

(Stone *et al.* 1988). *Orcuttia inaequalis* has been reported at elevations of 100 to 2,475 ft (30 to 755 m); the highest elevation sites are those on the volcanic tabletops of Fresno and Madera Counties (Stebbins *et al.* 1995; CNDDDB 2002).

The pools where *Orcuttia inaequalis* is known to occur form on acidic soils that vary in texture from clay to sandy loam. Soil series represented include the Hideaway series on Fresno-Madera County volcanic tabletops, and Amador, Cometa, Corning, Greenfield, Los Robles, Madera, Peters, Pollasky-Montpellier complex, Raynor, Redding, and San Joaquin soil series elsewhere in the range. The impermeable layer at historical or extant occurrences included iron-silica cemented hardpan, tuffaceous alluvium, and basaltic rock from ancient volcanic flows (Stone *et al.* 1988; Stebbins *et al.* 1995; EIP Associates 1999; CNDDDB 2002).

Further discussion on the life history and habitat characteristics of *Orcuttia inaequalis* can be found in the final rule to list the species (62 FR 14338).

Orcuttia tenuis

Albert Hitchcock (1934) named *Orcuttia tenuis* (slender Orcutt grass). The type specimen was collected in Goose Valley, Shasta County, in 1912. *Orcuttia tenuis* grows as single stems or in small tufts consisting of a few stems. Plants are sparsely hairy and branch only from the upper half of the stem. Although its stems typically are erect, they may become decumbent if many branches form near the stem tip (Reeder 1982). The inflorescence comprises more than half of the plant's height, and the spikelets are more or less evenly spaced throughout the inflorescence.

Similar to other vernal pool annuals, the number of individual plants within an occurrence of *Orcuttia tenuis* can vary greatly in size from year to year. Fluctuations of up to four orders of magnitude have been documented in Lake and Shasta Counties (Griggs 1980; Griggs and Jain 1983). At the Vina Plains Preserve, the single occurrence ranged in size from 1,000 to 147,700 individuals during the five times it was reported over a 13-year period (Stone *et al.* 1988; Alexander and Schlising 1997). However, *O. tenuis* occurrences do not always fluctuate in numbers of plants. Among five occurrences of *O. tenuis* that Griggs tracked from 1973 to 1979, two in the Dales area remained at the same order of magnitude for the entire period. None of the other five species of Orcuttieae included in the study remained stable for the full 7 years (Griggs 1980; Griggs and Jain 1983).

Orcuttia tenuis has the largest geographical range of all the members of the Orcuttieae. The species is known from 35 occurrences in Tehama County, 24 in Shasta County, 5 from Lassen County, 4 from Plumas County, 2 in Sacramento County, and 2 each in Butte, Lake, Modoc, Sacramento, and Siskiyou Counties (CNDDDB 2002). An additional occurrence has recently been found in Sacramento County (ESA 2001). Extirpated occurrences of *O. tenuis* occur near Reading Airport and Stillwater Plains in Shasta County, and additional possibly extirpated occurrences were near Goose Valley and Battle Creek in Tehama and Shasta Counties (CNDDDB 2002).

Orcuttia tenuis is found primarily on substrates of volcanic origin (Crampton 1959; Corbin and Schoolcraft 1989). Vernal pools in which *Orcuttia tenuis* grows are classified as Northern Volcanic Ashflow and Northern Volcanic Mudflow vernal pools (Sawyer and Keeler-Wolf 1995). Impervious layers range from iron-silica hardpan to bedrock (Stone *et al.* 1988; Corbin and Schoolcraft 1989; CNDDDB 2001). Among the populations studied by Stone and others (1988), the median area of pools occupied by *O. tenuis* was 1.6 ac (0.65 ha) and ranged from 0.2 to 111 ac (0.08 to 45 ha). On the Modoc Plateau, occupied pools known as of 1989 ranged in size from 5 to 100 ac (2 to 40 ha) and were typically at least 11.8 in (30 cm) deep; this species was restricted to the deepest areas of these pools (Corbin and Schoolcraft 1989). *Orcuttia tenuis* occurs through a wide range of elevations corresponding to its broad geographical range. The lowest reported elevation was 90 ft (27 m) in Sacramento County (Stone *et al.* 1988) and the highest was 5,761 ft (1,756 m) in Plumas County (Corbin, in litt. 1999).

Soil types supporting vernal pools where *Orcuttia tenuis* is known to occur are diverse, ranging from slightly to strongly acidic (Stone *et al.* 1988), and from clay to sandy, silty, or cobbly loam (Corbin and Schoolcraft 1989; CNDDDB 2001). The soil series has not been reported for all *O. tenuis* sites, but the species has been reported on Collayomi-Aiken-Whispering complex and the Konocti-Hambright complex soils. Modoc Plateau occurrences occur on the Gooval, Lasvar, Lasvar-Pitvar complex, and Nosoni soil series, whereas occurrences in northeastern Sacramento Valley are on the Anita, Guenon, Inks, Inskip, Laniger, Moda, Redding, Toomes, and Tuscan soil series. The Redding soil series also supports *O. tenuis* in Sacramento County (Stone *et al.* 1988; CNDDDB 2001).

Associated species vary throughout the range of *Orcuttia tenuis*. Although *O. tenuis* grows in the same vernal pool complexes as *O. pillosa* in Tehama County (including the Vina Plains Preserve), and *Orcuttia viscida* in Sacramento County, it has not been found to share any pools with either species (Stone *et al.* 1988; Cochrane *in litt.* 1995a; Alexander and Schlising 1997; CNDDDB 2001).

Further discussion on the life history and habitat characteristics of *Orcuttia tenuis* can be found in the final rule to list the species (62 FR 14338).

Tuctoria mucronata

Tuctoria mucronata (Solano grass) was originally described under the name *Orcuttia mucronata* based on specimens collected "12 miles due south of Dixon, Solano County" (Crampton 1959, p. 108). John Reeder (1982) transferred this species to a new genus, *Tuctoria*, resulting in the currently accepted name *Tuctoria mucronata*.

Tuctoria mucronata is grayish-green, pilose, and sticky. The tufted stems are decumbent and do not branch. The long leaves are rolled inward and have pointed tips. The base of the inflorescence is partially hidden by the uppermost leaves. As is characteristic of the genus, the spikelets are arranged in a spiral; the spikelets in the inflorescence of *Tuctoria mucronata* are crowded together.

Annual estimates or individual plant counts at Olcott Lake (Holland 1987; CNDDDB 2002) indicated that occurrence sizes for this species fluctuate dramatically from year to year, as do other members of the Orcuttieae. *Tuctoria mucronata* was not observed at Olcott Lake from 1976 through 1980, then reappeared in 1981 (Holland 1987), indicating that viable seeds can persist in the soil for a minimum of 5 years. Apparently both drought years and years of excessively high rainfall are unfavorable for *Tuctoria mucronata*; the largest expressions of this species were observed after rainfall seasons of 17.7 to 23.6 in (45 to 60 cm) of precipitation (Holland 1987).

Prior to 1985, *Tuctoria mucronata* was known only from Olcott Lake in Solano County, which is believed to be the type locality (Crampton 1959; CNDDDB 2002). A second occurrence was discovered in 1985 approximately 2.5 mi (4 km) southwest of Olcott Lake (CNDDDB 2002). *Tuctoria mucronata* is considered to be possibly extirpated from its type locality, because only four individual plants have been found within the last decade, all in 1993 (CNDDDB 2002). The other Solano