

Eighteen occurrences of *Legenere limosa* are (or were) on nature preserves or publicly-owned lands. Five occurrences are known currently from the Jepson Prairie Preserve in Solano County, two from the nearby Calhoun Cut Ecological Reserve, and two from the Dales Lake Ecological Reserve. *Legenere limosa* was known from Boggs Lake before the preserve was established, but it has not been rediscovered in that area for over 40 years (Holland 1984). *Legenere limosa* occurs in abundance in several vernal pools on the Valensin Ranch Property in Sacramento County owned and managed by The Nature Conservancy (J. Marty, unpub.data). A population of *L. limosa* was also discovered in a restored pool on Beale Air Force Base in Yuba County, California (J. Marty, unpub. data.). Two occurrences, at Hog Lake and on the Stillwater Plains, are on property administered by the U.S. Bureau of Land Management. Sacramento County owns land supporting three occurrences of *L. limosa*; one is at a wastewater treatment plant, and the other two are in county parks. Finally, one occurrence is on land owned by the Sacramento Municipal Utility District (California Natural Diversity Data Base 2001). However, mere occurrence on public land is not a guarantee of protection. Only the preserves and the U.S. Bureau of Land Management occurrences are managed to promote the continued existence of *L. limosa* and other rare species. As of 1991, one Sacramento County developer had plans to preserve several pools containing *L. limosa* when he developed the property (California Natural Diversity Data Base 2001).

8. *MYOSURUS MINIMUS* SSP. *APUS* (LITTLE MOUSETAIL)

a. Description and Taxonomy

Taxonomy.—Little mousetail was first named by Greene (1885) as *Myosurus minimus* var. *apus*. The type specimen of little mousetail was collected “from the table-lands back of San Diego” (Greene 1885:277). Campbell (1952) changed the rank of little mousetail from a variety to a subspecies, resulting in the new combination *Myosurus minimus* ssp. *apus*, which is in use today. This subspecies is believed to have originated as a hybrid between *Myosurus minimus* ssp. *filiformis* (thread-like mousetail) and *Myosurus sessilis* (sessile mousetail); *Myosurus minimus* var. *apus* is now self-perpetuating and therefore worthy of recognition as a separate taxon (Mason 1957, Stone 1959). However, *Myosurus minimus* var. *apus* may cross with *Myosurus sessilis* or with other mousetails and the hybrids then may interbreed again, resulting in a series of intermediates that are difficult to identify (Campbell 1952, Stone 1959) and that may not warrant taxonomic recognition (A. Whittemore *in litt.* 1993). Mousetails are members of the buttercup family (Ranunculaceae).

Description and Identification.—*Myosurus minimus* ssp. *apus* (Figure II-30) is a tiny, tufted annual lacking showy flowers. Both the leaves and

the scapes originate from the base of the plant. The very narrow leaves are only 2 to 9 centimeters (0.8 to 3.5 inches) long, and the cylindrical scapes are shorter (at most 7 centimeters [2.8 inches] long). Each scape bears a single, inconspicuous flower consisting of 5 to 10 greenish-white petal-like sepals, 3 to 5 greenish-white petals, about 10 stamens, and 70 or more separate pistils. The sepals have a flattened, erect portion 2.5 to 3.5 millimeters (0.10 to 0.14 inch) long and a shorter spur pointing downward. The petals are shorter than the sepals and do not have spurs. *Myosurus minimus* ssp. *apus* has achenes (single-seeded fruits) that are more or less rectangular, 0.75 to 2 millimeters (0.03 to 0.08 inch) long, and have a beak no more than 0.5 millimeter (0.02 inch) long protruding upward from one side. The pistils cover almost the entire length of the scape or receptacle that elongates as the achenes reach maturity, and the beaks are closely appressed to this elongate receptacle, often referred to as a “spike” in this genus (Campbell 1952, Mason 1957, Wilken 1993). The diploid chromosome number of *M. minimus* ssp. *apus* is 16 (Stone 1957 as cited in Stone 1959).

Myosurus minimus ssp. *minimus* (common mousetail) and *M. minimus* ssp. *filiformis* have scapes taller than their leaves, and the achenes are only in the upper part of the scape. *Myosurus sessilis* has shorter spurs on the sepals than does *M. minimus* ssp. *apus*, only five stamens per flower, and the achene beaks project outward from the scape (Campbell 1952). *Myosurus minimus* ssp. *alopecuroides* (foxtail mousetail) also has outward-projecting beaks (Stone 1959). Other taxa of *Myosurus* are differentiated by their scape length in relation to leaf length, achene shape, outcurved beaks, or tendency to drop their flower parts and achenes when they are mature, which *M. minimus* ssp. *apus* does not (Campbell 1952, Mason 1957, Wilken 1993).

b. Historical and Current Distribution

Historical Distribution.—*Myosurus minimus* ssp. *apus* was first collected in 1882. The typical form was known historically from southern California (Campbell 1952), occurring only in the San Diego and Western Riverside County Vernal Pool Regions (Keeler-Wolf *et al.* 1998) (**Figure II-31**). Campbell (1952) also mentioned collections of plants that differed somewhat from those in southern California but were more similar to *M. minimus* ssp. *apus* than to other taxa. These collections were from Alameda, Fresno, Merced, San Benito, San Luis Obispo, and Stanislaus Counties, plus one site that was along the border of Colusa and Glenn Counties. Stone (1959) collected specimens that he attributed to this taxon in Colusa, Contra Costa, Kern, and Stanislaus Counties. Whittemore (*in litt.* 1993) does not believe that the atypical plants mentioned by Campbell and Stone actually represent *M. minimus* ssp. *apus*. If the questionable populations are truly *M. minimus* ssp. *apus*, it also occurred historically in the Carrizo, Central Coast, Livermore, San Joaquin Valley, and Solano-Colusa Vernal Pool Regions,

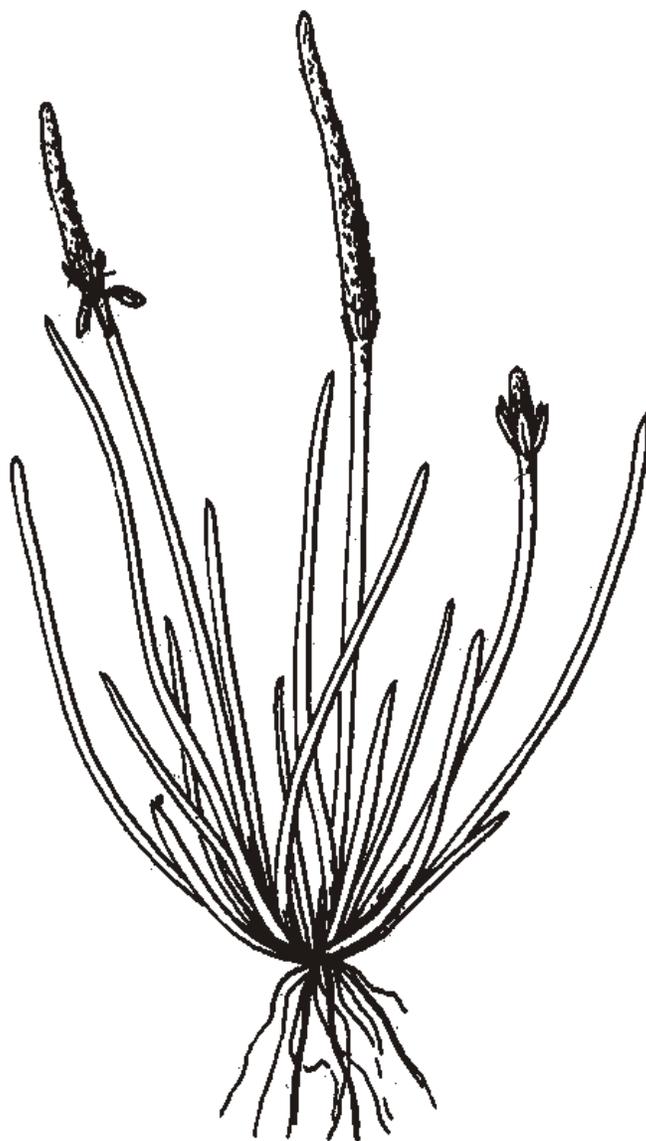


Figure II-30. Illustration of *Myosurus minimus* var. *apus* (little mousetail) Reprinted with permission from Abrams (1944), *Illustrated Flora of the Pacific States: Washington, Oregon, and California*, Vol. II. © Stanford University Press.

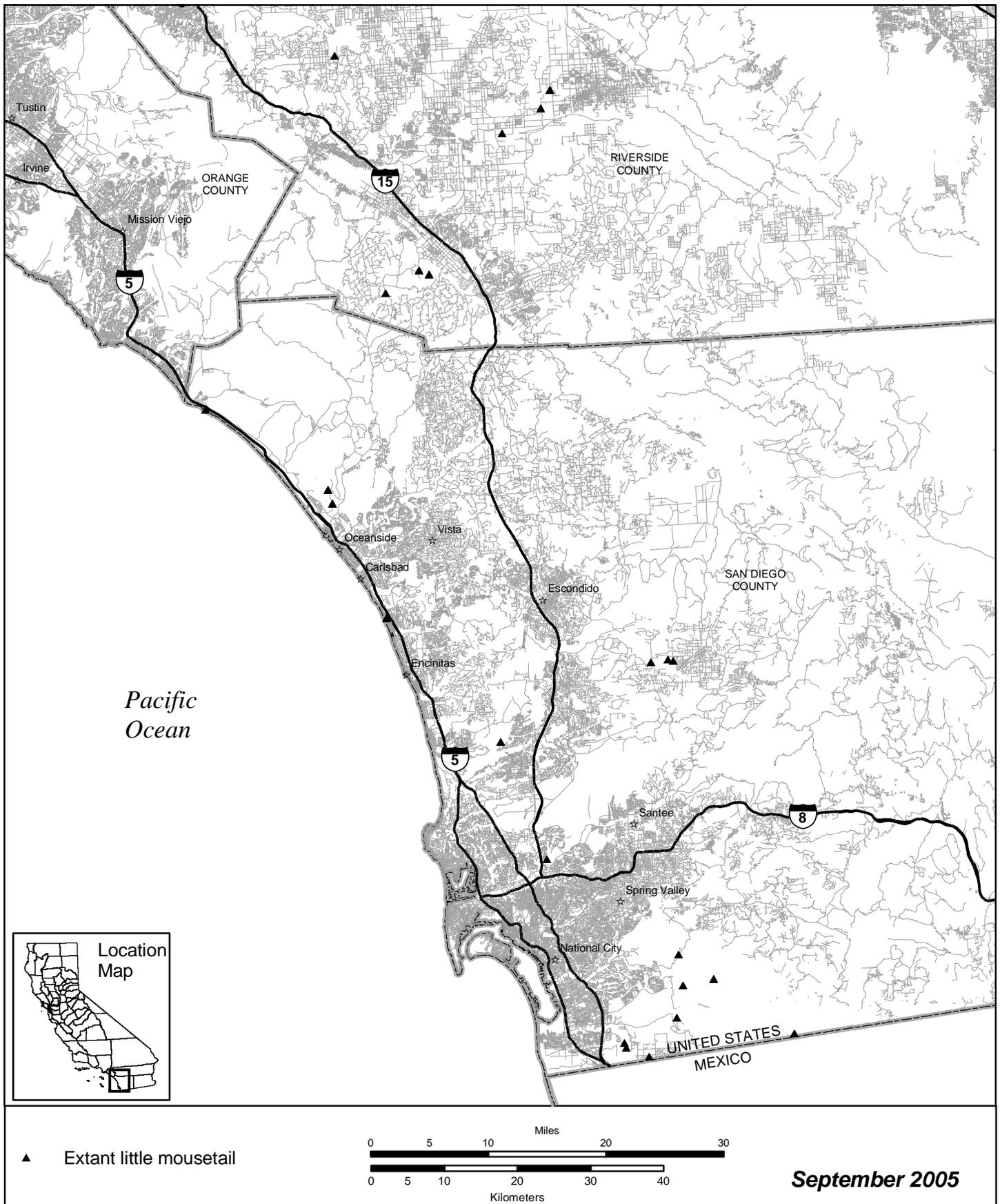


Figure II-31. Distribution of *Myosurus minimus* ssp. *apus* (little mouse-tail).

as well as in areas of Fresno and Kern Counties that are outside of the vernal pool regions designated by Keeler-Wolf *et al.* (1998).

Current Distribution.—The current distribution of *Myosurus minimus* ssp. *apus* is uncertain. Few sites have been revisited since they were first discovered, and contemporary botanists often are reluctant to assign a name to intermediate plants. The California Natural Diversity Data Base tracks only the Riverside and San Diego county occurrences; this taxon is presumed to remain extant at 24 occurrences in those two counties (California Natural Diversity Data Base 2005).

Atypical plants identified as *Myosurus minimus* ssp. *apus* have been reported recently from Alameda, Colusa, Contra Costa, and Kern Counties (Kuenster *et al.* 1994, J. Marr *in litt.* 1996, California Natural Diversity Data Base unprocessed data). An unknown subspecies of *M. minimus* still occurs in Merced County (Silveira 1996). In addition to the counties mentioned above, Tibor (2001) reported that *M. minimus* ssp. *apus* was extant in Butte, San Bernardino, and Stanislaus Counties, as well as Oregon and Baja California, Mexico. If all of the recent reports are correct, *M. minimus* ssp. *apus* is currently known from 10 California counties and from at least 6 vernal pool regions as defined by Keeler-Wolf *et al.* (1998). The vernal pool regions encompassing the recent reports are Livermore, Northeastern Sacramento Valley, San Diego, San Joaquin Valley, Solano-Colusa, and Western Riverside County; depending on the exact location of the Stanislaus County report, it could be in the Southern Sierra Foothills Vernal Pool Region or in the San Joaquin Valley Vernal Pool Region. The San Bernardino County report would be outside of any named vernal pool regions.

c. Life History and Habitat

Reproduction and Demography.—The timing of seed germination in nature has not been reported. However, two greenhouse germination experiments have been conducted with related taxa. Bliss and Zedler (1998) studied an unspecified subspecies of *Myosurus minimus* from San Diego. They compared initial wetting on 30 January, 1 March, and 31 March as well as various durations of inundation. Only the earliest wetting date was effective in triggering germination; out of 178 seeds that germinated during their study, 177 (99.4 percent) germinated following the January wetting. Fifty percent of those seeds germinated by 23 February. Also, Bliss and Zedler (1998) found that moist soil was more conducive to germination and growth of *M. minimus* than was inundated soil. Stone (1959) studied the related taxa *M. minimus* ssp. *filiformis* and *M. sessilis*. Under unspecified “standardized” conditions, both taxa reached median seed germination in 13 days. Flower buds formed about 2 months later,

averaging 69 days for *M. minimus* ssp. *filiformis* and 69 days for *M. sessilis* (Stone 1959).

Myosurus minimus ssp. *apus* flowers between March and June (Tibor 2001). The seeds mature in late March and April in the Central Valley, whereas plants in southern California begin producing seed in May (Campbell 1952). Dispersal mechanisms have not been reported. The soil seed bank of *M. minimus* ssp. *apus* has not been studied, but Campbell (1952) reported that seeds of other *M. minimus* subspecies are viable for only 2 to 3 years following their production.

Although tiny flies (order Diptera) have been observed visiting *Myosurus minimus* ssp. *minimus*, insects apparently are not necessary to transfer pollen (Knuth 1908). Reproduction in *Myosurus* has been studied in depth by Stone (1959). He noted that the reproductive strategy of *Myosurus minimus* ssp. *apus* was similar to that of *M. sessilis*, which he reported in greater detail. Both are predominantly self-pollinating. Pollen is shed before the flower opens, when the pistils and stamens are covered by the sepals; although fertilization does not take place until 3 to 10 days later, this mechanism ensures that pollen will reach all the pistils that have developed. After the pollen is shed, the flower opens. If growing conditions are favorable, the scape will continue to elongate and produce additional pistils at its tip. Only pollen produced by other flowers would be available for fertilization of the newly-formed pistils. In mixed populations, the pollen could even come from different species or subspecies of *Myosurus*. However, Stone found that only 2 percent of plants collected from the field exhibited any evidence of hybridization. He noted that hybridization would be more likely in years with long growing seasons because the plants would have a greater opportunity to develop exposed pistils.

Myosurus species may produce between 10 and 400 pistils per flower, with at most one seed each, and most plants produce only one or two flowers. However, both the number of flowers and the number of pistils may vary depending on the growing conditions (Stone 1959). Other aspects of *M. minimus* ssp. *apus* demography are unknown.

Habitat and Community Associations.—*Myosurus minimus* ssp. *apus* occurs in Northern Claypan, Northern Hardpan, San Diego Mesa, San Jacinto Valley, and Santa Rosa Plateau vernal pool types (Sawyer and Keeler-Wolf 1995). It also grows occasionally in other types of depressions that hold water seasonally (Stone 1959, California Natural Diversity Data Base 2001) and in alkaline marshes (Mason 1957). Most of the occupied vernal pools occur within coastal sage scrub, *Adenostoma fasciculatum* (chamise) chaparral, or annual and perennial grasslands (California Natural Diversity Data Base 2001). In one case this taxon was found in a depression in a fallow field (Stone 1959). In the few

instances where the sizes of occupied pools were reported, they ranged from 25 square meters (269 square feet) to 0.12 hectare (0.3 acre) in area (Stone 1959, California Natural Diversity Data Base 2001). Similarly, the microhabitats for *M. minimus* ssp. *apus* are not well documented; several southern California populations occurred on both the margins and beds of vernal pools (California Natural Diversity Data Base 2001).

Soils at the Central Valley sites studied by Stone (1959) were all alkaline and ranged in texture from clay to sandy loam. Information on characteristics of soils elsewhere in the range are not available. According to the California Natural Diversity Data Base (2001), elevations of occurrences in San Diego and Riverside Counties range from 4 to 640 meters (20 to 2,100 feet), but sites in other parts of the State would likely extend the elevation range.

Myosurus minimus ssp. *apus* is frequently associated with other *Myosurus* taxa, including *M. minimus* ssp. *minimus*, *M. minimus* ssp. *alopecuroides*, *M. minimus* ssp. *filiformis*, and *M. sessilis* (Stone 1959, California Natural Diversity Data Base 2001). Other genera with which it occurs in the Central Valley are *Downingia*, *Plantago* (plantain), and *Lepidium* (Stone 1959). At one site, it co-occurs with *Gratiola heterosepala* (California Natural Diversity Data Base 2005, under *G. heterosepala*). The most frequent associate of *M. minimus* ssp. *apus* in southern California is the federally- and State-listed endangered *Eryngium aristulatum* var. *parishii* (San Diego button-celery). Other federally- and State-listed endangered plants that co-occur with *M. minimus* ssp. *apus* are *Pogogyne nudiuscula* (Otay Mesa mint), *Pogogyne abramsii* (San Diego mesa mint), and *Orcuttia californica*; the federally-listed threatened species *Navarretia fossalis* (spreading navarretia) also co-occurs with *M. minimus* ssp. *apus* (California Natural Diversity Data Base 2005).

d. Reasons for Decline and Threats to Survival

Most species addressed in this recovery plan are threatened by similar factors because they occupy the same vernal pool ecosystems. These general threats, faced by all the covered species, are discussed in greater detail in the Introduction section of this recovery plan. Additional, specific threats to *Myosurus minimus* ssp. *apus* are described below.

The lack of site-specific historical information and the lack of recent surveys preclude quantification of habitat loss for this taxon. However, *Myosurus minimus* ssp. *apus* probably has declined because much vernal pool habitat throughout California has been lost through agricultural conversion and development, as described in other species accounts. At one San Diego site where *M. minimus* ssp. *apus* occurs, several vernal pools were destroyed by

conversion to agriculture, but it is not known whether or not this taxon had been present in those pools. Several other southern California sites where *M. minimus* ssp. *apus* occurs were disturbed by off-road vehicle use, road and powerline construction, livestock grazing, brush removal, and trash dumping (California Natural Diversity Data Base 2001).

Urban development is mentioned as a threat to one San Diego occurrence of *Myosurus minimus* ssp. *apus*. The same occurrence also is threatened by agriculture, trash dumping, livestock grazing, construction of a border crossing, and competition from weedy species. In addition, three southern California occurrences are threatened by damage from off-highway vehicles (California Natural Diversity Data Base 2005). However, other occurrences in that region also may be threatened, particularly by urban development, judging by the magnitude of threats to the listed species of southern California vernal pools (U.S. Fish and Wildlife Service 1998b). Threats have not been assessed at northern and central California occurrences of *M. minimus* ssp. *apus*. If insects do play a role in pollination of *M. minimus* ssp. *apus*, habitat loss for the pollinators could contribute to the decline of this plant.

e. Conservation Efforts

Myosurus minimus ssp. *apus* has no official Federal status. It is not protected in California but is listed as endangered in Oregon (Tibor 2001). *Myosurus minimus* ssp. *apus* formerly was considered to be rare and endangered by the California Native Plant Society (Smith *et al.* 1980). Although it is still considered to be “endangered throughout its range,” *M. minimus* ssp. *apus* now is on the California Native Plant Society “Review List” (List 3) of taxa for which insufficient information is available (Tibor 2001).

Ten of the extant occurrences are on public land or in the ownership of a conservation organization. Only three of these occurrences, all on The Nature Conservancy’s Santa Rosa Plateau Preserve in Riverside County, are being managed for the benefit of rare species (California Natural Diversity Data Base 2001). Three occurrences are on Federal land in San Diego County: one is on a Navy base and the other two are on the Camp Pendleton Marine Corps installation. Two other sites are administered by State agencies; one is on California Department of Water Resources property in Contra Costa County (Kuenster *et al.* 1994) and the other, in San Diego County, is partially owned by the California Department of Transportation (California Natural Diversity Data Base 2001). County agencies are responsible for one *Myosurus minimus* ssp. *apus* site each in Kern (J. Marr *in litt.* 1996), Riverside, and San Diego Counties (California Natural Diversity Data Base 2001). No conservation actions are known to have been taken specifically for the benefit of this taxon.