

Vernal Pool Tadpole Shrimp (*Lepidurus packardii*)



Status

State: Meets the requirements as a “rare, threatened or endangered species” under CEQA

Federal: Endangered

Critical Habitat: Designated, but none occurs in inventory area (USFWS 2003)

Population Trend

Global: Declining due to habitat loss and fragmentation (Eriksen and Belk 1999).

State: Same as above

Within Inventory Area: Unknown

Data Characterization

The location database for the vernal pool tadpole shrimp (*Lepidurus packardii*) within the inventory area does not include any records from within the ECCC HCP/NCP inventory area. However, this species commonly co-occurs with the vernal pool fairy shrimp, which is known to occur within the inventory area, and is also recorded from areas adjacent to the inventory area. Other natural and artificial habitats throughout the grassland habitats within the inventory area have a high probability of being occupied by additional populations of the vernal pool tadpole shrimp. Systematic, distribution, and ecological data are presented in Rogers (2001).

Range

The vernal pool tadpole shrimp is a California Great Central Valley endemic species, with the majority of the populations occurring in the Sacramento Valley. This species has also been reported from the Sacramento River Delta to the east side of San Francisco Bay, and from a few scattered localities in the San Joaquin Valley from San Joaquin County to Madera County (Rogers 2001).

Occurrences within the ECCC HCP/NCCP Inventory Area

The vernal pool tadpole shrimp is not known to be present within the ECCC HCP/NCCP inventory area. However, due to the presence of suitable habitat and populations within close proximity to the inventory area, unrecorded populations may be present in vernal pool and swale habitat of the non-native annual grassland and in other depressions that seasonally collect rainwater. Since a comprehensive survey for the vernal pool tadpole shrimp has not been conducted

in the inventory area, the current population distribution within the inventory area is unknown. As of January 2001, the California Natural Diversity Database listed 5 occurrences of vernal pool tadpole shrimp adjacent to the inventory area. The lack of data points within the open-space areas is probably due to a lack of survey effort.

Biology

Habitat

Vernal pool tadpole shrimp occur in a wide variety of seasonal habitats, including vernal pools, clay flats, alkaline pools, ephemeral stock tanks, roadside ditches, and road ruts (Rogers 2001, California Natural Diversity Database 2001). Habitats where vernal pool tadpole shrimps have been observed range in size from small, clear, well-vegetated vernal pools to highly turbid, alkali scald pools to large winter lakes (Rogers 2001). Tadpole shrimp cysts (resting eggs) must dry out before they will hatch.

Typically the vernal pool tadpole shrimp is found in habitats that are deeper than 12 centimeters, pond for 15 to 30 days, and do not suffer wide daily temperature fluctuations. The vernal pool tadpole shrimp has not been reported as utilizing strongly saline habitats. This species is found in seasonal wetlands and other winter/springtime temporarily ponded areas of sufficient size (depth and area) and seasonality that pond for a sufficient duration to maintain conducive water temperatures to allow the vernal pool tadpole shrimp to complete their life cycles (Rogers 2001).

Feeding

Tadpole shrimp are omnivores. Typically, they forage while digging through sediments at the bottom of their habitats, feeding on plants as well as metazoans. Tadpole shrimp are cannibalistic and have been observed consuming newly molted fellow tadpole shrimp (Rogers pers. comm.). In addition, vernal pool tadpole shrimp will consume fairy shrimp, including both vernal pool fairy shrimp and midvalley fairy shrimp. Though they do not actively seek out these species, they will consume them if the fairy shrimp are present at the bottom of the pool where the tadpole shrimp is foraging.

Ecology

Vernal pool tadpole shrimp are either hermaphroditic or parthenogenic (Rogers 2001). All animals produce cysts (resting eggs), which are typically shed as the animal moves about (Rogers in press). These cysts diapause (enter into a quiescent, dormant stage), remaining in the soil through the drying phase of the habitat, and then hatching as the subsequent rainy season inundates the habitat.

Cysts may hatch at various times, anywhere from 1 hour to 3 weeks after the pools are inundated. The exact hatching stimuli are unknown. The vernal pool tadpole shrimp mature more slowly than fairy shrimp, and are longer lived. Typically, adults will survive until the vernal pool dries or until temperatures of 10 to 15 degrees Celsius are reached (Rogers pers. comm.). Vernal pool tadpole shrimp can begin shedding cysts in as little as 15 days.

Vernal pool tadpole shrimp are prey to amphibians and waterfowl. Predator consumption of tadpole shrimp cysts aids in distributing populations of tadpole shrimps. Predators expel the cysts in their excrement, often at a location other than where they were consumed (Rogers in prep.). If conditions are suitable, these transported cysts may hatch at the new location and potentially establish a new population. Cysts can also be transported in mud carried on the feet of animals that may wade through the habitat, such as tule elk, (*Cervus elaphus nelsoni*) feral pigs, and livestock (Rogers in prep.).

Vernal pool tadpole fairy shrimp have been found co-occurring with the fairy shrimp *Lindieriella occidentalis*, *Branchinecta lynchi*, *Branchinecta coloradensis*, *Branchinecta lindahli*, and *Branchinecta conservatio* (Rogers in prep.).

Threats

Vernal pool tadpole shrimp are threatened by the same activities as other vernal pool invertebrates. These threats include the conversion of vernal pool habitat to agricultural lands and urban development, and stochastic extinction because of the small and isolated nature of remaining populations (U.S. Fish and Wildlife Service 1994). The limited and disjunct distribution of vernal pools, coupled with the even more limited distribution of the vernal pool tadpole shrimp, means that any reduction in vernal pool habitat quantity could adversely affect this species.

Habitat fragmentation can isolate and reduce population size, resulting in a process of progressive population extinctions. Small or isolated populations are more susceptible to extinction from random environmental disturbance. Recolonization opportunities are also diminished when physical barriers, such as development or lack of vernal pool habitat, isolate populations from one another or inhibit transport of cysts. Isolated populations are potentially more susceptible to inbreeding depression, which can result in local extinction or reduced fitness (Gilpin and Soule 1986, Goodman 1987a, 1987b). However this has never been demonstrated for branchiopod crustaceans.

Activities that alter the suitability of habitat may impact the special-status crustaceans dependent on these habitats. These activities include damaging the impermeable clay and/or hardpan layers of the habitat bottom, filling in the habitat, and altering (e.g. through contaminants) or destroying the watershed that conveys overland flow into the habitat. Additionally, introducing non-native plants, destroying or degrading the surrounding upland habitat, introducing fish (such as *Gambusia* spp.), into special-status shrimp habitats, and engaging in activities that discourage or prevent waterfowl and waders from feeding at

occupied habitats and thereby restricting gene-flow between populations may also significantly affect midvalley fairy shrimp populations.

Conservation and Management

Conservation of the vernal pool tadpole shrimp is directly tied to conservation of suitable vernal pool habitat. However, because comprehensive surveys for the vernal pool tadpole shrimp in the ECCC HCP/NCCP inventory area have not been conducted, the population size and locations of this species in the inventory area are not known. Also, suitable habitat for the vernal pool tadpole shrimp in the inventory area was identified based on a general classification of land-cover types. Field evaluation of the habitat classification has not been conducted, and the extent to which vernal pools in the inventory area meet the habitat requirements of vernal pool tadpole shrimp is unknown. The importance of artificial habitats that may support vernal pool tadpole shrimp in the inventory area has not been evaluated.

Species Distribution Model

No species distribution model could be developed for the vernal pool tadpole shrimp because vernal pools and other suitable microhabitats occur at too small a scale to be mapped in the inventory area (e.g., vernal pools are subsumed within “seasonal wetlands”).

Literature Cited

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