	adult		Hemiptera order, Lygaeidae family (Big eyed bugs)
Scutelleridae	scutellerid bug	(1)	adult		Homaemus aenifrons
Pentatomidae	stink bug	(48)	adult		*Chlorochroa sayi*, *C. uhleri*, *C. ligata* and *Thyanta custator*
Miridae	plant or leaf bug	(8)	adult		3 being Lygus hesperus and 1 L. elisus
Anthocoridae	minute pirate bugs	(1)	adult		*Orius tristicolor*
Nabidae	damsel bugs	(1)	adult		*Nabis alternatus*
Homoptera	aphids, scale insects, cicadas, leaf hoppers	776	of these:	24.32	Suborder of Hemiptera
Eutettix tenellus	leaf hoopers	(166)	adult		*Aceratigallia sanguinolent*a and *Dikraneura* sp. also represented.
Eutettix tenellus	leaf hoopers	(152)	nymphal		
Fulgoridae	Hemipteran insects	1		0.03	Order Hemiptera, Suborder Auchenorrhyncha, Family Fulgoridae
Aphididae	aphids	471	of these:	14.76	Order Hemiptera, suborder Homoptera
	Macrosiphum escalantii	(12)	adult		*Cinara sibericae*, *Aphis carbocolor*, *A. bonnevillensis* and *A.*
	M. coweni	(2)	adult		*medicaginis* also recognized.
Coccidae	scale insects	8		0.25	
Coleoptera	beetles	3	larvae	0.09	
Coleoptera	beetles	103	adult, of these:	3.23	
Carabidae	ground beetles	(1)	adult		
Chrysomelidae	leaf beetles	(6)	adult		4 being flea beetles
Buprestidae	metalic wood boring beetles	(1)	adult		
Scarabaeidae	scarab beetles	(1)	adult		
Melyridae	soft-winged flower beetles	(2)	adult		*Collops bipunctatus*
Lepidoptera	butterflies and moths	26	adult	0.81	
		17	larvae	0.53	
		45	eggs	1.41	
Diptera	flys	29	of these:	0.91	
Diptera	flys	1	larvae	0.03	*Pipuunculus* sp. protruding from a leaf hopper abdomen
Diptera	flys	28	of these:	0.88	
Culicidae	mosquitos	(4)	adult		
Tipulidae	crane fly	(4)	adult		
Chironomidae	non-biting midges	(1)	adult		
Syphidae	flower or syrphid flies	(1)	adult		
Calliphoridae	blow flies, carrion flies	(1)	adult		
Tabanidae	horse flies	(2)	adult		
Chrysops fulvaster	deer fly	(1)	adult		

Table RW-3. Summary of food sources for the rock wren.

Taxa	Common Name	Number of items found	Life stage	Percent of time item found	Notes
Knowlton 1942 (continued)					
Hymenoptera	sawflys, wasps, bees, ants	1,171	of these	36.70	
Formicidae	ants	(1,097)	adult		Many *Pogonomyrmex occidentalis*
Braconidae	wasp	(1)	adult		
	wild bee	(1)	adult		
Misc insect eggs		51	eggs	1.60	
Spiders		5	adult	0.16	Class Arachnida, Order Araneae
Red mite		1	adult	0.03	Class Arachnida, Order Mesostigmata
Solpugida	camel spiders, wind scopions, sun spiders	1	adult	0.03	Class Arachnida, Order Solifugae
Seeds		30		0.94	Mostly from weeds
Plant fragments					Observed in various stomachs
Total Number of Items:		3,191			
Tramontano 1964					
Three stomachs collected in winter, Molino Canyon, Santa Catalina Mountains, southeastern AZ					
Arachnida	spiders	1	adult	1.27	
Orthoptera	grasshoppers	1	adult	1.27	
Hemiptera: Reduviidae	assassin bugs	3	adult	3.80	
Hemiptera: Miradae	plant bugs	3	adult	3.80	
Homoptera: Cicadellidae	leaf hoppers	3	adult	3.80	
Neuroptera: Myrmeleontidae	antlions	2	larvae	2.53	
Coleoptera: Chrysomelidae	leaf beetles	10	adult	12.66	
Coleoptera: Curculionidae	weevils	6	adult	7.59	
Coleoptera: Carabidae	ground beetles	4	larvae	5.06	
Cepidoptera: Phalaenidae		6	larvae	7.59	
Hymenoptera: Formicidae	ants	40	adult	50.63	
Gravel, seed, plant remains		common			
Total Number of Items:		79			
Two stomachs collected in spring, Molino Canyon					
Arachnida	spiders	1	adult	2.38	
Odonata	dragonfly	1	nymph	2.38	
Orthoptera: Acrididae	grasshoppes	1	adult	2.38	
Hemiptera: Pentatomidae	stink bugs	2	adult	4.76	
Homoptera: Cicadellidae	leafhoppers	15	adult	35.71	
Neuroptera: Myrmeleontidae	antlions	2	larvae	4.76	
Coleoptera: Apionidae	seed weevils	14	adult	33.33	
Coleoptera: Scarabaeidae	June beetles	1	adult	2.38	
Coleoptera: Gyrinidae	whirligig beetles	2	adult	4.76	

Table RW-3. Summary of food sources for the rock wren. (Continued)

Taxa	Common Name	Number of items found	Life stage	Percent of time item found	Notes
Tramontano 1964 (continued)					
Two stomachs collected in spring, Molino Canyon (continued)					
Diptera: Tipulidae	crane flies	3	adult	7.14	
Gravel and seeds		few			
Total Number of Items:		42			
One stomach collected in summer, Molino Canyon					
Ortoptera	grasshopper	1	adult	4.17	
Hemiptera; Pentatomidae	stink bug	1	adult	4.17	
Hemiptera: Cicadellidae	leafhoppers	6	adult	25.00	
Neuroptera: Myrmeleontidae	antlions	5	adult	20.83	
Coleoptera: Tenebrionidae	darkling beetle	1	adult	4.17	
Coleoptera: Apionidae	seed weevils	5	adult	20.83	
Coleoptera: Mylabridae	pea weevil	1	adult	4.17	
Lepidoptera	moth	1	adult	4.17	
Lepidoptera	caterpillars	2	larvae	8.33	
Hymenoptera	small wasp	1	adult	4.17	
Small pebbles		2		8.33	
Total Number of Items:		24			

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