Sacramento Valley Tiger Beetle

(*Cicindela hirticollis abrupta*)

Legal Status
Federal: None
State: None

Global and State Conservation Status: G5THSH: Global rank, G5 = Secure: Common; widespread and abundant (applies to species); TH = subspecies ranking indicating possibly extinct, species missing; known from only historical occurrences but still some hope of rediscovery; State rank, SH = Same as subspecies rank but only for the range of taxa within California.

Recovery Plan: None

Species Description and Life History

Sacramento Valley tiger beetles (*Cicindela hirticollis abrupta*) are a subspecies of the unnamed tiger beetle *Cicindela hirticollis* (Say, 1817), which is a widespread taxon with several disjunct subspecies populations from Labrador, Canada through the continental United States. Adults are mainly ground dwelling, and hunt for prey on the soil surface, but are accomplished fliers as well. Like other tiger beetles, adult Sacramento Valley tiger beetles can be recognized to family by their body shape, which is classically cicindelid, with long-legs, a narrow pronotum and head, and protuberant eyes situated above the antennae. *C. hirticollis* can be recognized by two diagnostic characters which are a large tuft of long white hairs on the side of the thorax and the front maculation shaped roughly in the form of G, with a forward hook on its bottom end (Pearson et al. 2006). *C. hirticollis abrubta* can be recognized by the coloration, which is dark blackish-brown above, maculations are disrupted, and typically the front maculation is disconnected from the line along the outer elytral edge with its hook-shaped end curling inward more extremely than other subspecies (Pearson et al. 2006).

Sacramento Valley tiger beetles are similar to other tiger beetles in their foraging habits. They are voracious predators, with this subspecies specializing on ants as the preferred prey base, although tiger beetles in general are quite opportunistic and will hunt many types of insects. Unlike some insects, both the adults and larvae have similar diets and prowess as hunters, but tiger beetle larvae, which lack a hardened exoskeleton, wings, and hardened protective wing covers (elytra), have developed a hunting strategy to protect their soft bodies. Adults dig a pit in the appropriate substrate, lay a single fertilized egg at the bottom, and recover the pit. The larvae hatch and dig themselves out towards the surface, but do not leave the nursery pit. Their heads are essentially fully formed at the time of hatching, with a harder carapace than the soft body, and long mandibles, and they hold them flush with the entrance of the hole to disguise it to passing insects. Two hooks on the fifth abdominal terga at the caudal end of the larvae are used

to anchor them into the hole, and when an appropriate prey item comes within range, the larvae capture it with their oversized mandibles and pull it into the pit to be ingested.

The larval stage is persistent and may last up to three years. When pupation occurs, the larvae build a new side tunnel at a 90-degree angle to their nursery pit, during which time they are especially active predators (Balduf 1935). Once the side tunnel is completed, the larvae seal the entrance to their burrows and pupate during the late summer and early fall. The adults then continue to overwinter in the sealed burrows until spring, when they emerge.

Habitat Requirements and Ecology

Sacramento Valley tiger beetles are adapted to sandy, open soils and point bars such as occurred historically along the Sacramento River before flood control practices. They use unconsolidated sands and gravels, and given the soft bodies and long interment of the larvae, are at risk from any activities contributing to soil compaction. The favored habitat of the Sacramento Valley tiger beetles' comprises point sand bars that are principally unvegetated. They are much more specialized in their edaphic, hydrologic, and biotic habitat requirements than other related tiger beetles that utilize water edge and riparian habitats like *Cicindela oregona oregona*, which is still found at several historic Sacramento Valley tiger beetle sites where the two species used to occur sympatrically (Knisley and Fenster 2005).

A quantitative analysis was conducted at several historical population sites along the Sacramento River to determine the cause for extirpation. It was discovered that a combination of human disturbances to natural flood regimes, including point bar armoring, channel scouring, altered flow regimes, redirection, of flows through weirs, and lithologic controls, have changed the edaphic conditions these tiger beetles rely on for habitat (Fenster and Knisley 2006). These practices have resulted in fewer point bars and a dimorphism in remaining point bars structure such that the more northern bars are composed of gravel and more southern bars are composed of fine-grained particles. As these substrates are not mixed, water retention and microstability of the soils are negatively affected, resulting in larvae being at risk from collapsing burrows, unsuitable substrate for burrow construction to begin with, and potential desiccation (Fenster and Knisley 2006). Two large dams that affect the timing and variability of flows within this reach of the Sacramento River have also had a detrimental effect on the species, and are likely the primary cause for the apparent extirpation of all known populations (Knisley and Fenster 2005, Fenster and Knisley 2006). Flow regimes after damming have changed flows to a more stabilized state, with few or no scouring flood events, and controlled release of water continues much later than in the historic system, with significant, controlled flows in late summer through early winter. These factors contribute to the edaphic changes outlined above, and may also increase larval mortality through late-season flooding. Finally, an increased deposition of fine sediment like silts (which are related to the altered flood regimes) may allow undesired vegetation colonization of point bars (Fenster and Knisley 2006).

Tiger beetles, including this subspecies, are very responsive to changes in temperature, sometimes even visibly slowing activity under a passing cloud. Ranges of many riparian tiger beetles historically moved south or north along suitable habitat corridors in response to larger-scale climactic changes. Thus, global climate change may be a concern when designating suitable habitat for the species, as their range may shift over time under differing climactic regimes (Ashforth 2001).

Species Distribution and Population Trends

Distribution

Sacramento Valley tiger beetles were historically known from five populations along the Feather and Sacramento Rivers and associated tributaries in Yolo, Sutter, and Colusa Counties. However, all of these populations are currently presumed to be extirpated, as targeted surveys from 2001-2004 failed to discover any adults or larvae as well as an extreme reduction in suitable microhabitats within the historic habitat (Knisley and Fenster 2005). It is possible that undetected populations may exist in any remaining suitable habitats in these counties, or in areas with similar habitat within the Sacramento Valley such as in Sacramento County.

Population Trends

The Sacramento Valley tiger beetle is decreasing rapidly, or possibly already extirpated from Yolo County and from much of its former range. All known historic populations are no longer active, and there have been no collection records reported to the California Natural Diversity Database for the subspecies since the 1980s (CNDDB 2007).

Threats to the Species and Other Conservation Issues

The primary threat to Sacramento Valley tiger beetle is the loss of suitable point bar habitat from the alteration of historic flow regimes described above. The subspecies is highly specialized to substrate conditions and are very attuned to variation in sand bar composition and structure. Hydrological regimes are also important, as changes in the timing and variability of larval release may increase desiccation in the spring and flooding-related deaths in the summer and fall. There are additional threats to remaining habitat from development, which converts habitats and increases soil compaction. A combination of these factors reduces the number of available point bars while also altering the structure of the ones that remain such that they are unsuitable. This has led to smaller and more disjunct populations, with a greater average distance of dispersal to the nearest suitable habitat patch. Due to the soft body structure, long larval period, and nursery habits of the larvae, this stage is under significant extra threat from trampling from recreational traffic, both by pedestrians and vehicles. Finally, global climate change may present a significant threat to this species, which is very responsive to climactic and temperature alterations and may not be able to adjust its range north or south in response to changing weather patterns as in historic times.

The most significant data gaps relating to the ecology of the Sacramento Valley tiger beetle include knowledge of minimum patch size for successful breeding colonies, and possible competition and exclusion from remaining suitable burrowing sites by more generalist tiger beetles. Although this beetle was historically known from large river systems, suitable habitat in smaller tributaries of the Sacramento River could be protected and natural flood regimes restored to maintain suitable habitat for this species.

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References

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