Ohlone Tiger Beetle (*Cicindela ohlone*)

5-Year Review:
Evaluation and Summary

Photo credit: Alex Jones

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

July 2024

5-YEAR REVIEW
Ohlone Tiger Beetle (*Cicindela ohlone*)

GENERAL INFORMATION:

Species: Ohlone tiger beetle (*Cicindela ohlone*)
Date Final Listing Rule Published: October 3, 2001
Federal Register (FR) citation(s): 66 FR 50340
Classification: Endangered
Critical Habitat Designation: We have not designated critical habitat for the Ohlone tiger beetle.
State Listing: Not listed.

BACKGROUND:

FR notice citation announcing this status review:
[Service] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 47 Species in California, Nevada, and Oregon. Federal Register 88:56042–56044.

Most recent status review:
[Service] U.S. Fish and Wildlife Service. 2019. Ohlone tiger beetle (*Cicindela ohlone*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California. 5 pp.

We recommended no status change in the 2019 5-year status review.

Prior to 2019, we completed one additional 5-year status review in 2009 and recommended no status change (Service 2009).

Species overview:
The Ohlone tiger beetle is a member of the Coleopteran family Cicindelidae (tiger beetles) and is endemic to Santa Cruz County, California. The Ohlone tiger beetle was first collected in 1987 and described in 1993 (Freitag et al. 1993, entire). The U.S. Fish and Wildlife Service (Service) listed the Ohlone tiger beetle as endangered in 2001 (Service 2001, entire).

The species is patchily distributed and known only from coastal terraces of native grassland habitat associated with either Watsonville loam or Bonnydoon soil types, characterized by shallow, pale, poorly drained clay or sandy clay soil that bakes to a hard crust by summer, after winter and spring rains cease (Freitag et al. 1993, p. 117). Ohlone tiger beetles require open areas with bare ground or sparse vegetation (Knisley and Arnold 2013, entire; Arnold and Knisley 2018, entire). Adult beetles are typically found along trails or barren areas among low, sparse vegetation within grassland habitat (Freitag et al. 1993, p. 117; Service 2001, p. 50341). Adults use these areas for oviposition, thermoregulation, and foraging (Arnold and Knisley 2018, entire). In addition to areas of bare soil, Ohlone tiger beetle larval burrows have been observed in

sparsely vegetated patches in otherwise dense grassland (Arnold et al, 2012, p. 5). Larval burrows tend to be clustered rather than randomly distributed (Arnold and Knisley 2018, p. 586).

Specific biological and life history information for the Ohlone tiger beetle is not well known and the egg, larval, and pupal stages of the species have not been described (Arnold et al. (2012, p. 5). However, all tiger beetles share some general biological characteristics (Arnold et al. (2012, p. 5). All tiger beetle species prey on small arthropods and are typically diurnal (Pearson and Cassola 1992, p. 377). Like other tiger beetle species, Ohlone tiger beetle larvae live in small, tunnel-like burrows from which they lunge and seize passing prey (Essig 1926, p. 372; Arnold et al. 2012, pp. 4, 6; Knisley and Arnold 2013, entire). Adults run rapidly in and near the larval habitat and are strong flyers for short distances (Arnold et al. (2012, p. 5). Additionally, adults and larvae spend a considerable portion of their daily activity thermoregulating (Arnold et al. (2012, p. 5).

ASSESSMENT:

Information acquired since the last status review:
The U.S. Fish and Wildlife Service's (Service) Ventura Fish and Wildlife Office (VFWO) conducted this 5-year status review. We announced the review through a Federal Register (FR) notice on August 17, 2023 (Service 2023, entire). We did not receive any information from the public in response to our FR notice announcing this 5-year review. We also contacted species experts, partners, and universities to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files, including a review of Ohlone tiger beetle section 10(a)(1)(A) recovery permit annual reports.

Since the most recent 5-year status review in 2019 (Service 2019, entire), we are now aware of another Ohlone tiger beetle site; the Service and partners conducted surveys at multiple locations; and the Service and partners translocated and reintroduced Ohlone tiger beetles to Santa Cruz Gardens, a historically occupied site that had become extirpated. Individuals from four sites served as sources for the translocation. We have conducted subsequent annual monitoring at Santa Cruz Gardens. Adults and larval Ohlone tiger beetles have been observed at Santa Cruz Gardens each year since translocation. Additionally, effects from climate change are identified as a new threat to the species.

Distribution and Abundance:
The historical range prior to listing is largely unknown because the species was discovered a few years prior to its listing in 2001 (first collected in 1987 and described in 1993), and we are not aware of historical specimens or records (Service 2001, p. 50341). Based on topography, soils, and vegetation, among other factors, suitable habitat for Ohlone tiger beetles likely covered a greater area and was more continuous than at present due to habitat conversion to agriculture and urbanization (Service 2001, p. 50341). The current limited range of the Ohlone tiger beetle, which is the same as at listing, is within an approximate 7-mile (11-kilometer) radius from the city of Santa Cruz, California.

We lack information to define populations of Ohlone tiger beetles. No genetic studies have been conducted to understand relatedness between Ohlone tiger beetle sites. Thus, we avoid referring

to Ohlone tiger beetle populations when discussing species status. Instead, we have previously referred to general areas in the vicinity of Santa Cruz, California, and sites where Ohlone tiger beetles have been observed.

While we have no information to define Ohlone tiger beetle populations, the five general areas where Ohlone tiger beetles have been observed are distinct. The five Ohlone tiger beetle areas are separated from one another by distance and areas of non-habitat. Cornelisse et al. (2013, entire) referred to them as patches. Researchers have postulated that some Ohlone tiger beetle areas and sites may function as a metapopulation (Arnold and Knisley 2018, pp. 585–586; Cornelisse et al. 2013, entire).

Until research is conducted to better understand Ohlone tiger beetle genetics and to determine populations or metapopulations of the species, we will continue to refer to the species occurring in patches or areas, as these are areas of distinct habitat providing redundancy. A patch or area may consist of a single site or multiple sites where Ohlone tiger beetles have been observed. For the purposes of this status review, we use the term "site" to represent a general location where Ohlone tiger beetles have been observed at some point in time. However, not all sites are necessarily discrete from one another. In some instances, an individual adult has been observed at more than one site, demonstrating movement can occur among sites (Arnold and Knisley 2018, p. 581).

At the time of listing, we did not have data to quantify abundance (Service 2001, p. 50342). In the 2001 listing, we identified the Ohlone tiger beetle from four general areas in the vicinity of Santa Cruz, California: (1) northwest of city of Soquel, (2) within city of Scotts Valley, (3) west of the city of Santa Cruz, and (4) northwest of the city of Santa Cruz (Service 2001, p. 50342).

In the 2009 5-year status review, we identified five Ohlone tiger beetle areas, splitting the area (4) northwest of the city of Santa Cruz, above, into two areas: northwest of the city of Santa Cruz and north of the city of Santa Cruz. The five areas in the 2009 review are: (1) west of the city of Soquel, (2) city of Scotts Valley, (3) west of the city of Santa Cruz, (4) northwest of the city of Santa Cruz, and (5) north of the city of Santa Cruz (Service 2009, p. 6). In the 2009 5-year status review, we identified 16 sites within the 5 areas (Service 2009, pp. 6–9). At that time, Ohlone tiger beetles occupied seven sites across three areas, and the other nine sites were potentially extirpated (Service 2009, p. 19). See Table 1.

In the 2019 5-year status review, we identified the same 5 areas and assessed Ohlone tiger beetle status at the same 16 sites (Service 2019, pp. 3–4). At that time, Ohlone tiger beetles were present in three areas; eight sites were extant, three extirpated, and five potentially extirpated (Service 2019, p. 3). The extirpated and potentially extirpated sites were distributed across four of the five areas. See Table 1.

In this status review, we assess Ohlone tiger beetles in the same five areas. Since the 2019 5-year status review, we are now aware of another Ohlone tiger beetle site in the area west of the city of Santa Cruz referred to as Englesman Loop (Knisley and Arnold 2013, p. 572), making 17 total sites.

A range-wide, long-term monitoring program is not conducted for Ohlone tiger beetles. However, over the past several years researchers have conducted surveys regularly at some sites. At other sites, presence/absence surveys are conducted periodically, as resources and funding are available and access is allowed. When surveys do occur, sampling methods for Ohlone tiger beetles are not consistent across the range. The number of Ohlone tiger beetle individuals tends to be small when surveyors have counted, from less than 100 to several hundred individuals. The current status of the Ohlone tiger beetle is described below and in Table 1. We used "extant" for sites where surveys were conducted in 2023 or 2024, and used "presumed extant" for sites where the last Ohlone tiger beetle surveys were from 2022 or longer ago.

West of the city of Soquel

The Ohlone tiger beetle area located west of the city of Soquel includes a single site with suitable grassland habitat: Santa Cruz Gardens, which is managed by the Center for Natural Lands.

In the 2019 status review, we considered this site extirpated because Ohlone tiger beetles were not observed here between 2008 and 2019 (Service 2019, p. 3). Because Santa Cruz Gardens is a protected preserve that is now managed under the Santa Cruz Gardens Habitat Conservation Plan (HCP) (Porter-Livingston Development, Inc. and O'Hara-Balfour LP 2009, pp. 1–5), and had recently supported Ohlone tiger beetles, it was chosen as a site for reintroduction (Pearson 2023, entire). With partners, we conducted multiple translocations from 2020–2022. In March 2020, Ohlone tiger beetles were translocated from Glenwood Preserve, the University of California at Santa Cruz (UCSC) Mima Meadow/Inclusion Area A (IAA), and Moore Creek Preserve, and in March 2021 and March 2022, from Lower Marshall Field and Glenwood Preserve (Pearson 2023, pp. 6–7; see Appendix A). With partners, we conducted annual surveys and habitat assessments in the years following translocations and reintroductions.

Since the first translocations to this site in 2020, Ohlone tiger beetles have reproduced, and adults have been observed each year. However, abundance post-translocation may be declining (Pearson 2023, entire). Currently, the Ohlone tiger beetles is extant at Santa Cruz Gardens. Continued monitoring of this site is needed to determine if the site is self-sustaining.

Habitat assessments showed that ongoing vegetation management to simulate disturbance has successfully maintained suitable habitat for Ohlone tiger beetles (Pearson 2023, p. 10–15). Adaptive habitat management and maintenance may be needed for persistence at this site.

City of Scotts Valley

The Ohlone tiger beetle area located in the city of Scotts Valley includes a single site with suitable grassland habitat, Glenwood Open Space Preserve (Glenwood Preserve), which is owned by the city of Scotts Valley and managed by the Land Trust of Santa Cruz County. The Glenwood Preserve Long Term Management Plan outlines habitat enhancement activities and designates two Beetle Expansion Zones (WRA 2017, p. 59-60) to encourage Ohlone tiger beetle colonization. Management objectives specified by this plan are to restrict trail expansion and access to occupied Ohlone tiger beetle habitat, employ cattle grazing and invasive plant removal to enhance habitat, avoid using pesticides known to impact Ohlone tiger beetle, and conduct annual monitoring surveys (WRA 2017, p. 49).

In 2000, land managers initiated annual monitoring of Ohlone tiger beetle adults at Glenwood Preserve. Monitoring of larval burrows began in 2003. Surveyors observed Ohlone tiger beetles each year since these surveys began, and the estimated number of adults has fluctuated ranging in the hundreds of individuals (Arnold and Knisley 2018, p. 584 Figure 5; Timmer and Filous 2023, Table 2). The Ohlone tiger beetle is self-sustaining at Glenwood Preserve, and individuals from the site served as a source for translocations to Santa Cruz Gardens in 2020, 2021, and 2022 (Pearson 2023, pp. 6–7). The Ohlone tiger beetles is extant at this site.

Northwest of the city of Santa Cruz

The Ohlone tiger beetle area located northwest of the city of Santa Cruz includes six sites, five of which are owned by UCSC and are part of the UCSC Campus Natural Reserve: Marshall Field Far North, Marshall Field North, Marshall Field Main Meadow, Marshall Field Main West of Empire Grade, and Lower Marshall Field. The sixth site is owned by the California Department of Parks and Recreation and occurs in Wilder Ranch State Park. For our purposes in this document, this site is referred to as Wilder southwest of Empire Grade (referred to as "Grey Whale portion of Wilder Ranch State Park" in Arnold and Knisley 2018, p. 579). These six sites are distinct patches separated by areas of non-habitat (e.g., forest or roads). Some sites contain suitable grassland habitats, while the habitat in other sites has become unsuitable.

Since as early as 2000, researchers conducted regular surveys for Ohlone tiger beetles at three sites in this area: Marshall Field Main Meadow, Lower Marshall Field, and Wilder southwest of Empire Grade (Arnold and Knisley 2018, p.579; Jones in litt. 2023). Information is limited for other sites northwest of the city of Santa Cruz. Current status of the Ohlone tiger beetle at the six sites in the area located northwest of the city of Santa Cruz follows:

Marshall Field Far North. This site is not surveyed regularly. We have no new information on this site since the previous 5-year status review. Until we have data to show otherwise, we presume the status has remained the same: the Ohlone tiger beetle is potentially extirpated at this site. This site has high potential to become suitable and re-occupied by Ohlone tiger beetles if habitat is managed for the species.

Marshall Field North. This site is not surveyed regularly. We have no new information on this site since the previous 5-year status review. Until we have data to show otherwise, we presume the status has remained the same: the Ohlone tiger beetle is presumed extant at this site.

Marshall Field Main Meadow. Surveyors observed Ohlone tiger beetles at this site in 2022 (Jones in litt. 2023). The Ohlone tiger beetle is presumed extant at this site.

Marshall Field Main West of Empire Grade. Surveyors observed Ohlone tiger beetles at this site in 2021 (Jones in litt. 2023). The Ohlone tiger beetle is presumed extant at this site.

Lower Marshall Field. Surveyors observed Ohlone tiger beetles at this site in 2023 (Jones in litt. 2023). In 2021 and 2022, this site served as a source for Ohlone tiger beetle translocations to Santa Cruz Gardens (Pearson 2023, pp. 6–7). The Ohlone tiger beetle is extant at this site.

Wilder southwest of Empire Grade. Researchers conducted annual monitoring of Ohlone tiger beetle adults at this site from 2001 to 2017. They observed Ohlone tiger beetles each year and the estimated number of adults fluctuated ranging from under 300 to approximately 1,000 individuals (Arnold and Knisley 2018, p. 584 Figure 5). The Ohlone tiger beetle is presumed extant at this site.

North of the city of Santa Cruz

The Ohlone tiger beetle area located north of the city of Santa Cruz includes a single site, Pogonip Open Space, owned by the City of Santa Cruz. This site formerly contained suitable grassland habitat, but due to changes in vegetation (densely vegetated meadows, increased thatch, and few patches of bare ground) habitat has become unsuitable for the Ohlone tiger beetle. Ohlone tiger beetles have not been observed at Pogonip Open Space since 2004 (Arnold in litt. 2022, p. 1; Service 2019, p. 3). The Ohlone tiger beetle has been extirpated from this site. If habitat is managed or restored to become suitable, this site has potential to become re-occupied by Ohlone tiger beetles.

West of the city of Santa Cruz

The Ohlone tiger beetle area located west of the city of Santa Cruz includes eight sites, one of which is an additional since the past 5-year status review. This new site is referred to as Engelsman Loop. Landownership of these sites includes the City of Santa Cruz (two sites): Moore Creek Preserve and Moore Creek at Meder Street; UCSC (one site): UCSC – IAA; or private (five sites): Jades Ranch, Younger Ranch, Younger Ranch Lower, South of Meder Street Poliski-Gross, and Engelsman Loop.

Many of the sites in the area located west of the city of Santa Cruz are less distinct than sites in other Ohlone tiger beetle areas because habitat remains somewhat contiguous among multiple sites, although some sites are distinct patches separated by areas of non-habitat. An adult Ohlone tiger beetle was recaptured approximately 0.25 mile from its initial capture site in this Ohlone tiger beetle area, demonstrating movement can occur among sites (Arnold and Knisley 2018, p. 581). Some sites contain suitable grassland habitats, while other sites have become unsuitable habitat because of changes in vegetation or alteration of habitat. Current status of the Ohlone tiger beetle at the eight sites in area located west of the city of Santa Cruz follows:

Moore Creek Preserve. This site is an open space preserve owned and managed by the City of Santa Cruz. Researchers conducted annual monitoring of Ohlone tiger beetle at this site since 2001. They observed Ohlone tiger beetles each year and the estimated number of adults fluctuated ranging from approximately 400–1800 individuals (Arnold and Knisley 2018, p. 584 Figure 5; Mitcham pers. comm. 2024). In 2020, this site served as a source for Ohlone tiger beetle translocations to Santa Cruz Gardens (Pearson 2023, p. 6). The Ohlone tiger beetle is extant at this site.

Moore Creek at Meder Street. This site is not surveyed regularly. We have no new information on this site since the previous 5-year status review. Thus, we presume the status has remained the same as stated in the previous 5-year status review: the Ohlone tiger beetle is potentially extirpated at this site. However, the City of Santa Cruz has committed to begin management activities for the Ohlone tiger beetle at 11 acres of this site, as described in the City of Santa Cruz

Operations and Maintenance HCP (City of Santa Cruz 2021, pp. 78–80). Because the City of Santa Cruz has committed to long-term management of this site, Ohlone tiger beetles will likely re-occupy this site through natural colonization, or if needed through coordinated species reintroductions in the coming years.

UCSC – IAA. This site is part of the Ranch View Terrace HCP (Jones & Stokes 2004, p. 1-2). The plan includes regularly scheduled surveys for Ohlone tiger beetles (Jones & Stokes 2004, p. 6-5). Surveyors observed Ohlone tiger beetles from 2020 to 2023, with counts ranging from less than 100 to over 200 individuals (UCSC 2023, p. 10). In 2020, this site served as a source for Ohlone tiger beetle translocations to Santa Cruz Gardens (Pearson 2023, p. 6). The Ohlone tiger beetle is extant at this site.

Jades Ranch. Portions of this site were converted to horse stables over a decade ago (Knisley and Arnold 2013, p. 576). The Ohlone tiger beetle has been extirpated from the converted portions because the habitat was altered and is unsuitable. However, suitable habitat remains at other portions of this site and the species is presumed extant.

Younger Ranch. Portions of this site were converted to vineyard over a decade ago (Knisley and Arnold 2013, p. 576). The Ohlone tiger beetle has been extirpated from the converted portions because the habitat was altered and is unsuitable. However, suitable habitat remains at other portions of this site and the species is presumed extant.

Younger Ranch Lower. This site is not surveyed regularly. Researchers observed Ohlone tiger beetles at this site in 2009; since then, surveyors have not been allowed access to these private lands (Knisley and Arnold 2013, p. 576). We have no new information on this site since the previous 5-year status review. Until we have data to show otherwise, we presume the status has remained the same: the Ohlone tiger beetle is presumed extant at this site.

South of Meder Street Poliski-Gross. This site is not surveyed regularly. By 2009, the Ohlone tiger beetle was likely extirpated from this site because increased vegetation cover and accumulation of thatch made habitat unsuitable (Knisley and Arnold 2013, p. 576). If habitat is managed or restored to become suitable, this site has potential to become re-occupied by Ohlone tiger beetles.

Engelsman Loop. This site is not surveyed regularly and has limited access. Researchers observed Ohlone tiger beetles at this site in 2009 (Knisley and Arnold 2013, p. 576) and in 2020 (Jones in litt. 2020). The Ohlone tiger beetle is presumed extant at this site.

Summary of Distribution and Abundance

Historically, the Ohlone tiger beetle has had limited distribution across five areas in the vicinity of the city of Santa Cruz, California. In these Ohlone tiger beetle areas, individuals have been observed at some point in time at 17 sites.

Ohlone tiger beetles are currently present in 4 areas: 13 sites are extant, and 4 sites are potentially extirpated/extirpated. Habitat has been altered within portions of two sites, resulting in local extirpation of Ohlone tiger beetles from those altered portions, while the surrounding

suitable habitat of the site remains occupied. Vegetation has changed and habitat has currently become unsuitable in four sites, resulting in potential extirpations/extirpations from those sites.

No range-wide monitoring program is conducted for Ohlone tiger beetles. Some sites are regularly surveyed while others are not. As such, abundance information can be lacking entirely or is difficult to compare among sites across the range.

Table 1. Status of Ohlone tiger beetle by site in 2009 5-year status review, 2019 5-year status review, and this (2024) 5-year status review.

Ohlone Tiger Beetle Area	Location Name	2009	2019	2024
West of the city of Soquel	Santa Cruz Gardens*	Potentially Extirpated	Extirpated	Extant
City of Scotts Valley	Glenwood Open Space Preserve	Extant	Extant	Extant
Northwest of the city of Santa Cruz	Marshall Field Far North	Potentially Extirpated	Potentially Extirpated	Potentially Extirpated
	Marshall Field North	Extant	Extant	Presumed Extant
	Marshall Field Main Meadow	Extant	Extant	Presumed Extant
	Marshall Field Main West of Empire Grade	Potentially Extirpated	Extant	Presumed Extant
	Lower Marshall Field	Potentially Extirpated	Extant	Extant
	Wilder Southwest of Empire Grade	Extant	Potentially Extirpated	Presumed Extant
North of the city of Santa Cruz	Pogonip Open Space	Potentially Extirpated	Extirpated	Extirpated
West of the city of Santa Cruz	Moore Creek Preserve	Potentially Extirpated	Extant	Extant
	Moore Creek at Meder Street	Extant	Potentially Extirpated	Potentially Extirpated
	UCSC Mima Meadow/Inclusion Area A (UCSC – IAA)	Extant	Extant	Extant
	Jades Ranch	Potentially Extirpated	Potentially Extirpated	Presumed Extant (locally extirpated from portion of habitat that was altered)
	Younger Ranch	Extirpated	Extirpated	Presumed Extant (locally extirpated from portion of habitat that was altered)
	Younger Ranch, Lower	Extant	Extant	Presumed Extant
	South of Meder Street Poliski-Gross	Potentially Extirpated	Potentially Extirpated	Potentially Extirpated
	Engelsman Loop	(not identified as a site)	(not identified as a site)	Presumed Extant

*Ohlone tiger beetles were translocated to this site 2020-2022.

Threats:
The threats to the species identified at the time of listing included: habitat fragmentation and destruction due to urban development; habitat degradation due to invasion of nonnative vegetation; vulnerability to random local extirpations; unrestricted collecting; predation and parasitism; inadequacy of existing regulatory mechanisms; recreational activities; and pesticide use (Service 2001, p. 50348). These threats to the Ohlone tiger beetle remain, and the threat of habitat alteration is a primary concern because habitat at some sites has become and remains unsuitable. A new additional threat in this 5-year status review is the effects of climate change: extreme precipitation and prolonged drought.

Climate change
From monitoring data at Glenwood Preserve, researchers found a positive correlation between dry years and adult Ohlone tiger beetle numbers (Timmer and Filous 2023, p. 8). Although female Ohlone tiger beetle require some amount of soil moisture to oviposit (Brust et al. 2012, p. 313; Timmer and Filous 2023, pp. 8–9), too much precipitation can kill individual Ohlone tiger beetles. At UCSC – IAA, researchers found that from December 2022–April 2023, mima mounds flooded, likely drowning that generation of Ohlone tiger beetle larvae, and remained inundated and thus unavailable for oviposition for an extended period, which may have caused the low number of burrows that summer (UCSC 2023, p. 18). Prolonged drought and extreme precipitation events are projected to increase in frequency and variation over the next 74 years (Langridge 2018, pp. 16–17, 22–23), which could continue to interfere with oviposition success and larval survival across the Ohlone tiger beetle's range.

Evaluation of Recovery Criteria:
The Service has not developed a recovery plan for the Ohlone tiger beetle. However, before it was listed, we included the species as a sensitive species in the recovery plan for insect and plant taxa from the Santa Cruz Mountains in California (Service 1998). At the time, we were considering the Ohlone tiger beetle for listing. However, because the species was not listed when the recovery plan was published, the Service did not establish recovery criteria for the Ohlone tiger beetle.

Conclusion:
After reviewing the best available scientific information, we conclude that the Ohlone tiger beetle remains an endangered species. Some previously occupied Ohlone tiger beetle sites have been lost to habitat alteration and are no longer suitable. Additionally, we don't have information to evaluate Ohlone tiger beetle population trends across the range. The evaluation of threats affecting the species in consideration of the factors described in section 4(a)(1) of the Endangered Species Act and analysis of the status of the species in our 2009 5-year review (Service 2009) remain an accurate reflection of the species' current status, with a new additional threat from the effects of climate change.

RECOMMENDATIONS FOR FUTURE ACTIONS:

Below we present recommendations to inform and implement recovery of the Ohlone tiger beetle.

- Develop and implement Ohlone tiger beetle management plans across the species range.
    - Manage and restore habitat at sites where changes in vegetation rendered habitat unsuitable for Ohlone tiger beetles.
    - Continue to enhance existing and potential habitat throughout the species range, as necessary, through removal of invasive species, grazing, burning, planting, or other management actions as deemed appropriate by the Service.
    - Work with UCSC and California State Parks to reduce encroachment of forest into Ohlone tiger beetle habitats.
- Conduct genetic research on Ohlone tiger beetles to determine populations/metapopulations.
    - Results from genetic studies can inform potential translocations to maintain or increase genetic diversity among occupied sites or how to determine which site(s) to use for reintroductions.
- Translocate and reintroduce Ohlone tiger beetle individuals to extirpated sites with suitable habit.
    - Once habitat is managed or restored to become suitable, translocate and reintroduce Ohlone tiger beetle individuals to these extirpated sites.
    - Work with the City of Santa Cruz to translocate and reintroduce Ohlone tiger beetles to Pogonip Open Space, a currently extirpated site.
- Develop and conduct an annual, range-wide monitoring program for the Ohlone tiger beetle to derive statistically robust population estimates. This monitoring should be developed with experts to include standardized measures for Ohlone tiger beetle surveys incorporating probability of detection and systematic, stratified random sampling in a spatially balanced manner.
    - Continued monitoring of Santa Cruz Gardens is needed to determine if the site is self-sustaining.
- Work with landowners to protect existing Ohlone tiger beetle sites with deed restrictions, conservation easements, or through fee title acquisitions.
- Develop a recovery plan for the Ohlone tiger beetle.
- Investigate and implement a captive propagation program for the Ohlone tiger beetle to bolster existing populations.

Lead Field Supervisor, Ventura Fish and Wildlife Office

Approved STEPHEN HENRY Digitally signed by STEPHEN HENRY Date: 2024.07.30 10:35:19 -07'00'

LITERATURE CITED:

Arnold, R.A., K.W. Bartolome, and L.D. Ford. 2012. Review of historical and current land use practices, characterization of suitable habitat, and habitat management recommendations for the endangered Ohlone tiger beetle, *Cicindela ohlone* (Coleoptera: Cicindelidae). Final Report. U.S. Fish and Wildlife Service Project #11130000. Dated January 2012. 43 pp + appendices.

Arnold, R.A., and C.B. Knisley. 2018. Biology and conservation of *Cicindela ohlone* Freitag and Kavanaugh, the endangered Ohlone tiger beetle (Coleoptera: Carabidae: Cicindelinae). II. Population ecology of adults and larvae and recommended monitoring methods. The Coleopterists Bulletin 72(3): 577-589.

Brust, M.L., C.B. Knisley, S.M. Spomer, and K. Miwa. 2012. Observations of oviposition behavior among North American tiger beetle (Coleoptera: Carabidae: Cicindelinae) species and notes on mass rearing. The Coleopterists Bulletin 66(4): 309–314.

City of Santa Cruz. 2021. City of Santa Cruz Operations and Maintenance Habitat Conservation Plan. Prepared by: Ebbin, Moser + Skaggs LLP, Hagar Environmental Science, Dana Bland & Associates, Entomological Consulting Services, Ltd., Kittleson Environmental Consulting Services, and Biotic Resources Group. Dated January 25, 2021. vii + 154 pp. + appendices.

Cornelisse, T.M., M.K. Bennett, and D.K. Letourneau. 2013. The implications of habitat management on the population viability of the endangered Ohlone tiger beetle (*Cicindela ohlone*) metapopulation. PLosS ONE 8(8): e71005. Doi:10.1371/journal.pone.0071005

Essig, E.O. 1926. Insects of western North America. The MacMillan Company, New York, New York. 1035 pp.

Freitag, R., D.H. Kavanaugh, and R. Morgan. 1993. A new species of *Cicindela* (*Cicindela*) (Coleoptera: Carabidae: Cicindelini) from remnant native grassland in Santa Cruz County, California. Coleopterists Bulletin 46: 113-120.

Jones & Stokes. 2004. Draft Habitat Conservation Plan, Ranch View Terrace, University of California, Santa Cruz. July. (J&S 02-428.) Prepared for University of California, Santa Cruz Physical Planning & Construction, Campus and Community Planning Office. Santa Cruz, CA.

Knisley, C.B., and R.A. Arnold. 2013. Biology and conservation of *Cicindela ohlone* Freitag and Kavanaugh, the endangered Ohlone tiger beetle (Coleoptera: Carabidae: Cicindelinae). I. Distribution and natural history. The Coleopterists Bulletin 67(4): 569-580.

Langridge, Ruth. 2018. University of California, Santa Cruz. Central Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-006.

Pearson, D.L. and F. Cassola. 1992. World-wide species richness patterns of tiger beetles (Coleoptera: Cicindelidae): indicator taxon for biodiversity and conservation studies. Conservation Biology 6:376-391.

Pearson, K. 2023. Assessment of Cicindela Ohlone habitat and translocation success at Santa Cruz Gardens. Senior thesis submitted to the University of California Santa Cruz.

Porter-Livingston Development, Inc. and O'Hara-Balfour LP. 2009. Habitat Conservation Plan for the Ohlone tiger beetle, the Santa Cruz tarplant, and the Gairdner's yampah, Santa Cruz Gardens Unit 12 Project Site (APNs 025-391-01, 025-401-01, 025-401-02, & 025-491-01). Soquel, California. Prepared by: Richard A. Arnold and Kathleen Lyons. Dated July 28, 2009. vi + 56 + appendices.

[Service] U.S. Fish and Wildlife Service. 1998. Recovery plan for insect and plant taxa from the Santa Cruz Mountains in California. U.S. Fish and Wildlife Service, Region 1, Portland, Oregon. 83 pp.

[Service] U.S. Fish and Wildlife Service. 2001. Endangered and Threatened Wildlife and Plants; Endangered Status for the Ohlone Tiger Beetle (*Cicindela ohlone*). Federal Register 66: 50340-50350.

[Service] U.S. Fish and Wildlife Service. 2009. Ohlone tiger beetle (*Cicindela ohlone*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California.

[Service] U.S. Fish and Wildlife Service. 2019. Ohlone tiger beetle (*Cicindela ohlone*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office, Ventura, California.

[Service] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 47 Species in California, Nevada, and Oregon. Federal Register 88: 56042-56044.

Timmer M. and Filous T. 2023. Glenwood Open Space Preserve – 2022 Ohlone Tiger Beetle Monitoring Report. Unpublished report submitted to the U.S. Fish and Wildlife Service, Region 8, Ventura, California.

[UCSC] University of California at Santa Cruz. 2023. Ranch View Terrace Habitat Conservation Plan. Annual Report. 20pp.

WRA. 2017. Long term management plan with an emphasis on the Ohlone tiger beetle, Scotts Valley spineflower, and Scotts Valley polygonum. Prepared for the Land Trust of Santa Cruz County and City of Scotts Valley.

In Litteris:

Arnold, R.A. 2022. Letter to William Davilla, EcoSystems West Consulting Group. Ohlone tiger beetle status at Pogonip Park. Dated 13 June 2022.

Jones, A. 2020. Campus Natural Reserve Manager, University of California Santa Cruz, Santa Cruz, California. E-mail to Chad Mitcham, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office. Subject: Re: [EXTERNAL] Re: otb at Englesman Loop. Dated March 3, 2020.

Jones, A. 2023. Campus Natural Reserve Manager, University of California Santa Cruz, Santa Cruz, California. E-mail to Chad Mitcham, U.S. Fish and Wildlife Service, Ventura Fish and Wildlife Office. Subject: [EXTERNAL] Re: Ohlone tiger beetle status review. Dated August 17, 2023.

Personal Communication:

Mitcham, C. 2024. Video call between Eric Morrissette, USFWS Ventura Office and Chad Mitcham, USFWS Santa Cruz suboffice. Discussion Topic: Ohlone tiger beetles at Moore Creek Preserve. July 9, 2024.

Appendix A: Table of translocations from source sites to reintroduction at Santa Cruz Gardens.

Table A1. Date, source, and numbers of individuals foreach Ohlone tiger beetle translocation event for the Santa Cruz Gardens reintroduction effort. Data from Peterson (2023, p. 6–7).

Translocation, Month and Year	Source Site(s)	Number of adults released at Santa Cruz Gardens
March 11, 2020	Inclusion area A Glenwood Preserve	20 10
March 31, 2020	Moore Creek Preserve	13
March 24, 2021	Lower Marshall Field Glenwood Preserve	10 11
March 8, 2022	Lower Marshall Field Glenwood Preserve	9 6