

A.18 Conservancy Fairy Shrimp (*Branchinecta conservatio*)



A.18.1 Legal and Other Status

The Conservancy fairy shrimp is listed as endangered under the ESA throughout its range (59 FR 48136). Critical habitat has been designated for the Conservancy fairy shrimp in Butte County, including areas in the Butte Regional HCP/NCCP Plan Area. Critical habitat includes 20,546 acres (16,182 hectares) in Unit 1 (Vina Plains Unit), a portion of which is in Butte County, and all of which is on private property. The Vina Plains Unit extends from Deer Creek in Tehama County to North of Rock Creek and the Chico Airport near the City of Chico in Butte County (71 FR 7118).

A.18.2 Species Distribution and Status

A.18.2.1 Range and Status



The historical distribution of the Conservancy fairy shrimp is not known; however, the distribution of vernal pool habitats in the areas where the species is now known to occur was once more continuous and larger in area than today. It is likely the Conservancy fairy shrimp once occupied vernal pool habitats throughout a large portion of the Central Valley and southern coastal regions of California, and it may still exist in unsurveyed pools within this region (USFWS 2006). The species is currently known from several disjunct populations: the Vina Plains in Tehama County, south of Chico in Butte County, several areas in Solano County, Sacramento National Wildlife Refuge in Glenn County, San Luis National Wildlife Refuge and the Haystack mountain/Yosemite Lake area in Merced County, in the Tule Ranch unit of the California Department of Fish and Game Yolo Basin Wildlife Area in Yolo County, on Maps Ranch in Stanislaus County, and on Beale Air Force Base in Yuba County (CNDDDB 2006).

The Conservancy fairy shrimp is also found at two locations on the Los Padres National Forest in Ventura County (USFWS 2005, 2006).

A.18.2.2 Distribution and Status in the Plan Area

In the Northeastern Sacramento Valley Vernal Pool Region (Keeler-Wolf et al. 1998), four populations of Conservancy fairy shrimp are found in the Vina Plains area in Tehama County, just north of Butte County, and one reported population comprised of three occurrences is within Plan Area. The Plan Area location is within Caltrans property along both sides of Highway 99 about 1.1 kilometers (0.7 mile) north of the intersection with Cana Highway (CNDDDB 2006) (Figure A.18-1, *Conservancy Fairy Shrimp Recorded Occurrence*).

A.18.3 Habitat Requirements and Special Considerations

Conservancy fairy shrimp inhabit rather large, cool-water vernal pools with moderately turbid water. None are known to occur in running or marine waters or other permanent bodies of water. The pools generally last until June, but the Conservancy shrimp adult life stage has typically been completed before then. They have been collected from early November to early April (59 FR 48136, USFWS 2002, 2005). As with other vernal pool crustaceans, Conservancy fairy shrimp are sporadic in their distribution, often inhabiting only one or a few vernal pools in otherwise more widespread pool complexes. Pools within a complex typically are separated by distances on the order of 5 or more feet and may form dense, interconnected mosaics of small pools or a sparser scattering of larger pools (USFWS 2002). Conservancy fairy shrimp have been found in vernal pools that range in size from 323 square feet to 88 acres (30 square meters to 36 hectares) at elevations ranging from 16 to 5,577 feet (5 to 1,700 meters). The species has been found at sites that are low in alkalinity (16 to 47 parts per million) and total dissolved solids (20 to 60 parts per million), with pH near 7, and at water temperatures as high as 23°C (73°F). The Conservancy fairy shrimp occurs in vernal pools found on several different landforms, geologic formations, and soil types (USFWS 2005). In Butte County, this species was found in unstable pools located in swales formed by old, braided alluvium that are filled by winter/spring rains and last until June (CNDDDB 2006).

A.18.3.1 Community Associations

The Conservancy fairy shrimp occupies the same vernal pool habitats as many of the other vernal pool species, including several other rare and endangered vernal pool crustaceans. This species has been found in association with the vernal pool fairy shrimp (*Brachinecta lynchi*, federally listed as threatened), vernal pool tadpole shrimp (*Lepidurus packardii*, federally listed as endangered), and California fairy shrimp (*Linderiella occidentalis*, a species of concern). Although these species may all be found in one general location, they have rarely been collected from the same pool at the same time. In general, Conservancy fairy shrimp have very large populations within a given pool, and it is usually the most abundant fairy shrimp when more than one species is present. They feed on algae, bacteria, protozoa, rotifers, and bits of detritus (Johnson and Williams 2006). The Conservancy fairy shrimp is a prey species for the vernal pool tadpole shrimp as well as a variety of insect and vertebrate predator species (USFWS 2005).

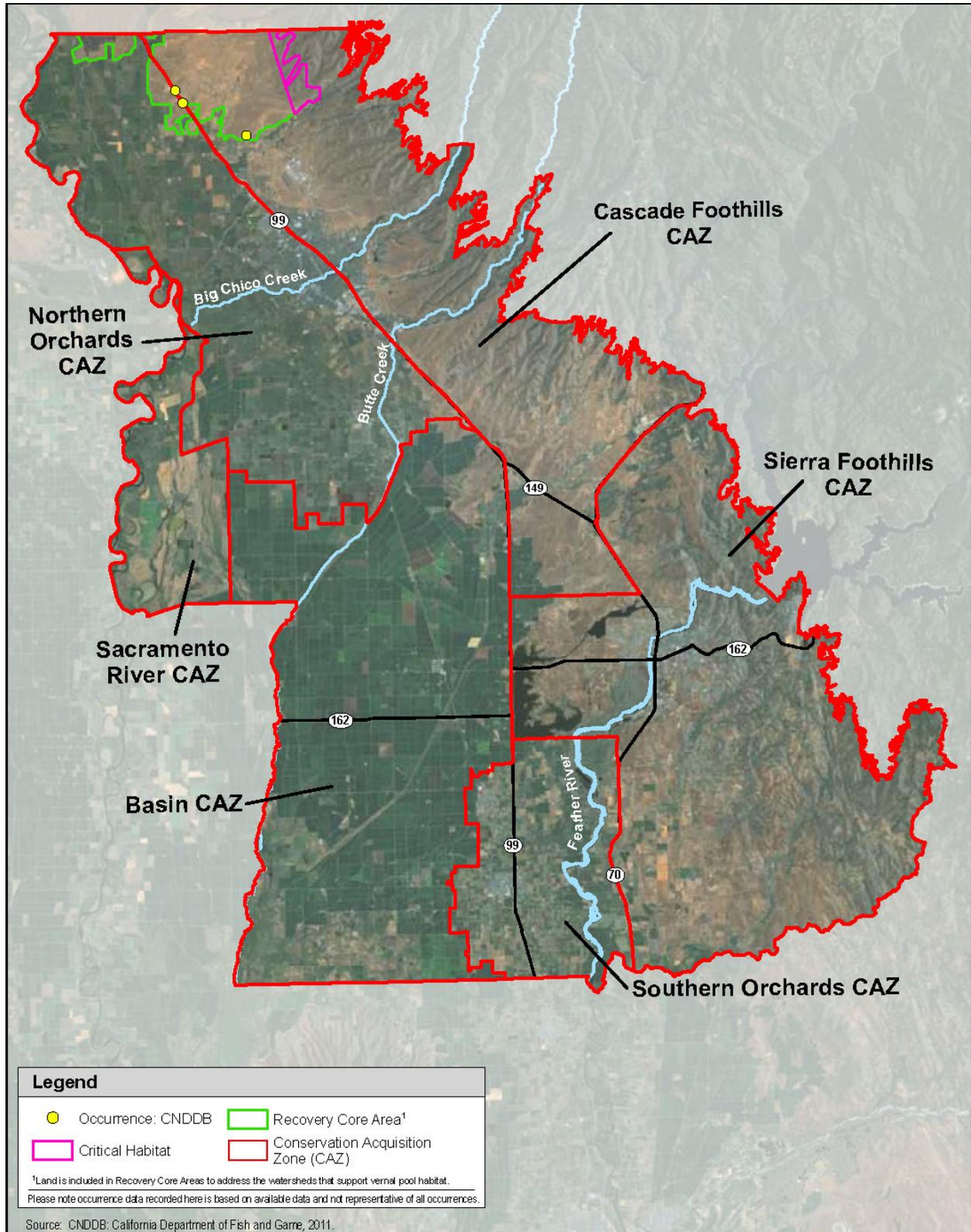


Figure A.18-1. Conservancy Fairy Shrimp Recorded Occurrences

In Butte County, plant species that have been found in the same vernal pool habitats as the Conservancy fairy shrimp include blennosperma (*Blennosperma nanum*) and coyote thistle (*Eryngium vaseyi*) (CNDDDB 2006).

The Conservancy fairy shrimp probably has a similar diet to other fairy shrimp, consisting of algae, bacteria, protozoa, rotifers, and bits of detritus (Pennak 1989 as cited in USFWS 2002).

A.18.4 Life History

Like other vernal pool crustaceans, the life history of the Conservancy fairy shrimp is uniquely adapted to the ephemeral conditions of its vernal pool habitat. It is usually collected at cool temperatures and appears to be relatively long-lived (59 FR 48136). Conservancy fairy shrimp reach maturity in an average of 46 days, and live for as long as 154 days; however, aquatic invertebrate growth rates are largely controlled by water temperature and can vary greatly. For example, in warmer pools, the Conservancy fairy shrimp can reach maturity in as little as 19 days (USFWS 2006). Conservancy fairy shrimp produce one large cohort of offspring each wet season (USFWS 2005).

A key adaptation of all fairy shrimp, including the Conservancy fairy shrimp, is the production of drought-resistant eggs. Female fairy shrimp carry their eggs in a ventral brood sac, and the eggs are either dropped to the pool bottom or remain in the brood sac until the mother dies and sinks. When the pool dries out, so do the eggs (these are known as cysts). The cysts remain in the dry pool bed until rains and other environmental stimuli induce them to hatch. The cysts are capable of withstanding heat, cold, and prolonged desiccation. When the pools refill, some, but not all, of the cysts may hatch and a cyst bank in the soil may contain cysts from several years of breeding. Hatching can begin within the same week that a pool starts to fill.

A.18.5 Threats

Threats to vernal pool habitat, and vernal pool species in general (including Conservancy fairy shrimp), were identified in the Recovery Plan (USFWS 2005). In addition, the Recovery Plan identified several threats specific to the Conservancy fairy shrimp.

A.18.5.1 Habitat Loss and Fragmentation

Habitat loss and fragmentation were identified as the largest threats to the survival and recovery of vernal pool species. Habitat loss is generally a result of urbanization, agricultural conversion, and mining and can also occur as a result of habitat alteration and degradation due to changes to natural hydrology, invasive species, incompatible grazing regimes (including insufficient grazing for prolonged periods), infrastructure projects (such as roads and utility projects), recreational activities (such as off-road vehicles and hiking), erosion, climatic and environmental change, and contamination. Habitat fragmentation is also related to habitat loss when individual vernal pools become disconnected and isolated as a result of activities such as road development and other infrastructure projects. Widespread urbanization and the construction of infrastructure are major contributors to the loss of vernal pool habitats and their associated species. In addition, gravel and clay mining operations needed to support urban development, including roads and other infrastructure, have resulted in the destruction of vernal pools (USFWS 2005, 2006).

The CNDDDB lists numerous occurrences of Conservancy fairy shrimp as threatened by development and agricultural conversions throughout its range. In the Northeastern Sacramento Valley Vernal Pool Region, several of the known occurrences of the Conservancy fairy shrimp are located on Caltrans rights-of-way and are threatened by future road improvement projects in this region (USFWS 2005). In Butte County, the only reported occurrence of this species is in a large vernal pool complex within the Caltrans right-of-way along Highway 99, and it is threatened by possible expansion of this road (CNDDDB 2006).

A.18.5.2 Agricultural Conversion and Incompatible Livestock Grazing Practices

Conversion of land use, such as from grasslands or pastures to more intensive agricultural uses, such as croplands, or from one crop type to another, has contributed and continues to contribute to the decline of vernal pools in general. Although not identified as the primary threat to the Conservancy fairy shrimp populations in Butte County, changes in grazing practices could alter the vernal pool habitat, making it unsuitable for this species (USFWS 2005).

A.18.5.3 Competition from Invasive Species

Vernal pool plant species have declined due to the introduction of invasive nonnative plant and animal species. Waxy manna grass (*Glyceria declinata*), an invasive aquatic grass (Gerlach et al. 2009), greatly increases the amount of decomposing biomass in vernal pools and may result in higher respiratory oxygen consumption relative to photosynthetic oxygen generation (Rogers 1998). In addition, upland biomass of invasive species such as medusahead (*Taeniatherum caput-medusae*) can produce dense vegetation and thatch, shortening the ponding duration of some pools (Marty 2004, Pyke and Marty 2005). Increasing dominance by competitors may also contribute to changes in hydrology and livestock grazing practices. Introduction of species, such as bullfrogs, that may prey on fairy shrimp can be a threat to the species where vernal pool habitat occurs near suitable bullfrog habitat (USFWS 2005).

A.18.5.4 Altered Hydrology

Changes in hydrology that result in a change in the timing, frequency, and duration of inundation in vernal pools can create conditions that render existing vernal pools unsuitable for vernal pool species. The vernal pool complexes in areas proposed for road improvements could be affected by alteration of hydrology, which could diminish habitat for Conservancy fairy shrimp (USFWS 2005).

A.18.5.5 Contamination

Slight changes in water chemistry directly affect sensitive vernal pool species, especially vernal pool crustaceans. Water contamination can occur from herbicides, fertilizers, and other chemicals commonly used in urban and agricultural settings. Pesticide applications for controlling West Nile virus, a disease transmitted by infected mosquitoes, may also affect fairy shrimp species. Fertilizers may also contribute to the growth of invasive plants (USFWS 2005).

A.18.5.6 Other Threats

Several other threats to vernal pools, and their associate species in general, were identified in the Recovery Plan (USFWS 2005). Although not specifically identified as a threat to Conservancy fairy shrimp, these threats contribute to the decline of vernal pool habitats, which will affect all species that are dependent on functional vernal pool habitats for survival. Human use and recreational activities,

such as off-road vehicle use, hiking, and bicycling, threaten vernal pool ecosystems. When access is through vernal pool complexes, hydrological functions may be impaired by displaced soil, causing erosion or interrupting swale connectivity. Also, off-road enthusiasts, such as bicyclists, may create dirt jump ramps, which could result in the burial of seeds and cysts of plants and animals or soil compaction. Recreational users also may introduce, or facilitate spread of, invasive plants or dispose waste and debris into vernal pool habitat and alter the ecology (USFWS 2005).

Habitat alteration may also occur due to large-scale climate and environmental changes, such as global warming, which lead to changes in the precipitation pattern and atmospheric conditions. Most of the populations of Conservancy fairy shrimp are isolated from other populations and are distributed in discontinuous vernal pool systems; small, isolated populations are vulnerable, which could result in extirpation from a particular area (USFWS 2005, 2006).

A.18.6 Relevant Conservation Efforts

Throughout the range of the species, vernal pool habitats supporting populations of Conservancy fairy shrimp have been protected through a variety of other means, including preserves, refuges, and protections on private lands. Within the Northeastern Sacramento Vernal Pool Region, the Conservancy fairy shrimp is protected at the Vina Plains Preserve owned by The Nature Conservancy. Although Conservancy fairy shrimp populations are protected from development on these locations, it is not known if specific management and monitoring for the species is currently being conducted at these sites (USFWS 2005).

A.18.7 Species Habitat Suitability Model

A habitat suitability model has not been developed for Conservancy shrimp because its known occurrences are disjunct and it does not occur in many vernal pools that otherwise appear to support suitable habitat.

A.18.8 Recovery Plan Goals

A general statement for recovery of Conservancy fairy shrimp is presented in the Recovery Plan: to ensure protection of the full geographic, genetic, and ecological extent of this species and to improve the circumstances that caused it to be listed in the first place. Accomplishment of this goal would be achieved by protecting 100 percent of this species' occurrences throughout its range, including 95 percent of its suitable habitat in the Vina Plains, Caswell, Grassland Ecological Area, Ventura County, Jepson Prairie, Sacramento National Wildlife Reserve, and Madera Core Areas. In addition, the species would be reintroduced into vernal pool regions and soil types from which surveys indicate that it has been eradicated.

A.18.9 References

A.18.9.1 Literature Cited

- CNDDDB (California Natural Diversity Database). 2006. RareFind. October. California Department of Fish and Game Natural Heritage Division.
- CNDDDB (California Natural Diversity Database). 2011. California Department of Fish and Game, Sacramento.
- Eriksen, C. and D. Belk. 1999. Fairy shrimps of California's pools, puddles, and playas. Mad River Press, Eureka, California.
- Gerlach, J.D., S. Bushman, and H. Meimberg. 2009. *Glyceria Declinata* Invades California's Vernal Pools. *Invasive Plant Science and Management* 2:92–97.
- Keeler-Wolf, T., D. R. Elam, K. Lewis, and S. A. Flint. 1998. *California Vernal Pool Assessment Preliminary Report*. Sacramento: California Department of Fish and Game.
- Johnson, C. D. and D. F. Williams. 2006. Conservancy Fairy Shrimp (*Branchinecta conservatio*), Endangered Species Recovery Program. California State University, Stanislaus. Available: <http://esrp.csustan.edu/speciesprofiles/profile.php?sp=brco>.
- Marty, J. 2004. Effects of Cattle Grazing on Diversity in Ephemeral Wetlands. *Conservation Biology* 19:1626–1632.
- Pyke, C. P. and J. Marty. 2005. Cattle Grazing Mediates Climate Change Impacts on Ephemeral Wetlands. *Conservation Biology* 19:1619–1625.
- Rogers, D. C. 1998. Aquatic Macroinvertebrate Occurrences and Population Trends in Constructed and Natural Vernal Pools in Folsom, California. Pages 224–235 in C. W. Witham, E. T. Bauder, D. Belk, W.R. Ferrin Jr., and R. Orduff (eds.). *Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference*. Sacramento: California Native Plant Society.
- USFWS (U.S. Fish and Wildlife Service). 2002. *Life History of the Conservancy Shrimp*. Updated February 1, 2002. Available: http://ecos.fws.gov/docs/life_histories/K03D.html.
- USFWS (U.S. Fish and Wildlife Service). 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Portland, OR.
- USFWS (U.S. Fish and Wildlife Service). 2006. Sacramento Fish and Wildlife Office. Species Account: Available: http://www.fws.gov/sacramento/es/animal_spp_accts/conserv_shrimp.htm.

A.18.9.2 Federal Register

- 59 FR 48136. 1994. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, and the Vernal Pool Tadpole Shrimp; and Threatened Status for the Vernal Pool Fairy Shrimp. Final Rule. *Federal Register* 59:48136.

71 FR 7118. 2006. Endangered and Threatened Wildlife and Plants: Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal pool Plants; Final Rule. *Federal Register* 71:7118.