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NOTES

Previously Undocumented Habitat Use by the California Tiger Salamander (*Ambystoma californiense*)

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***Abstract.*—Populations of the endangered California Tiger Salamander (*Ambystoma californiense*) have experienced declines throughout the species range. Although the species is relatively easy to detect in its aquatic breeding habitat, little remains known about the details of the non-breeding upland habitat by this species. We found seven adult California Tiger Salamanders beneath thatch of emergent vegetation at the bottom of a constructed pond that was known to be dry for 15 mo. This represents new information on the adult phase of the use of habitat by this species, and we suggest this behavior might be more widespread, yet undetected.**

Key Words.—dry pond; excavation; habitat; restoration

The California Tiger Salamander (*Ambystoma californiense*) is a bi-phasic amphibian species, which is endemic to California and in decline throughout its range (U.S. Fish and Wildlife Service [USFWS] 2000, 2002, 2004). Habitat loss and associated population declines supported listing of the species as threatened or endangered at both the federal and state levels (Stebbins and Cohen 1995; USFWS 2002, 2004; Fitzpatrick and Shaffer 2004). This species generally breeds in perennial and ephemeral ponds, vernal pools, slow sections of creeks, and other still waters (Storer 1925; Loredo and Van Vuren 1996; Alvarez 2004; Alvarez et al. 2021). The California Tiger Salamander spends the majority of its adult life stage underground, typically in rodent burrows (Storer 1925; Loredo and Van Vuren 1996; Stebbins and McGinnis 2012). Adults migrate to aquatic breeding habitat during fall and winter rains but are otherwise believed to remain underground (Storer 1925; Twitty 1941; Stebbins and McGinnis 2012). Recently, Alvarez et al. (2021) reported habitat use where California Tiger Salamanders were found breeding in sites not previously considered suitable. Herein, we report on previously unreported habitat use by the species.

We worked in a pond located in the upper Marsh Creek watershed, which is in eastern Contra Costa County, California (Fig. 1), and is comprised primarily of annual non-native grasses, Oak Savannah, Blue Oak (*Quercus douglasii*) and Valley Oak (*Q. lobata*) woodland, and mixed Chaparral habitats covering low rolling hills. This portion of the watershed is owned and managed by the Contra Costa Water District, which oversees special-status species and their habitat through a Programmatic Biological Opinion. As part of annual efforts to enhance habitat for California Tiger Salamanders and California Red-legged Frogs (*Rana draytonii*), we planned to remove silt and excess vegetation from a mitigation pond (Pond 3W) within the headwaters of a tributary to Marsh Creek. Pond 3W was a constructed wetland site (hereafter: pond) that functioned as a breeding site for California Tiger Salamanders, California Red-legged Frogs, and other native amphibians (unpubl. data; Fig. 2). The pond was approximately 4,400 m in area and 1.6 m maximum depth when inundated. During the construction of the pond in 1998, hundreds of vegetative plugs of Spikerush (*Eleocharis palustris*) were planted to establish a vegetated wetland feature with a mixed vegetation (upland and aquatic) component.

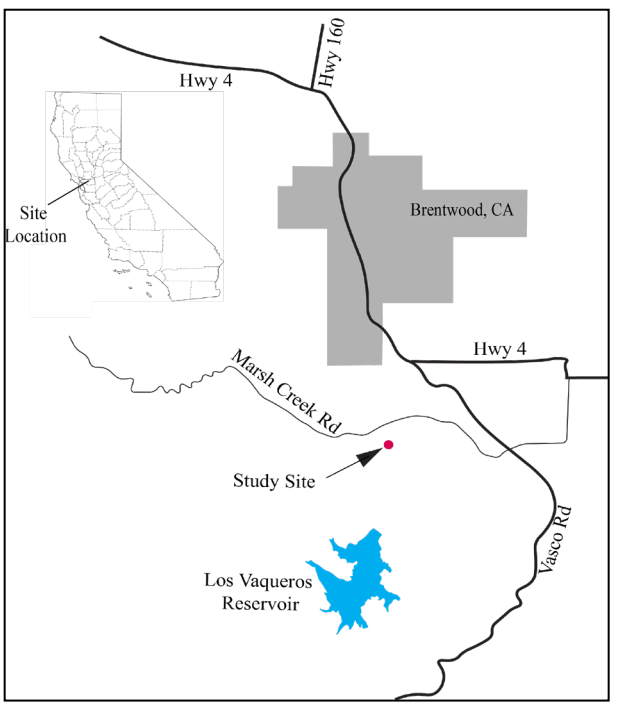

Figure 1. Vicinity and specific location of pond B3W (Study Site) in the upper Marsh Creek Watershed, north of the Los Vaqueros Reservoir, Contra Costa County, California.

Figure 2. Constructed wetland (i.e., pond) prior to removal of silt and vegetation (darker area), and the subsequent discovery of seven California Tiger Salamanders (*Ambystoma californiense*) under the dense thatch layer, Contra Costa County, California. (Photographed by Jeff A. Alvarez).

At the time of the restoration effort (September 2014), the pond had ≥ 90% vegetative cover comprised of cattail (*Typha* sp.) and Hard-stem Bulrush (*Schoenoplectus acutus*), with no open water component. Due to the conditions at the time, it was determined that silt (approximately 1 m in depth) and 70% of the emergent vegetation would be removed, and the bottom contour of the pond would be returned to the original design. An excavator was used to slowly remove vegetation first from the outer edges, progressing toward the center of the pond. The excavator operator was monitored by biologists who instructed the operator to remove layers of soil between 15 and 30 cm deep during each pass.

Biological monitors recovered animals that were found moving within the active construction zone or that were found within loose soil. As the excavator operator worked to the presumed center of the pond, biologists discovered a single adult California Tiger Salamander in the loose soil that was left after peeling the layer of emergent vegetation from the pond bottom. On the second pass through the vegetation, we discovered five additional adult California Tiger Salamanders (Fig. 3). At this time the monitoring biologists instructed the operator to work more slowly and to remove layers that were < 15 cm each. In doing so biologists found an additional single adult California Tiger Salamander nested in the loose soil at the pond bottom. Thereafter we observed no other California Tiger Salamanders within the work area or in the spoils deposition site upslope of the pond. In addition to the seven California Tiger Salamanders, biologists found 19 Pacific Treefrogs (*Hyliola regilla*), 13 Western Toads (*Anaxyrus boreas*), five Western Skinks (*Plestiodon skiltonianus*), four Western Fence Lizards (*Sceloporus occidentalis*), two Gopher Snakes (*Pituophis catenifer*), one Northern Pacific Rattlesnake (*Crotalus oreganus*), five California Voles (*Microtus californicus*), two Deer Mice (*Peromyscus* sp.), and two Botta's Pocket Gophers (*Thomomys bottae*).

This pond site, which had an artificial source for hydration (i.e., water pumped from a well) was monitored six times annually for its vegetation components and hydrology for 16 y, beginning in 1998. Water levels were typically maintained through an electrically powered well that was manually operated. Unpublished records from the Contra Costa Water District showed that the pond was determined to be dry (i.e., no standing water based on visual surveys and staff gauge readings) for 15 consecutive months prior to our restoration. We surmised that adult California Tiger Salamanders may have migrated to the pond site during their fall migration in the previous year, but the pond remained dry. These animals sought refuge in the pond, under a very dense (approximately 1 m thick) layer of cattail and bulrush thatch that lay flat over the center portion of the pond. This thick layer of thatch may have provided adequate refuge for these adult salamanders for many months. The dry vegetation and thatch layer may have also maintained high humidity levels at the soil surface and provided cover from many predators.

Although biologists were mandated to monitor the site by the Programmatic Biological Opinion, the presence, or even potential presence, of adult salamanders at the bottom of a pond that was dry for 15 mo was not anticipated. We considered this observation novel and surprising because most adult salamanders are found within rodent burrows in September (Storer 1925; Loredo and Van Vuren 1996; Stebbins and McGinnis 2012), the time of our work. Storer (1925) was the first to state that adult California Tiger Salamanders may be found under cover objects on the surface, and our own work corroborates this assertion, but this may only be true during the migratory period (unpubl. data).

Our findings reported here indicate a continued need to assess and investigate the natural history of this species. We have found that habitats such as a dry pond are often considered *a priori* unoccupied by salamanders. The only reason salamanders were found in the dry pond was because of the decision to conduct silt and vegetation removal without any expectation of finding California Tiger Salamanders. We contend that reports of novel observations of behaviors previously unreported may fill a gap in knowledge about species natural history that can be vital to the management and persistence of that species on a site. Bury (2006) pointed out the connection between natural history, field ecology, conservation biology, and wildlife management, fields that are critical to managing species at risk. We agree and suggest that our observation can be connected to many other singular observations that facilitate understanding the natural history of this species. This species has a cryptic natural history, particularly in upland portions of occupied habitats, where it can be difficult to detect (Searcy and Shaffer 2008; Wang et al. 2009). In our case, a pond that is typically a breeding site for the California Tiger Salamander served as upland habitat because it was dry for over a year.

Figure 2. Fresh excavation at the bottom of a pond that was dry for 15 mo, with adult California Tiger Salamanders (*Ambystoma californiense*) found among the loose soil and shallow cracks after the thick thatch layer of emergent vegetation was removed, Contra Costa County, California. (Photographed by Jeff A. Alvarez).

We suggest thorough pre-construction surveys of sites prior to land management actions that alter habitat components. Yet, even when the results of these types of surveys include no species observations, biological monitoring should still be required. The role of a biological monitor should include preconstruction surveys and on-site monitoring of ground disturbing projects, which can yield novel observations of protected species.

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