Conservancy Fairy Shrimp
(*Branchinecta conservatio*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California

June 2012

5-YEAR REVIEW

Conservancy Fairy Shrimp (*Branchinecta conservatio*)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

Conservancy fairy shrimp are endemic to vernal pools in California, and this species is restricted to the Central Valley except for one population along the Central Coast in Ventura County (Figure 1). The majority of sites inhabited by the Conservancy fairy shrimp are relatively large and turbid vernal pools, often referred to as playa pools (Helm 1998, Eriksen and Belk 1999, Vollmar 2002). Playa pools often remain inundated much longer than typical vernal pools, in some cases well into the summer, and can be identified by their large size (typically greater than 60 meters in diameter) (Vollmar 2002).

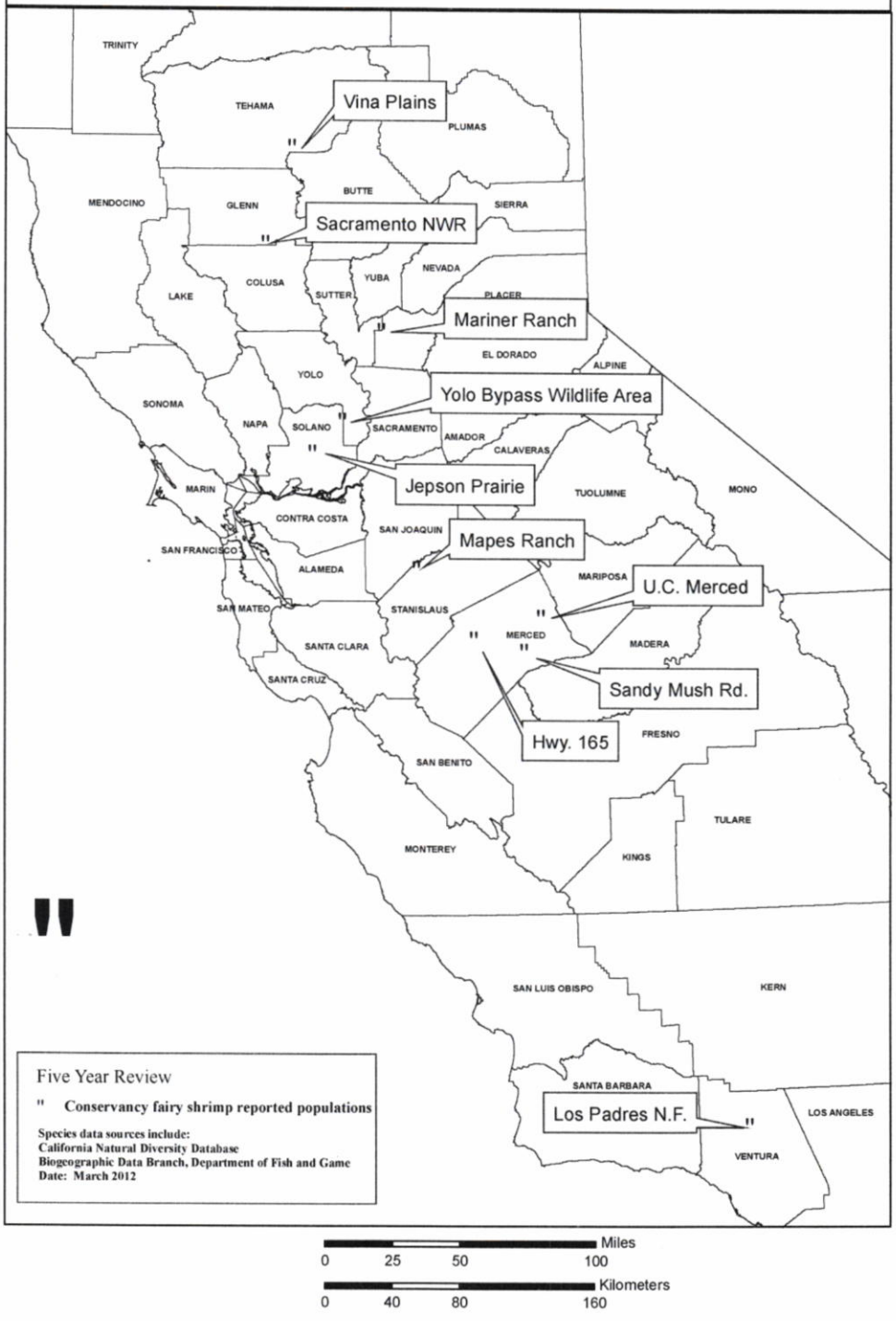
For the purpose of this 5-year review, the Service has grouped together "clusters" of individual Conservancy fairy shrimp locality records that are in close proximity to each other (i.e., generally within 5 miles or less of each other), and defined these clusters as "populations". For example, in the Jepson Prairie area, the California Natural Diversity Database (CNDDB 2012) reports 13 locality records for this species. Twelve of the 13 localities are within an approximately 2.5 mile radius of one another, with the remaining occurrence approximately 5 miles to the southwest. Because of the relatively close proximity of these 13 localities, the Service refers to this cluster of localities as one population (the Jepson Prairie Population). However, other populations, such as the Yolo Bypass Wildlife Area, in Yolo County, and Mariner Ranch in Placer County are comprised of only a single vernal pool (i.e., locality). In general, our definition of "locality" does not necessarily coincide with a single vernal pool, nor do we think these groups necessarily represent biological populations. Rather, this is a convenient way to reference clusters of known occurrences in various parts of the range. Thus,

our grouping methodology is consistent with the rationale used to determine the six populations described at the time of listing.

Conservancy fairy shrimp are rare, and at the time of listing, six widely separated populations (i.e., clusters of localities) of this species were known (Service 1994). The status of one of these six populations is unknown. This particular population was described as being located "south of Chico, Tehama County". Tehama County is actually north of Chico, and this population was not discussed in either the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Recovery Plan) (Service 2005a), or in the last 5-year review for this species (Service 2007a). Therefore, this population will not be addressed further in this document. Extensive surveys for fairy shrimp throughout the range of Conservancy fairy shrimp have located five additional populations since the species was listed in 1994. Currently, the Service is aware of 10 populations of Conservancy fairy shrimp, which include (from north to south): (1) Vina Plains, Butte and Tehama counties; (2) Sacramento National Wildlife Refuge (NWR), Glenn County; (3) Mariner Ranch, Placer County; (4) Yolo Bypass Wildlife Area, Yolo County; (5) Jepson Prairie, Solano County; (6) Mapes Ranch, Stanislaus County; (7) University of California (U.C.) Merced area, Merced County; (8) the Highway 165 area, Merced County; (9) Sandy Mush Road, Merced County; and (10) Los Padres National Forest, Ventura County (Figure 1).

As described in the last 5-year review (Service 2007a) Conservancy fairy shrimp were reported at Beale Air Force Base (Beale) in Yuba County in 1991. The specimens collected at Beale were later identified as vernal pool fairy shrimp (C. Rogers, EcoAnalysts, Inc., pers. comm. 2007). Extensive surveys for vernal pool crustaceans have been conducted at Beale since 1991, and no additional Conservancy fairy shrimp have been detected (Kirsten Christopherson, Beale, pers. comm. 2012.). For these reasons, Conservancy fairy shrimp are not believed to occur at Beale or in Yuba County at this time.

Figure 1 Reported Populations of Conservancy Fairy Shrimp



Methodology Used to Complete This Review:

This review was prepared by the Sacramento Fish and Wildlife Office (SFWO), following the Region 8 guidance issued in March 2008. We used information from the Recovery Plan, survey information from experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game. Our primary source of information for this 5-year review was information provided by experts in the field of vernal pool crustaceans and discussions with entities responsible for the management of the lands on which the Conservancy fairy shrimp is known to occur. We received no information from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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>
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Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on May 25, 2011 (Service 2011).

Listing History:

> **Original Listing**
> **FR Notice:** 59 FR 48136
> **Date of Final Listing Rule:** September 19, 1994
> **Entity Listed:** Conservancy fairy shrimp (*Branchinecta conservatio*)
> **Classification:** Endangered

Associated Rulemakings:

Critical habitat for this species was proposed on September 24, 2002 (Service 2002). The final rule to designate critical habitat for the Conservancy fairy shrimp was published on

August 6, 2003 (Service 2003). A re-evaluation of non-economic exclusions from the August 2003 final designation was published on March 8, 2005 (Service 2005b). An evaluation of economic exclusions from the August 2003, final designation was published on August 11, 2005 (Service 2005c). Administrative revisions were published on February 10, 2006 (Service 2006). Clarifications on the economic and non-economic exclusions for the final designation of critical habitat were published on May 31, 2007 (Service 2007b).

Review History: The first 5-year review for the Conservancy fairy shrimp was completed in September, 2007 (Service 2007a) by the SFWO, and concluded that no change in listing status was warranted.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for Conservancy fairy shrimp is 8 according to the Service's 2011 Recovery Data Call for the Sacramento Fish and Wildlife Office. This is based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a species that faces a moderate degree of threat and has a high potential for recovery.

Recovery Plan or Outline

> **Name of Plan or Outline:** Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon
> **Date Issued:** December 15, 2005

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is an invertebrate, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status

Species Biology and Life History

As summarized in the Recovery Plan, Conservancy fairy shrimp (*Branchinecta conservatio*) are tiny freshwater crustaceans with delicate elongate bodies, large stalked compound eyes, and 11 pairs of phyllopods (swimming legs that also function as gills). Conservancy fairy shrimp do not have a hard shell, a characteristic of the order Anostraca to which they belong. This species can be differentiated from other branchinectids by the flattened portions of its antennae. Conservancy fairy shrimp are endemic to vernal pools, and have adapted to this ephemeral

environment. Conservancy fairy shrimp hatch out of tiny cysts within the soil during the first winter rains, and complete their entire life cycle by early summer. This species is restricted to the Central Valley of California, except for one population in the Central Coast in Ventura County (Figure 1). The majority of sites inhabited by this animal are relatively large and turbid vernal pools called playa pools (Helm 1998, Eriksen and Belk 1999, Vollmar 2002, Service 2005a). Playa pools typically remain inundated much longer than most vernal pools, often well into the summer, even though they normally have maximum depths comparable to vernal pools (Vollmar 2002). For more detailed information regarding this species' biology and life history, see the Recovery Plan (Service 2005a).

Spatial Distribution

Following is a discussion of the known populations of Conservancy fairy shrimp by vernal pool region.

Northeastern Sacramento Valley Vernal Pool Region

Vina Plains, Butte and Tehama Counties

The Vina Plains population is comprised of five localities within a 1-mile area, and three additional localities within 5 miles. There are four known localities within the Nature Conservancy's Vina Plains Preserve (CNDDB 2012). Localities outside of the Vina Plains Preserve include the Laniger Lakes locality, Tehama County (D. Muth, LSA Associates, Inc. pers. comm. 2012), two localities along State Route (SR) 99 in Butte County, just south of the Tehama County line, along Keefer Road, east of SR 99 (CNDDB 2012), the Neary Parcel, just east of SR 99 and south of Vina Plains in Tehama County (Restoration Resources, *in litt*. 2010), and Meridian Ranch Conservation Bank, approximately 1.5 miles east of the SR 99 localities (B. Helm, Helm Biological Consulting, pers. comm. 2012).

All of these localities are within the Vina Plains Core Recovery area, which is a zone 1 core recovery area (i.e., the highest priority of habitat protection needed for recovery of this species). The localities within the Vina Plains Preserve are protected by a conservation easement. While the Laniger Lakes locality was previously proposed for protection as a preserve to offset losses to vernal pool habitat resulting from development projects, the Service does not believe that this population has any protections in place at this time. The remaining localities within the Vina Plains area are on private land and not currently protected.

One locality along SR 99 (adjacent to the Vina Plains Preserve) is on property owned by the U.S. Department of Agriculture under the Wetlands Reserve System. It is unknown if this site is actively managed for the benefit of vernal pool species. The remaining SR 99 locality and the Keefer Road locality are not protected at this time.

The Neary parcel is located adjacent to the Vina Plains Preserve. Conservancy fairy shrimp were detected in three vernal pools during surveys in 2009 by Restoration Resources (Restoration Resources, *in litt*. 2010). Two of these occurrences are located in small, shallow pools along the northern property boundary, and it is likely that Conservancy fairy shrimp or their cysts were

transported to these pools from the Vina Plains Preserve through surface flows during heavy rain events (Helm, pers. comm. 2012). The third pool in which this species was identified is very large, and more typical of the type of pools generally inhabited by this species. While portions of the Neary parcel are protected by a conservation easement, none of the vernal pool habitat is included in the easements at this time (C. Brown, California Department of Transportation, pers. comm. 2012). The Butte County Association of Governments currently owns the Neary parcel, although the California Department of Transportation has retained the rights to future conservation values.

Conservancy fairy shrimp were recently discovered in a single pool at the pending Meridian Mitigation Bank in Butte County. During surveys in the winter of 2012, Conservancy fairy shrimp were found in an additional pool on this site. Surveys are still underway at this time. This locality is located south of Vina Plains and the Neary parcel, and east of the SR 99 locality. The original occurrence is currently protected by a conservation easement, and it is expected that a conservation easement will be placed over the newly discovered occurrence in 2012 (M. Gause, Westervelt Ecological Services, pers. comm. 2012).

Southeastern Sacramento Valley Vernal Pool Region

Mariner Conservation Bank, Placer County

At the time of the last 5-year review, a single male Conservancy fairy shrimp had been detected in a vernal pool at the Mariner Ranch Conservation Bank in Placer County (Helm, pers. comm. 2007). Additional surveys in 2008 and 2011 detected this species in higher numbers within the same vernal pool (Helm Biological Consulting, *in litt*. 2011). The Mariner Ranch Conservation Bank is now sold out, and is protected by a conservation easement. This locality is within the Western Placer County Core Recovery Area. Conservancy fairy shrimp were detected at this site after the 2005 Recovery Plan was finalized. The Recovery Plan did not address this core area in relation to Conservancy fairy shrimp. There are multiple sites within this core area that are protected for the benefit of vernal pool species, including the Orchard Creek Vernal Pool Conservation Bank, Twelve Bridges Preserve, Sheridan Conservation Bank, and Yankee Slough Conservation Bank. Conservancy fairy shrimp have not been detected during fairy shrimp surveys at any of these sites.

Solano-Colusa Vernal Pool Region

Jepson Prairie, Solano County

The Jepson Prairie population contains 13 localities of this species. Twelve of these localities are within 3 miles of each other, and the remaining locality is approximately 5 miles to the southwest. This species has been detected within the Jepson Prairie Preserve, Wilcox Ranch, Muzzy Ranch Conservation Bank, Elsie Gridley Vernal Pool Conservation Bank, Burke Ranch Vernal Pool Conservation Bank, the Potrero Hills Landfill, and the Montezuma Wetlands Preserve.

Five of these localities are within the Jepson Prairie Core Recovery Area, which is a zone 1 core area (with the exception of the Montezuma Wetlands Preserve, which is within the Collinsville core area discussed in the next paragraph). Of the five sites within the Jepson Prairie core area, all but the Potrero Hills Landfill site are protected under conservation easements. The Director's Guild and Grifith's Ranch parcels of the Potrero Hills Landfill site will be protected by a conservation easement in the near future (A. Raab, Sacramento Fish and Wildlife Office, pers. comm. 2012), which will preserve this locality. There are a number of other preserved properties within this core area, including: Muzzy Ranch, Campbell Ranch Conservation Bank, North Suisan Conservation Bank, and the California Department of Fish and Game's Barker Slough Ecological Reserve and Calhoun Cut Ecological Reserve. These preserved areas are protected for the benefit of native species, including vernal pool species. The Service is not aware of other sites containing suitable habitat within this core area that are protected for the benefit of vernal pool species.

The Montezuma Wetlands project is within the Collinsville Core Recovery Area, which is a zone 1 area. The Montezuma Wetlands project site is managed for vernal pool species, but is not protected under a conservation easement (D. Lipton, Lipton Environmental Group, pers. comm. 2007). The Service is not aware of other sites containing suitable habitat within this core area that are protected for the benefit of vernal pool species.

Yolo Bypass Wildlife Area, Yolo County

Conservancy fairy shrimp were detected in a single vernal pool in 2003 within the Yolo Bypass Wildlife Area, which is owned and managed by California Department of Fish and Game (CNDDB 2012, C. Witham, California Native Plant Society, pers comm. 2007). Additional (non-protocol level) surveys have occurred intermittently since, and Conservancy fairy shrimp were last detected on this site in 2008 (Witham, pers. comm. 2012).

Sacramento National Wildlife Refuge, Glenn County

Only one locality of Conservancy fairy shrimp is known within the Sacramento National Wildlife Refuge (NWR). This locality was detected in 1994 in a single vernal pool. Surveys throughout the Sacramento NWR have not detected additional localities of this species to date (J. Silveira, Sacramento National Wildlife Refuge, pers. comm, 2012).

This locality is within the Sacramento National Wildlife Refuge Core Recovery Area, which is a zone 1 core area. The Sacramento NWR manages the complex for the benefit of vernal pool species, including Conservancy fairy shrimp. The Service is not aware of other sites containing suitable habitat within this core area that are protected for the benefit of vernal pool species.

San Joaquin Valley Vernal Pool Region

Mapes Ranch, Stanislaus County

This locality of Conservancy fairy shrimp is located ten miles west of Modesto, on Mapes Ranch (private property), and contains two vernal pools where the species has been reported. This

detection was made in two separate vernal pools in 1991 (CNDDB 2012). The Service is not aware of any subsequent surveys on this property. Changes in the management of vernal pools on Mapes Ranch may have altered the hydrology of these two pools, and it is possible that Conservancy fairy shrimp have been extirpated from this site (B. Helm, pers. comm. 2012).

Mapes Ranch is within the Caswell Core Recovery Area, which is a zone 1 area. The San Joaquin River NWR is within this core area, but Conservancy fairy shrimp have not been detected there (D. Woolington, Merced National Wildlife Refuge, pers. comm. 2007).

Highway 165, Merced County

The Highway 165 population consists of four localities within a 5-mile area, including the San Luis NWR, Merced NWR, and the California Department of Parks and Recreation's Great Valley Grasslands State Park (CNDDB 2012). These localities are all protected.

Please note that the previous 5-year review included the Viera-Sandy Mush Road Conservation Bank locality (described below) with what we have termed the Highway 165 population in this document. Because the Viera-Sandy Mush Road Conservation Bank locality is approximately 13.5 miles from the nearest Highway 165 locality, and based on the definition of population defined in this as well as the last 5-year review, the Service believes that the Viera-Sandy Mush Road Conservation Bank locality is best represented as a distinct population (the Sandy Mush Road population). This population, including two new localities, is described below.

Sandy Mush Road, Merced County

The Sandy Mush Road population consists of three localities within a 5-mile area. These localities include the Viera-Sandy Mush Road Conservation Bank (managed by the Center for Natural Lands Management), the Deadman's Creek Conservation Bank (managed by Wildlands Inc.), and Dutchman's Creek Conservation Bank (managed by Westervelt Ecological Services) (Helm pers. comm. 2012). Localities within both the Viera-Sandy Mush Road Mitigation Bank and the Deadman's Creek Conservation Bank are protected by conservation easements. Dutchman's Creek Conservation Bank is pending agency approval, and is expected to be protected by a conservation easement in the near future.

All of these localities are within the Grassland Ecological Core Recovery Area, which is a zone 1 core recovery area. The Service is not aware of other sites containing suitable habitat within this core area that are protected for the benefit of vernal pool species.

Southern Sierra Foothills Vernal Pool Region

U.C. Merced Area, Merced County

The U.C. Merced Area population is comprised of four localities within a 1-mile area. Two localities of Conservancy fairy shrimp are known to occur within the Flying M Ranch (CNDDB 2012). The Ichord Ranch and the Virginia Smith Trust property have one locality each (J. Vollmar, Vollmar Consulting, pers. comm. 2007).

These localities are within the Madera Core Recovery Area, which is a zone 1 core area. The Virginia Smith Trust property is protected under a conservation easement. A conservation easement has been placed on the Ichord Ranch property, although the easement excludes the portion of the property where Conservancy fairy shrimp occur. Regardless, this locality is now surrounded by protected lands and will likely be protected by default (Vollmar, pers. comm. 2012). The Flying M Ranch is not protected under a conservation easement at this time (Vollmar, pers. comm. 2007). There are a number of sites within this core area that are protected with conservation easements that may have suitable habitat for Conservancy fairy shrimp, although suitable habitat within these sites has not been quantified and species surveys have not been performed. These sites include Flynn Ranch, Knapp Ranch, Nelson Ranch, Cunningham Ranch, Furey Ranch, and the Drayer Ranch Conservation Bank (Vollmar, pers. comm. 2007). The Service is not aware of other sites containing suitable habitat within this core area that are protected for the benefit of vernal pool species.

Santa Barbara Vernal Pool Region

Los Padres National Forest, Ventura County

This population is within the Los Padres National Forest, along Lockwood Valley Road, which is managed by the U.S. Forest Service. The Conservancy fairy shrimp habitat is within a vernal pool complex called the Foster Bear Ponds, which is a unique high-elevation vernal pool complex environment that is rarely associated with Conservancy fairy shrimp. The Foster Bear Ponds encompass approximately 4 acres and is where the species co-occurs with vernal pool fairy shrimp (Forest Service 2005). The pools and connecting swales of the vernal pool complex exist in a pinon-juniper woodland and are surrounded by characteristic vernal pool species such as *Psilocarphus brevissimus, Crassula aquatica, Myosurus minimus, Plagiobothrys* sp., and *Deschampsia danthonioides* (Vanderwier, pers. comm. 2012). Open gravelly areas in the surrounding uplands support a diversity of wildflower species, including *Lewisia, Calochortus, Allium, Penstemon, Lupinus,* and *Mimulus*. Although the vernal pool complex is within the Piru Allotment, the U.S. Forest Service excluded livestock grazing in 2000 and fenced off the vernal pool area to prevent human intrusion. No new occurrences for Conservancy fairy shrimp have been discovered on the forest (Forest Service 2005). Comprehensive forest-wide surveys have not been conducted for Conservancy fairy shrimp; other occurrences are likely to exist within potential vernal pool habitat on the Los Padres National Forest.

Conservancy fairy shrimp critical habitat on Forest Service land is located in the north-central portion of Ventura County on the Los Padres National Forest (68 FR 46685). Of the 8 units of critical habitat designated for Conservancy fairy shrimp, only one unit, Unit 8, occurs on the forest. The unit encompasses approximately 46,531 acres, of which 96 percent is managed by the Los Padres National Forest and the remaining 4 percent is privately owned. Approximately 197 acres (0.4 percent) of critical habitat Unit 8 are within the Foster Bear Ponds Special Interest Area. The vernal pool complex is important for the conservation and survival of the species as it represents the extreme southern end of the Conservancy fairy shrimp species range.

This locality is also within the Ventura County Core Recovery Area, which is a zone 2 core recovery area. The Service is not aware of other sites containing suitable habitat within this core area that are protected for the benefit of vernal pool species.

Abundance

Since the last 5-year review, the Service is aware of two new populations of Conservancy fairy shrimp, for a total of 10 known populations. These occurrences include Mariner Ranch in Placer County and Sandy Mush Road in Merced County. The status of the Mapes Ranch population is unknown at this time. The 10 known populations are widely separated, with nine of the 10 populations being distributed throughout the Central Valley. Each population generally consists of small groups of occurrences, and in the case of the Mariner Conservation Bank, the entire population is comprised of a single vernal pool. Due to the small size and isolated nature of existing populations, risk of local extinctions is high and opportunities for re-colonization is low.

Habitat or Ecosystem

Conservancy fairy shrimp are endemic to the vernal pools of California, and have adapted to this ephemeral environment. California has a Mediterranean climate, which results in the filling of vernal pools during the cool, rainy winters and drying during the hot summers. Conservancy fairy shrimp hatch out of tiny cysts within the soil during the first winter rains, and complete their entire life cycle by early summer. The majority of sites inhabited by this animal are relatively large and turbid vernal pools called playa pools (Helm 1998, Eriksen and Belk 1999, Vollmar 2002, Service 2005a). Playa pools typically remain inundated much longer than most vernal pools, often well into the summer, even though they normally have maximum depths comparable to vernal pools (Vollmar 2002). In some portions of California, as much as 95-100 percent of vernal pool habitat has been lost to development (Service 2005a)

Genetics

Preliminary results from a study being conducted at U.C. Merced suggest that there may be significant genetic variation between Conservancy fairy shrimp in the Sacramento Valley and the San Joaquin Valley (A. Aguilar, U.C. Merced, pers. comm. 2012). U.C. Merced is in the process of trying to obtain additional specimens for analysis.

Species-specific Research and/or Grant-supported Activities

Other than the genetic research described above, the Service is not aware of any ongoing research activities specifically targeting the Conservancy fairy shrimp. Occasional surveys continue to occur on properties known to support this species, including the Yolo Bypass Wildlife Area and at conservation banks. These surveys are generally informal, but provide important information regarding the status of known populations.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Portions of 9 of the 10 known populations of this species are protected from the direct effects of development on Federal, State, and private lands. At the time of listing in 1994, Conservancy fairy shrimp localities were protected in the Jepson Prairie Preserve, the Vina Plains Preserve, the Sacramento NWR, the Merced NWR, the San Luis NWR, and Los Padres National Forest (Service 1994). Since the species was listed in 1994, Conservancy fairy shrimp localities have been protected under conservation easements at the Wilcox Ranch, Muzzy Ranch, and the Elsie Gridley Conservation Bank, all in Solano County. In Merced County, the Virginia Smith Trust parcel, Viera-Sandy Mush Road Vernal Pool Conservation Bank, and Deadman's Creek Conservation Bank localities are all protected. The Mariner Vernal Pool Conservation Bank, in Placer County, is protected under a conservation easement. One occurrence at the Meridian Mitigation Bank, in Butte County, is protected under a conservation easement, and an additional occurrence on this property is expected to be protected by the end of 2012 (Gause, pers. comm. 2012). A large portion of Ichord Ranch, in Merced County, has been protected by a conservation easement. This easement does not include the known Conservancy fairy shrimp locality; however, the area is now effectively "landlocked" by protected lands and will likely be protected from development by default (Vollmar, pers. comm. 2012). The Conservancy fairy shrimp locality at this site was excluded from the existing conservation easement in order to facilitate the future sale of this site as mitigation for vernal pool impacts elsewhere. The locality at Dutchman's Creek Conservation Bank will likely be protected by a conservation easement in the near future. The Potrero Hills Landfill locality, in Solano County, is expected to be protected by a conservation easement in the near future. Two populations of Conservancy fairy shrimp have been detected on State lands since the time of listing, and include the Great Valley Grasslands State Park and the Yolo Bypass Wildlife Area.

Although substantial progress with regard to protecting Conservancy fairy shrimp habitat has been made, many unprotected localities remain. Two of four localities in the U.C. Merced population are not protected from habitat loss or modification. These localities are located on the Flying M Ranch. Several occurrences within the Vina Plains population are on private land and are not currently protected. The Mapes Ranch population is not protected, and it is unknown whether this population persists. Some localities within the Jepson Prairie population are located in restored wetland areas that are not protected by conservation easements, but are currently managed for vernal pool species. The Service is not aware of any projects that are proposed within the vicinity of the unprotected Conservancy fairy shrimp localities in the Vina Plains, Jepson Prairie, or Mapes Ranch populations.

The U.C. Merced population is threatened by habitat fragmentation and degradation from increased development pressures in the region. There is also a threat of direct habitat loss; however, this appears less severe than the threats of fragmentation and degradation. Currently,

the known localities within the U.C. Merced population are zoned by the City of Merced as exclusive agriculture, and are not managed for vernal pool species (Jones and Stokes 2008).

Current land-use plans for U.C. Merced have designated the Virginia Smith Trust parcel as conservation land, but the remaining localities (Ichord Ranch and Flying M Ranch) are not designated as conservation lands (Jones and Stokes 2008). The Ichord Ranch locality is now surrounded by lands protected by conservation easements, and the Service expects that the vernal pool known to harbor Conservancy fairy shrimp at this location will be protected in the future. The Service is not aware of specific projects that would result in the destruction of these two localities, they are threatened because of the uncertainty of where future development will occur in the area.

The historic range of the Conservancy fairy shrimp is not known, and the loss and modification of vernal pool habitat statewide continues to be the primary threat to the Conservancy fairy shrimp. Loss of habitat due to urbanization reduces the ability of the Conservancy fairy shrimp to persist and recover.

Even in areas where habitat is protected, the urbanization of surrounding lands can reduce the suitability of protected habitats, and hinders the dispersal of the Conservancy fairy shrimp within and between populations, as well as causing increased edge effects to pool complexes. Acquisition of land and conservation easements has resulted in the preservation of vernal pool habitat for the species, but the trend of vernal pool habitat loss in the state has continued. Remnant habitat that has been protected in small parcels is often subject to changed hydrological conditions, invasion by nonnative plants and other species, increased vegetation growth, and other conditions (such as inappropriate grazing levels) that serve to make habitat less suitable for the shrimp.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial purposes was not known to be a factor in the 1994 final rule (Service 1994). Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

The 1994 final rule does not state whether disease is a factor for Conservancy fairy shrimp (Service 1994). The Service is not aware of any new information regarding disease or predation as threats to this species.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

The Federal Endangered Species Act: The Endangered Species Act of 1973, as amended (ESA), is the primary Federal law that provides protection for Conservancy fairy shrimp. Section 7(a)(2) requires Federal agencies to consult with the Service to ensure any project they fund,

authorize, or carry out does not jeopardize a listed species. If a Federal agency is not involved in a proposed project, and federally-listed species may be taken as part of the project, then an incidental take permit pursuant to section 10(a)(1)(B) should be obtained. Section 9 and Federal regulations pursuant to section 4(d) prohibit the "take" of federally endangered wildlife. The protection of Section 9 afforded to endangered species is extended to threatened wildlife and plants by regulation.

Federal Clean Water Act: The Section 404 of the Clean Water Act may afford some protection to Conservancy fairy shrimp. The U.S. Army Corps of Engineers (Corps) issues permits for the discharge of dredged or fill material into navigable waters of the U.S. The Corps interprets "the waters of the United States" expansively to include not only traditional navigable waters, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. Before issuing a 404 permit to a project applicant that may affect federally-listed species, the Corps is required under section 7 of the ESA to consult with the Service. If ESA protections were removed, Section 404 of the Clean Water Act would not contribute to the conservation of Conservancy fairy shrimp on its own.

Recent Supreme Court rulings have called into question the Corps' definition of Waters of the U.S. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving "isolated" wetlands. Currently, the Corps regulatory oversight of vernal pools is in doubt because of their "isolated" nature. If the Corps discontinues regulation of vernal pools, unmitigated destruction of suitable habitat for Conservancy fairy shrimp may increase over the range of the species. However, the State of California's Regional Water Quality Control Board has the option to regulate projects that result in the dredge and fill of wetland habitat if a Federal 404 permit is not required (see California State Laws, below).

California State Laws: The State's authority to conserve wildlife is comprised of the California Endangered Species Act (CESA) and the California Environmental Quality Act (CEQA). Conservancy fairy shrimp are not listed under CESA. CEQA (chapter 2, section 21050 *et seq.* of the California Public Resources Code) requires government agencies to consider and disclose environmental impacts of projects and to avoid or mitigate them where possible. Under CEQA, public agencies must prepare environmental documents to disclose environmental impacts of a project and to identify conservation measures and project alternatives. Through this process, the public can review proposed project plans and influence the process through public comment. If a project may impact known populations of Conservancy fairy shrimp, these impacts would be disclosed to the Service and allow the Service an opportunity to comment on the proposed project's effects to this species. Typically, project proponents proposed conservation measures to offset or minimize adverse effects to listed species. However, CEQA does not guarantee that such conservation measures will be implemented.

The Clean Water Act Section 401 Water Quality Certification and/or Waste Discharge Requirements are regulated by the State of California's Regional Water Quality Control Board. Anyone proposing to conduct a project that requires a Federal permit or involves dredge or fill activities that may result in a discharge to U.S. surface waters and/or "Waters of the State" are required to obtain a Clean Water Act Section 401 Water Quality Certification and/or Waste Discharge Requirements permit. However, if a proposed project does not require a Federal

permit, but does involve dredge or fill activities that may result in a discharge to "Waters of the State", the Regional Water Quality Control Board has the option to regulate the project under its state authority (Porter-Cologne) in the form of Waste Discharge Requirements or Waiver of Waste Discharge Requirements.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

Other natural or manmade threats cited in the 1994 final rule include stochastic extinction due to the high degree of isolation and small numbers of populations of this species (Service 1994). Stochastic extinction as a result of random or unpredictable disturbances is a continued threat to the species. Additional threats not discussed in the 1994 listing rule include climate change, invasive plant species, inappropriate grazing regimes, and contaminants (e.g., pesticide use).

The threats of climate change, invasive plant species, inappropriate grazing, contaminants, and risk of localized stochastic extirpations remain for all localities of Conservancy fairy shrimp whether they are on protected lands or not. Threats to Conservancy fairy shrimp are not likely being managed at all on most private, unprotected lands. The majority of localities of this species do not have management plans or monitoring programs to ensure that potential threats posed by invasive weedy species, inappropriate grazing regimes, or pesticide use are managed and controlled in perpetuity. In addition, funding is not sufficient at any of the protected localities for systematic surveys to be conducted to determine if potential threats are present. The lack of management, monitoring, and funding are not, in themselves, threats to Conservancy fairy shrimp; however, without these components, potential threats may not be identified or eliminated.

Climate Change

Climate change is expected to have an effect on vernal pool hydrology through changes in the amount and timing of precipitation inputs to vernal pools and the rate of loss through evaporation and evapotranspiration (Pyke 2004, Pyke and Marty 2005). These changes in hydrology will likely affect fairy shrimp species because they are obligate aquatic organisms with life histories dependent on certain hydrologic conditions (Pyke 2005a). The suitability of vernal pools for fairy shrimp depends in large part on the timing and duration of wetland inundation, as these species are dependent on vernal pools that have sufficient water to remain wet throughout the annual reproductive phase of the species.

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007, Pyke 2005a). However, climatic conditions for smaller sub-regions such as California remain uncertain (Pyke 2005a). It is unknown at this time if climate change in California will result in a localized, relatively small cooling and drying trend, or a warmer trend with higher precipitation events (Pyke 2005a). However, it is possible that either scenario would result in negative effects to vernal pool invertebrate species (Pyke 2004, Pyke and Marty 2005). Cooling and drying trends could adversely affect Conservancy fairy shrimp through decreased inundation periods that do not

allow the species sufficient time to complete its life cycle. In contrast, warmer conditions could increase inundation periods, which would not necessarily be a negative effect because increased inundation periods would increase available habitat for Conservancy fairy shrimp. However, increased inundation periods associated with a warming trend could also negatively affect the species by not providing cool enough temperatures for Conservancy fairy shrimp to hatch or reproduce. In addition, increased inundation periods could increase the abundance of predator species that require more permanent water sources in vernal pools such as dragonflies, aquatic beetles, and amphibians (Erikson and Belk 1999, Pyke 2005a).

Based on existing data (Helm 1998, Eriksen and Belk 1999), weather conditions in which vernal pool flooding promotes hatching, but in which pools dry (or become too warm) before embryos are fully developed, are expected to have the greatest negative effect on the resistance and resilience of Conservancy fairy shrimp populations as depletion of previous years' cysts (accumulation of dormant eggs in vernal pool soils) occurs. Vernal pool crustaceans have developed life-history strategies to survive drought periods. They are, however, adapted to complete their life cycles within limited temperature ranges and require a minimum length of inundation to reach maturity and reproduce. Climate change is expected to lead to increased variability in precipitation and to increased loss of soil moisture due to evaporation and transpiration of water from plants (Field et al. 1999), which may exacerbate effects due to drought. Drought-mediated decreases in water depth and inundation period could increase the frequency at which pools dry before shrimp have completed their life cycle, or cause pool temperatures to more often exceed temperatures suitable for hatching and persistence of the species.

Pyke (2004, 2005b) postulated that climate change in the future may result in changes in hydrology that would adversely affect Conservancy fairy shrimp at sites that are currently preserved for this species. In addition, the current configuration of vernal pool habitats within preserves are not likely to sustain Conservancy fairy shrimp in the event of a prolonged drought, as this species requires longer inundation periods to complete its life cycle. Habitat that is not currently suitable, but may be suitable in the future, may not be available for preservation in the future (Pyke 2005a, 2005b). Monitoring of vernal pool ecosystems to determine effects from climate change is necessary to determine what adaptive land management practices would be the most appropriate to ensure the sustainability of vernal pool species (Pyke and Marty 2005, Pyke and Fisher 2005), including the Conservancy fairy shrimp.

Small Numbers of Populations/Local Stochastic Extirpations

The combination of highly specialized pool type and soil characteristics makes the Conservancy fairy shrimp exceedingly rare (Vollmar 2002). This species is only known to occur in ten disjunct populations, with some populations being comprised of a single vernal pool. The conservation biology literature commonly notes the vulnerability of taxa known from one or very few locations (e.g., Shaffer 1981, 1987; Primack 1998; Groom et al. 2006). Such populations may be highly susceptible to extirpation due to chance events or additional environmental disturbance (Gilpin and Soule 1988; Goodman 1987), such as adverse effects from changes in hydrology or temperatures due to climate change, invasive plant species, and inappropriate

grazing regimes. If an extirpation event occurs in an isolated population, the opportunities for recolonization will be greatly reduced due to physical isolation from other source populations.

Non-native Plants

Non-native plant species occur commonly in vernal pool complexes and have become a threat to native vernal pool species through their capacity to change pool hydrology (Marty 2005). It is likely that a lack of fires, coupled with a lack of adequate grazing, has increased the densities of non-native herbaceous vegetation surrounding vernal pools, degrading the habitat (Wells *et al*. 1997).

Non-native grasses maintain dominance at pool edges, sequestering light and soil moisture, and Italian ryegrass (*Lolium multiflorum*) and waxy mannagrass (*Glyceria declinata*) increase thatch buildup (dead, dried plant material) (Sacramento County 2006), which can lead to oxygen depletion in the pools (Dunne and Leopold 1978). These non-native plants thus can contribute to the shortening of inundation periods through increased evapo-transpiration in the vernal pools (Marty 2005) and the reduction of the amount of water entering the system through surface and subsurface flows. Invasive weedy plants are a threat at many of the localities for this species, including Vina Plains (R. Schlising, C.S.U. Chico, pers comm. 2007), Jepson Prairie (B. Wallace, Solano Land Trust, pers. comm. 2006), and the Sacramento NWR (although they are not yet a problem at the single Conservancy fairy shrimp locality; Silveira, pers. comm., 2007). The Service does not have information on this threat at other localities due to a lack of monitoring at these sites, although it is reasonable to expect non-native plants are present at some of them.

Grazing

Inappropriate grazing practices include complete elimination of grazing in areas where non-native grasses dominate the uplands surrounding vernal pools, and inappropriate timing or intensity of grazing. Appropriate grazing practices utilize a grazing regime to ensure proper function of hydrology in vernal pools (Marty 2005). In particular, an appropriate grazing regime ensures that non-native weedy plants such as Italian ryegrass and waxy mannagrass, which increase thatch buildup, decrease ponding durations, and decrease the aquatic habitat available to Conservancy fairy shrimp. The majority of localities for this species are grazed by cattle, although not all are grazed for the benefit of vernal pool species. Management and monitoring plans that do not include an adaptive management approach and do not facilitate natural processes and functions may not result in conservation of Conservancy fairy shrimp. Similarly, lack of funding to implement grazing management and monitoring activities may contribute to a decline of habitat conditions and species baseline (Service 2005a).

Contaminants/Pesticides

Pesticides, herbicides, and other chemicals can be conveyed into the vernal pool habitats by overland run-off during rain events, or they may enter vernal pools by drift or direct over-spray

(Johnson 2005). In addition, pesticides applied to agricultural fields and orchards in the Central Valley can volatize to the atmosphere. Once in the atmosphere, the pesticides can be transported by bulk air movement and directly enter the vernal pool system from rainfall (Johnson 2005). Pesticides are commonly accumulated in the soil, and long-term accumulation of certain compounds may also result (Johnson 2005). Little is known about the relative sensitivity of vernal pool invertebrates to commonly used agricultural pesticides and chemical concentrations. However, research has shown that many commonly used pesticides may result in adverse effects to aquatic invertebrate species (Weston et al. 2005). Johnson (2005) found that 11 of 18 vernal pools sampled within the Sacramento NWR contained pesticides, although this study did not include the single vernal pool with a known occurrence of Conservancy fairy shrimp. However, pesticides are known to be used within close proximity of known Conservancy fairy shrimp localities. Marovich and Kishaba (1997) overlaid CNDDB occurrences with pesticide-use areas detailed in the California Department of Pesticide Regulation's annual Pesticide Use Reports, and determined that a variety of common pesticides were applied within the vicinity of known occurrences of Conservancy fairy shrimp. The actual distances of pesticide applications from Conservancy fairy shrimp localities were not reported in this study, but distances ranged from 0 to 3 miles (Marovich and Kishaba 1997).

Because pesticides can be transported through the variety of methods previously discussed, and the high prevalence of pesticide use throughout the Central Valley, we believe it is likely that vernal pools containing Conservancy fairy shrimp have been exposed to harmful pesticides to some degree. The current effects of contaminants on this species are not known at this time. Further research and monitoring are necessary to determine the degree that the Conservancy fairy shrimp is threatened by contaminants such as pesticides.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

General recovery criteria for Conservancy fairy shrimp and 19 other listed plants and animals are described in the Recovery Plan (Service 2005a). This Recovery Plan uses an ecosystem-level approach because many of the listed species and species of concern co-occur in the same natural ecosystem and share the same threats. The over-arching recovery strategy for Conservancy fairy shrimp is habitat protection and management. The five key elements that comprise this ecosystem-level recovery and conservation strategy are: (1) habitat protection; (2) adaptive management, restoration, and monitoring; (3) status surveys; (4) research; and (5) participation and outreach.

Downlisting /delisting criteria for Conservancy fairy shrimp include:

1. <u>Habitat protection</u>: Accomplish habitat protection that promotes vernal pool ecosystem function sufficient to contribute to population viability of the covered species.

This criterion addresses Factor A[1].

1A. Suitable vernal pool habitat within each prioritized core area for the species is protected.

Vernal pool regions in the Recovery Plan are based largely on the presence of endemic species, with soils and geomorphology as secondary elements, and each region contains one or more of the vernal pool species covered in the plan. Core areas are distinct areas in each vernal pool region that support high concentrations of federally-listed vernal pool species, are representative of a given species' range, and are generally where recovery actions are focused. Core areas represent viable populations (possibly even source populations of vernal pool species for larger metapopulations) that will contribute to the connectivity of habitat and thus increase dispersal opportunities between populations. More than one federally-listed vernal pool species may be found within a single core area, and the core areas encompass areas larger than just the known localities of Conservancy fairy shrimp. In the Recovery Plan, the nine core areas that pertain to the Conservancy fairy shrimp include: Vina Plains, Western Placer County, Caswell, Grasslands Ecological Area, Ventura County, Jepson Prairie, Sacramento NWR, Collinsville, and Madera (Table 1).

[1] A) Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

Table 1: Conservancy fairy shrimp core recovery areas.

Northeastern Sacramento Valley Vernal Pool Region Core area: Vina Plains (zone 1)
Southeastern Sacramento Valley Vernal Pool Region Core Area: Western Placer County (zone 2)
San Joaquin Valley Vernal Pool Region Core areas: Caswell (zone 1) Grasslands Ecological Area (zone 1)
Solano-Colusa Vernal Pool Region Core areas: Sacramento NWR (zone 1) Jepson Prairie (zone 1) Collinsville (zone 1)
Southern Sierra Foothills Vernal Pool Region Core areas: Madera (zone 1)
Santa Barbara Vernal Pool Region Core area: Ventura County (zone 2)

The Recovery Plan identifies specific percentages of suitable habitat to be protected in each of the nine core areas. Core areas are ranked as zone 1, 2, or 3 in order of their overall priority for recovery. Core areas containing Conservancy fairy shrimp are included as both zones 1 and 2 in the Recovery Plan, with no core areas ranked as zone 3 (zone 3 represents currently unoccupied, historical habitat, which has not been identified for this species). Table 1 provides a summary of the six vernal pool regions that pertain to Conservancy fairy shrimp, and the zone designations for each of the nine core areas.

To downlist the Conservancy fairy shrimp, the Recovery Plan recommends that 95 percent of the suitable species habitat in each of the zone 1 and zone 2 core areas (i.e., 95 percent of the suitable habitat in the Vina Plains core area, 95 percent of the suitable habitat in the Caswell area, etc.) be protected. This criterion has not been met. To delist the species, in addition to achieving the downlisting criteria, any newly discovered populations should be protected. This recovery criterion has been partially met, as the populations discovered since listing have been or will be protected.

The Service does not yet have sufficient information to quantify either the acreage of suitable habitat within each core area or the acreage of protected habitat that is suitable for Conservancy fairy shrimp. The amount of suitable habitat that exists range wide has not yet been estimated; therefore, the percent that has been protected range wide is still unknown.

1B. Species localities distributed across the species geographic range and genetic range are protected. Protection of extreme edges of populations protects the genetic differences that occur there.

This criterion has been met. The majority of known Conservancy fairy shrimp localities are protected by conservation easements or are protected on public lands. Unprotected localities include portions of the U.C. Merced population and the Vina Plains population, and the entire Mapes Ranch population. Two localities within the Jepson Prairie population are not currently protected under conservation easements, although they are currently managed for vernal pool species, and one of these localities is expected to be protected in the near future. Extreme edges of the Conservancy fairy shrimp's range are protected. The northern-most population occurs within Vina Plains, where the Vina Plains Preserve and Meridian Ranch localities are protected. The Los Padres National Forest protects the southern-most population of this species. Table 2 provides information on the protected localities of each population.

1C. Reintroduction and introductions must be carried out and meet success criteria.

The Recovery Plan recommends introduction to vernal pool regions and soil types from which status surveys indicate the species has been extirpated. Although the status of the Mapes Ranch locality is unknown at this time, the Service is not aware of any instances where the species has been extirpated; therefore, this recovery criterion is not relevant to the species at this time.

Table 2: Known populations (from north to south) of Conservancy fairy shrimp and protection status.

Population	Land owner(s)	Status of Protection of Population
Vina Plains, Butte and Tehama County	The Nature Conservancy, Butte County Association of Governments, and private	5 of 10 localities are protected at the Nature Conservancy's Vina Plains Preserve and Meridian Ranch Conservation bank under conservation easements. A newly discovered locality at the Meridian Ranch site will be protected by a conservation easement in 2012.
Sacramento NWR, Glenn County	Service	Protected – Federal lands.
Mariner Ranch Mitigation Bank, Placer County	Private	Protected – conservation easement.
Yolo Bypass Wildlife Area, Yolo County	California Department of Fish and Game	Protected – State lands.
Jepson Prairie, Solano County	The Nature Conservancy and private	11 localities are protected under conservation easements; one locality will be protected in the near future; 2 localities are in restored wetland areas that are not under easements, but are managed forvernal pool species.
Mapes Ranch, Stanislaus County	Private	Not protected.
U.C. Merced Area, Merced County	Private	One of four localities is protected at the Virginia Smith Trust parcel under a conservation easement. One locality at the Ichord Ranch is surrounded by protected land, two occurrences at Flying M Ranch are not protected.
Highway 165, Merced County	Service, California Department of Parks and Recreation, and private	Protected – Federal (San Luis and Merced NWRs) and State lands, and conservation easements on private land.
Sandy Mush Road, Merced County	Private	Protected by conservation easements at the Viera-Sandy Mush Road and Deadman's Creek Conservation Bank's, likely soon to be protected at the Dutchman's Creek Conservation Bank.
Los Padres National Forest, Ventura County	U.S. Forest Service	Protected – Federal lands.

1D. Additional localities are permanently protected, if determined essential to recovery goals.

At the time of listing in 1994, there were six known populations of Conservancy fairy shrimp. The Service does not have information on the exact location or current status of one of these populations (described as "south of Chico, Tehama County"). At the time of the 2005 Recovery Plan, there were eight known populations. In total, there are five additional populations since listing: 1) the Mariner Ranch in Placer County; 2) the Yolo Bypass Wildlife Area in Yolo

County; 3) Mapes Ranch in Stanislaus County; 4) the Highway 165 population in Merced County; and 5) the Sandy Mush Road population, also in Merced County. Due to the rarity of Conservancy fairy shrimp, it is essential to protect all new detected populations to recover this species. Other than the Mapes Ranch population, all known new populations since the time of listing are either protected or in the process of being protected (one locality in the Sandy Mush Road population). Various localities within other existing populations are not protected at this time.

1E. Habitat protection results in protection of hydrology essential to vernal pool ecosystem function, and monitoring indicates that hydrology that contributes to population viability has been maintained through at least one multi-year period that includes above average, average, and below average local rainfall as defined above, a multi-year drought, and a minimum of 5 years of post-drought monitoring.

Monitoring of hydrology has not occurred at any of the known extant populations; therefore, the Service is unable to determine whether the hydrology at extant locations has supported viable populations through a variety of hydrologic conditions. It is probable that many of the protected sites have functional hydrology that would meet the requirements specified in this recovery criterion. However, the Service has not identified the parameters that need to be monitored to determine if this criterion has been met.

2. Adaptive Habitat Management and Monitoring:

This criterion implicitly addresses Factors A, D, and E.

2A. Habitat management and monitoring plans that facilitate maintenance of vernal pool ecosystem function and population viability have been developed and implemented for all habitat protected, as previously discussed in sections 1A-E.

This criterion has been partially met. Localities at the Vina Plains Preserve, Meridian Ranch, Mariner Ranch, Wilcox Ranch, Muzzy Ranch, Elsie Gridley Conservation Bank, Montezuma Wetlands Preserve, Potrero Hills Landfill, Yolo Basin Wildlife Area, Sacramento NWR, Great Valley Grasslands State Park, Viera-Sandy Mush Road Conservation Bank, and Deadman's Creek Conservation Bank are known to be managed for vernal pool species under various forms of management plans. Dutchman's Creek Conservation Bank is currently developing a plan. Various unprotected localities are not known to be actively managed for the benefit of vernal pool species.

2B. Mechanisms are in place to provide for management in perpetuity and long-term monitoring of 1. A-E, as previously discussed (funding, personnel, etc).

This criterion has been met for many of the known populations of Conservancy fairy shrimp through allocation of appropriate funds from the agency's annual budgets. The San Luis, Merced, and Sacramento NWRs are managed by the Service. The Los Padres National Forest is managed by the U.S. Forest Service. The Yolo Bypass Wildlife Area is managed by California Department of Fish and Game and the Great Valley Grasslands State Park is managed by the

California Department of Parks and Recreation. Funding in perpetuity exists for the Jepson Prairie Preserve through an endowment.

Most of the remaining localities occur on conservation banks, and have endowment funds to ensure long-term management and monitoring. Portions of the Vina Plains, U.C. Merced, Highway 165, and the entire Mapes Ranch population are not protected or managed for the Conservancy fairy shrimp.

2C. Monitoring indicates that ecosystem function has been maintained in the areas protected under 1A-D for at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years of post-drought monitoring.

Monitoring of ecosystem function has not occurred for any of the known populations of this species; therefore, the Service is unable to determine if the ecosystem function has been maintained at extant locations that has supported viable populations through a variety of hydrologic conditions. It is probable that many of the protected sites have functional ecosystems that would meet the requirements specified in this recovery criterion. Parameters that should be monitored to determine whether this criterion has been met have not been identified.

3. <u>Status Surveys</u>: This criterion implicitly addresses Factors A, D, and E.

3A. Status surveys, 5-year status reviews, and population monitoring show populations within each vernal pool region where the species occur are viable (e.g., evidence of reproduction and recruitment) and have been maintained (stable or increasing) for at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years of post-drought monitoring.

Monitoring has not occurred during a time period that meets the requirements specified in the Recovery Plan; therefore, this criterion has not been met at this time. The Recovery Plan states that standardized status surveys should establish parameters that evaluate population sizes to determine overall trends in species status rangewide (e.g., evidence of reproduction and recruitment). Specific monitoring parameters have not yet been identified for this species.

3B. Status surveys, status reviews, and habitat monitoring show that threats identified during and since the listing process have been ameliorated or eliminated. Site-specific threats identified through standardized site assessments and habitat management planning also must be ameliorated or eliminated.

The Service is not aware of formal status surveys and habitat monitoring having occurred at any sites with known Conservancy fairy shrimp on an annual basis. The primary threat to this species described in the 1994 final listing rule is habitat loss due to urbanization and conversion to agriculture. This continues to be a threat to vernal pool species in general; however, the majority of known populations of Conservancy fairy shrimp are protected from land-use

conversion on Federal, State, or private lands. Therefore, this threat has been removed from protected populations. Other threats, such as climate change, the potential for stochastic extinction resulting from isolated and small numbers of populations, and habitat degradation from improper grazing practices and invasive weedy plants, remain the same. Due to the lack of habitat monitoring at the majority of known localities of this species, the Service is not aware if site-specific threats (i.e., inappropriate grazing practices, invasive weedy plant species, or other unforeseen threats) have increased or decreased since the time of listing.

4. <u>Research:</u>

Research implicitly addresses all five listing factors.

4A. Research actions necessary for recovery and conservation of the covered species have been identified (these are research actions that have not been specifically identified in the recovery actions but for which a process to develop them has been identified). Research actions (both specifically identified in the recovery actions and determined through the process) on species biology and ecology, habitat management and restoration, and methods to eliminate or ameliorate threats have been completed and incorporated into habitat protection, habitat management and monitoring, and species monitoring plans, and refinement of recovery criteria and actions.

The Recovery Plan discusses a variety of research that would be beneficial to help refine recovery actions and criteria, and guide overall recovery and long-term conservation efforts. The Recovery Plan recommends research on genetics, taxonomy, biology of vernal pool species, the effects of habitat management practices on vernal pool species and their habitat, and threats to vernal pool species and ecosystems (Service 2005a). The majority of information needs discussed in the Recovery Plan are still outstanding. The Service is not aware of any ongoing or proposed research pertaining specifically to Conservancy fairy shrimp conservation; therefore, this criterion has not been met.

4B. Research on genetic structure has been completed (for species where necessary – for reintroduction and introduction, seed banking) and results incorporated into habitat protection plans to ensure that within and among population genetic variation is fully representative by populations protected in the Habitat Protection section of this document, described previously in sections 1A-E.

See 4A, above. The Service is aware of an ongoing genetic study at U.C. Merced. The results of this study are not yet available.

4C. Research necessary to determine appropriate parameters to measure population viability for each species have been completed.

See 4A, above.

5. <u>Participation and outreach:</u>

Participation and outreach affect all listing factors and this criterion remains valid.

5A. Recovery Implementation Team is established and functioning to oversee rangewide recovery efforts.

The criterion has been met by the establishment of a Recovery Implementation Team in June of 2009. The team meets quarterly.

5B. Vernal Pool Regional working groups are established and functioning to oversee regional recovery efforts.

This criterion has been partially met. One working group is currently active (Butte County). Selection of members to serve in additional working groups is underway, and the groups will consist of representatives from the agencies, landowners/stakeholders, and species experts.

5C. Participation plans for each vernal pool region have been completed and implemented.

This criterion has not been met.

5D. Vernal Pool Regional working groups have developed and implemented outreach and incentive programs that develop partnerships.

This criterion has not been met.

IV. SYNTHESIS

When the Conservancy fairy shrimp was listed as endangered in 1994, the primary threats to its survival and recovery were stochastic (random) extinction by virtue of the small isolated nature of many of the populations, and loss of habitat due to urban development and conversion to agriculture (Service 1994). The Service has determined that this species is still in danger of extinction throughout its range. Conservancy fairy shrimp are extremely rare and are only known to occur in 10 disjunct populations, with some populations being comprised of single vernal pools. This species is highly susceptible to extirpation due to chance events or additional environmental disturbance as described above. If an isolated population is extirpated, the opportunities for recolonization will be greatly reduced due to physical isolation from other source populations.

The majority of the 10 known populations are protected from direct habitat loss by conservation easements or are found on public lands, so substantial progress with regard to protecting Conservancy fairy shrimp habitat has been made. However, unprotected localities exist within many known populations.

Although preserves and public lands have set been set aside for the protection of vernal pool habitats, the long-term sustainability and viability of Conservancy fairy shrimp within these preserves is not yet known. Studies have demonstrated that the current configuration of vernal pool habitats within preserves is not likely to sustain Conservancy fairy shrimp in the event of a prolonged drought, as this species requires longer inundation periods to complete its life cycle (Pyke 2004, Pyke 2005b). Therefore, despite protection of vernal pool habitat in conservation areas, available information suggests the distribution of these areas is not yet sufficient to provide for the species' recovery.

Beyond habitat preservation, other conservation measures, such as habitat management and monitoring, are necessary to ensure the long-term sustainability of this species. Potential threats such as habitat degradation due to inappropriate grazing regimes, pesticide use, invasive weedy species, or other unforeseen circumstances remain for the majority of the localities of Conservancy fairy shrimp whether they are on lands protected from habitat modification or not. Although the habitat might be secure from conversion, it is not secure from ecological factors that can modify habitat and affect population status and viability. Site-specific habitat management and monitoring are essential so that potential threats to the species can be identified and eliminated. None of the known localities have sufficient funding for systematic monitoring to determine habitat quality or species status trends. In most cases, threats to this species, such as those described above, will not be detected and managed for.

We conclude that the Conservancy fairy shrimp still meets the Act's definition of endangered for the following reasons: (1) the rare nature of this species increases the risk of local extirpations from stochastic events that could preclude recolonization by disjunct populations; (2) all localities of Conservancy fairy shrimp are still threatened by additional environmental disturbances, including possible changes in hydrology resulting from drought and climate change, degradation of habitat from invasive weedy plant species and inappropriate grazing regimes; and (3) the lack of management and monitoring activities at the majority of known localities of this species makes it difficult to characterize the size and connectivity of occupied habitats, identify the magnitude and imminence of remaining threats, and ensure that threats will be identified and ameliorated. Therefore, we recommend no status change at this time.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
_X__ No Change

New Recovery Priority Number and Brief Rationale: No change.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

The following recommendations for future actions are from the 2005 Recovery Plan and the results of discussions on the status of the species and the species' needs with several recognized Conservancy fairy shrimp experts:

1. Preservation of Zone 1 and 2 core areas should be pursued to preserve known localities that are currently not protected. Core Areas that are within Zone 1 include Vina Plains, Caswell, Grasslands, Jepson Prairie, Sacramento NWR, Collinsville, and Madera. Zone 2 core areas include the Ventura and Western Placer County Core Areas.

2. Develop standardized monitoring for species status at areas with known localities throughout the range of this species. Conduct additional research at these sites to incorporate research recommendations outlined in the Recovery Plan. Results from monitoring and research should be included in the management plans for these areas.

3. Encourage researchers and project proponents to complete surveys for vernal pool crustaceans statewide in an effort to detect additional Conservancy fairy shrimp localities and populations.

4. Conduct surveys at Mapes Ranch to determine if this population is extant. This will require landowner permission for access.

5. Acquire conservation easements or fee title for properties with unprotected populations of Conservancy fairy shrimp to ensure these populations continue to persist.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Conservancy fairy shrimp (*Branchinecta conservatio*)

Current Classification:

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Appropriate Listing/Reclassification Priority Number:

Review Conducted By: Ben Watson, Sacramento Fish and Wildlife Office

Date Submitted to Region 8: _____

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

FD

Approve _____ Date 20 June 2012

Cooperating Field Supervisor, Ventura Fish and Wildlife Office

Approve _____ Date 6/29/12

REGIONAL OFFICE APPROVAL:

Lead Regional Director, U.S. Fish and Wildlife Service, Region 8

Approve _____ Date _____