5-YEAR REVIEW
San Joaquin kit fox (*Vulpes macrotis mutica*)

GENERAL INFORMATION

Species: San Joaquin kit fox (*Vulpes macrotis mutica*)
Date listed: March 11, 1967
Federal Register (FR) citation: 32 FR 4001
Classification: Endangered

State Listing: The San Joaquin kit fox is listed as threatened under the California Endangered Species Act (June 27, 1971).

BACKGROUND

Species overview:
The San Joaquin kit fox is the larger of the two subspecies of kit fox, which is the smallest canid species in North America. Kit foxes have long slender legs and are about 12 inches (30 centimeters) high at the shoulder. The average weight of adult males is 5 pounds (2.3 kilograms), and of adult females is 4.6 pounds (2.1 kilograms) (Morrell 1971, p. 21). General physical characteristics of kit foxes include a small, slim body, relatively large ears set close together, narrow nose, and a long, bushy tail tapering slightly toward the tip. Color and texture of the fur coat of kit foxes varies geographically and seasonally. The subspecies' most commonly described colorations are buff, tan, grizzled, or yellowish-gray dorsal coats (McGrew 1979, p. 1).

Most recent status review:
[Service] U.S. Fish and Wildlife Service. 2020. San Joaquin kit fox (*Vulpes macrotis mutica*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 6 pp.

We recommended no status change in the 2020 review.

FR notice citation announcing this status review:
[Service] U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for 59 Pacific Southwest. Federal Register 89:83510–83514.

We received information in response to the notice from the Center for Natural Lands Management regarding the use of their managed lands by the subspecies.

ASSESSMENT

Information acquired since the last status review:
This 5-year review was conducted by the U.S. Fish and Wildlife Service's (Service) Sacramento Fish and Wildlife Office. We solicited information for this review from interested parties through a Federal Register notice announcing this review on October 16, 2024. We also contacted the Bureau of Land Management, the California Department of Fish and Wildlife, and the

Endangered Species Recovery Program located at California State University - Stanislaus 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 reports from the Kern National Wildlife Refuge, project monitoring reports, annual reports from 10(a)(1)(a) recovery permit holders for the subspecies, and reports from the California Natural Diversity Database.

Following the Service's previous status review for the subspecies in 2020 (previous review; Service 2020a, entire) we received numerous survey and monitoring reports for San Joaquin kit fox and a report of development of a new tool for monitoring population abundance which we discuss in the **Distribution and abundance** section below. Additionally, the Service has received numerous research results on the effects of urbanization and disease on the subspecies which we discuss in the **Threats** section below**.**

Distribution and abundance:
As described in Section 2.3 of the Species Status Assessment report (SSA; Service 2020b, pp. 15–16) the subspecies' historical range was from southern Kern County north to eastern Contra Costa County and eastern Stanislaus County along the San Joaquin Valley as well as portions of adjacent Coast Range foothills and valleys. By the time of the Service's previous review (Service 2020a, p. 2) the subspecies was likely extirpated from Alameda and Contra Costa Counties as well as the Salinas Valley and its adjoining foothills, as described in Section 3.2 of the SSA (Service 2020b, pp. 27–29).

To date, there are no rangewide surveys for the subspecies and thus we base our assessment of the current distribution of the subspecies on sporadic monitoring and survey reports from portions of its range. Based on these reports, the current distribution of the subspecies appears unchanged from distribution presented in Figure 8 of the SSA (Service 2020b, p. 29). Specifically, the Service received reports of continued subspecies presence on the Carrizo Plain (Brandon Swanson, California Department of Fish and Wildlife, *in litt.* 2025); in the Panoche Valley area (Center for Natural Lands Management 2024, entire); on the Kern National Wildlife Refuge Complex (Kathryn Jimenez, Kern National Wildlife Refuge Complex, *in litt.* 2025); in the Cholame Valley area (Will Knowlton, Althouse and Meade, *in litt.* 2024); and in the Cities of Coalinga and Bakersfield (Brian Cypher, California State University – Stanislaus, *in litt.* 2023). Our review of California Natural Diversity Database records for the subspecies found no new records following the Service's previous review in 2020 (CNDDB 2025). Overall, these data are concordant with the assessments of the subspecies' distribution in Section 3.2 of the SSA (Service 2020b, pp. 27–29) and the Service's previous review (Service 2020a, p. 2).

As described in the Service's previous review (Service 2020a, p. 2) and in Section 3.2 of the SSA (Service 2020b, pp. 27–28), the subspecies was likely absent from Alameda and Contra Costa Counties as well as the Salinas Valley and its adjoining foothills.. Specifically, in the northern portion of the species' range scent dog surveys conducted in 2001–2003 in Contra Costa and Alameda Counties did not detect the species (Smith et al. 2006, p. 214). Additional scent dog surveys conducted in 2018 at Lawrence Livermore National Laboratory did not detect the species (Woollet 2019, p. 8). Similarly, a 2005–2007 study of the species near Santa Nella in Merced County north of Highway 152 using camera traps, track stations, and spotlighting identified only two observations of the species (Constable et al. 2009, pp. 16–17, 18, Table 2) and concluded that the observations were likely of a dispersing rather than resident individual

(Constable et al. 2009, p. 36). Following the Service's previous report we have received no new observations of the species in the northern portion of its range, specifically areas of its range north of Highway 152. Thus, while dispersing individuals of the species may still use areas north of Highway 152, current data indicate that use of these areas by individuals is rare. As discussed in the **Recommendations** section below, we will continue to work with our partners to evaluate future survey data, occurrence information, and conservation opportunities in the area.

As described in Section 3.1 of the SSA (Service 2020b, p. 27) the Service's 1983 recovery plan for the subspecies estimated a historical abundance between 8,667 and 12,134 total foxes rangewide (Service 1983, p. 10). At the time of the Service's previous review (Service 2020a, p. 2), the most recent abundance estimate available for the subspecies was from Cypher *et al.* (2013, entire) which estimated an abundance of 3,616 foxes rangewide in 2013. As discussed in the **Threats** section below, the Service's previous review described declines in overall abundance resulting from the sarcoptic mange epidemic in the relatively abundant Bakersfield population (Service 2020a, p. 2).

To date, there are no rangewide abundance surveys for the subspecies and thus we base our assessment of current abundance of the subspecies on results from the few studies of population abundance which have occurred following the Service's previous review (Service 2020a, p. 2). As discussed in Section 3.2 of the SSA (Service 2020b, pp. 27–29) subspecies population sizes are known to fluctuate widely based on environmental conditions. Cypher *et al.* (2022a, p. 23) studied the ecology of the subspecies on the Carrizo Plain and found a causal relationship between the timing and amount of precipitation influencing prey availability and in turn subspecies abundance. Also, on the Carrizo Plain, the California Department of Fish and Wildlife has used distance sampling modeling of spotlighting data and estimated Carrizo Plain population sizes of 496, 908, 1,026, and 1,239 over the years 2021, 2022, 2023, and 2024 respectively (B. Swanson, *in litt.* 2025) indicating an overall upward abundance trend for this population following the Service's previous review. Cypher *et al.* (2022b, p. 20) radio-tracked 74 kit foxes from June 2019 to May 2022 in the Panoche area. The primary intent of this study was to compare the life histories of kit foxes on a photovoltaic solar plant and an adjacent undeveloped reference area and thus this study did not directly address trends in abundance over this period. However, this study did find that survival rates on the solar plant site stayed consistent across years while survival rates on the adjacent undeveloped reference area had a declining trend over years (Cypher *et al.* 2022b, p. 44). For the urban Bakersfield population, Cypher *et al.* (2025, Figure 9) provide camera station counts of foxes observed in Bakersfield from 2015 to 2022 which we reproduce below (Figure 1).

These camera station counts indicate a rapid decline in kit foxes observed from 2015 until the time of the Service's previous review in 2020 (Service 2020a, p. 2) linked to the sarcoptic mange epidemic. The two years following 2020 indicate a positive trend in kit foxes observed by camera stations. Cypher (2024, p. 58) states that by the year 2022 this study detected no mange in the population. Overall, these anecdotal data are consistent with the assessments of subspecies abundances presented in the Service's previous review (Service 2020a, p. 2) and the SSA (Service 2020b, pp. 27–28 and Figure 8).

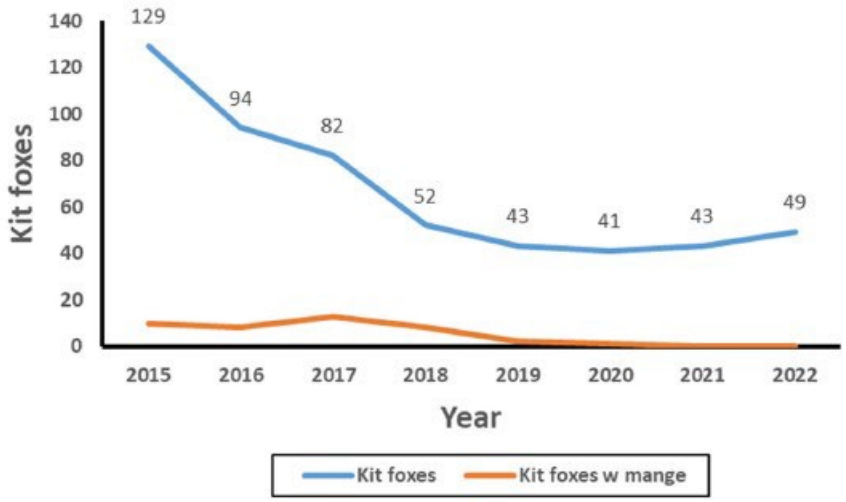

Figure 1. Camera station observations of San Joaquin kit fox in Bakersfield, by year, including kit foxes with mange. Reproduced from Cypher *et al.* 2025 Figure 9.

A significant development for the future study of abundance in the subspecies is the development of the capability to identify individuals from fecal samples using Single Nucleotide Polymorphism genotyping (Parker *et al.* 2021, entire). This technology provides the capability to identify and track individual kit foxes using non-invasive sampling and would allow less costly and more detailed studies of breeding, movement, and demography for the subspecies.

Threats:

The Department of the Interior's 1967 listing rule for the subspecies did not identify specific threats to the subspecies (Department of the Interior 1967, p. 4001). However, the Service's previous review (Service 2020a, pp. 1–2) and Section 3.3 of the SSA (Service 2020b, pp. 30–47) did identify specific threats to the subspecies from land development, climate variability, pesticide use, predation, disease, and road mortality. Each of these threats is still present and the effects of these threats on the subspecies remain similar to the effects described in the Service's previous status review (Service 2020a, pp. 1–2) and Sections 3.3 and 4.1 of the SSA (Service 2020b, pp. 30–47, 54–56). Nevertheless, research results and monitoring reports subsequent to the Service's previous review provide additional information on threats from land development, predation, and disease.

Land development

Section 3.3 of the SSA identified threats to the subspecies from agricultural land conversion, urbanization, and energy development (Service 2020b, pp. 30–47). Following the Service's previous review, we received several studies of the interaction between the subspecies and an urbanized environment particularly in the Bakersfield area, studies and monitoring reports of the interaction between the subspecies and photovoltaic solar project developments, and information on development of Habitat Conservation Plans (HCPs) involving the subspecies.

We received several studies of the interaction between the subspecies and urban environments following the Service's previous review (Service 2020a, entire). Some of these studies also incorporated studies of sarcoptic mange transmission. We discuss the disease-related findings of these studies in the *Disease* section below. Cypher *et al.* (2022c, p. 2727) found that kit foxes

newly in contact with non-native red foxes (*Vulpes vulpes*) in an urban environment used temporal, rather than spatial, partitioning to avoid these potential competitors and predators. Alipio *et al.* (2024, p. 10) expanded this study to additional canid species beyond red fox and again found that the subspecies used temporal, more so than spatial, partitioning to reduce interaction with potential competitors and predators in urbanized environments. Cypher *et al.* (2024, p. 519) describe a source of kit fox fatalities unique to urban environments specifically entanglement with batting cage or soccer nets. Cypher *et al.* (2023a, p. 276) found that kit foxes from urban areas regularly travel into adjacent nonurban habitats on excursions of distances up to 1.8 miles (2.9 kilometers) and durations up to 14 days indicating that gene flow between urban and nonurban populations is likely ongoing. Cypher *et al.* (2025, p. 239) found that habitat characteristics of urban habitats led to high levels of spatial overlap and den sharing among urban kit foxes. Ralls *et al.* (2024, p. 868) found that kit foxes in an urban area display social group flexibility and frequently form groups larger than a single mated pair such as groups comprised of a single male with multiple reproductive females as well as genetically-related "helper" foxes. The authors attribute the phenomenon to the abundant available resources in urban areas. Cypher *et al.* (2023b, p. 20) found that kit foxes will readily use construction sites, specifically those for road construction, despite intensive construction activities. They stress that preventing kit foxes from establishing dens on construction sites would reduce conflict between kit foxes and development activities conflict between kit foxes and development activities. Altogether, the results of these studies are concordant with the analyses of the effects of urbanization on the subspecies presented in Sections 3.3.1.2 and 4.1.2 of the SSA (Service 2020b, pp. 34, 55) and the Service's previous review (Service 2020a, pp. 1–2).

We received multiple studies of the effects of photovoltaic solar development on the subspecies following the Service's previous review (Service 2020a, entire). Monitoring reports from the California Flats solar development near Cholame, California, indicate that the subspecies frequently uses the area within photovoltaic arrays for natal dens (W. Knowlton, *in litt.* 2024). Cypher *et al.* (2022b, p. 57) found that kit foxes using the Panoche Valley solar development site and adjacent undeveloped areas were ecologically similar and that there were no significant adverse impacts to the subspecies from this solar development. However, the authors of this study caution that this absence of adverse effects may result from implementation of a variety of conservation measures for the subspecies on the solar development site. Altogether, these reports are concordant with the assessment of the effects of photovoltaic solar development on the subspecies presented in Section 3.3.1.3 of the SSA (Service 2020b, pp. 35–36) wherein solar development is not incompatible with subspecies use.

Predation

Following the Service's previous review (Service 2020a, entire), we received reports from studies on the interaction between the subspecies and its predators. As described above, Cypher *et al.* (2022c, p. 2727) found that kit foxes newly in contact with non-native red foxes (*Vulpes vulpes*) in an urban environment used temporal partitioning to avoid these potential competitors and predators. Alipio *et al.* (2024, p. 10) expanded this study to include other canid species and found that the subspecies used temporal, more so than spatial, partitioning to reduce interaction with potential competitors and predators in urbanized environments. Overall, these results are in concordance with the assessment of the effects of predation on the subspecies presented in Section 3.3.4 of the SSA (Service 2020b, p. 41) and in the Service's previous review (Service 2020a, p. 2).

Disease

At the time of the SSA for the subspecies (Service 2020b, p. 42) and the previous review (Service 2020a, p. 2) sarcoptic mange was causing a steep decline in the Bakersfield population. However, following the Service's previous status review camera trapping observations indicate that this population decline has stabilized since the year 2020 (Figure 1 above) and also that rates of sarcoptic mange infection have subsided to the point where no mange was detected in 2022 (Cypher 2024, p. 58). We have received numerous post-epidemic reports on the effects of sarcoptic mange on the subspecies following the Service's previous review. Cypher *et al.* (2023a, p. 277) found that kit foxes from urban areas where the sarcoptic mange epidemic is occurring readily travel to adjacent non-urban areas and are potential transmission vectors. However, these authors found that kit foxes in these non-urban areas were not affected by sarcoptic mange. Based on observations, the authors attribute this lack of spread to shorter travel distances by infected urban foxes and lower rates of den sharing among non-urban foxes. Cypher *et al.* (2025, p. 239) found frequent use of den sharing by urban foxes and suggest that this behavior contributed to the spread of sarcoptic mange in urban foxes. Rudd *et al.* (2020a, p. 637) tested the efficacy of flumethrin-impregnated collars to reduce sarcoptic mange infection of kit foxes but found no difference between treated and control groups. Rudd *et al.* (2020b, p. 456) used genetics to study the relationship between sarcoptic mange mites from infected kit fox populations in Bakersfield and Taft nearby. The genetic information indicates that the most likely source of the Taft mites was Bakersfield kit foxes rather than coyotes (*Canis latrans*), red foxes, or domestic dogs (*Canis lupus*). Wilbert *et al.* (2020, p. 291) studied immune system genes in the subspecies and concluded that balancing selection may have maintained genetic diversity of these genes in the subspecies. Also, the data indicate that genetic diversity at these genes is similar between urban and non-urban kit foxes despite the increased exposure of urban kit foxes to diseases such as sarcoptic mange. Altogether, the Bakersfield kit fox population has stabilized following the peak of the sarcoptic mange epidemic and the population reduction noted in the Service's previous review (Service 2020a, p. 2). To date there remains no effective treatment for sarcoptic mange, and ideal habitat conditions remain for the spread of sarcoptic mange for the Bakersfield population. Therefore, sarcoptic mange remains a threat to the subspecies and the analysis of the effects of disease on the subspecies in the SSA (Service 2020b, p. 42) remains accurate.

Habitat conservation:

We reviewed information in our records on lands which have implemented management practices or protections for the subspecies following the Service's previous review (Service 2020a, entire). As described in Section 3.3.1.4 of the SSA, at the time of the Service's previous status review HCPs with management or protection for the subspecies covered over 90,000 acres; however, not all of this acreage is used by the subspecies. Following the Service's previous status review, the Bakersfield Metropolitan HCP expired on June 1, 2023 which reduced the acreage of protected lands by approximately 15,200 acres. Also following the Service's previous status review, the Service and its partners have developed four HCPs in areas where the subspecies is known to occur: the 496-acre Aera Block 12 HCP on an oil and gas development site (ICF 2019, entire; Service 2020c, entire), the 7,253-acre Pelicans Jaw Solar HCP on a photovoltaic solar development site (Dudek 2023, entire; Service 2024a, entire), the 762-acre Azalea Hybrid Power Project HCP on a photovoltaic solar development site (Kern County 2022, entire; Service 2024b, entire), and the 887-acre Chalan Solar and Storage Project HCP on a photovoltaic solar development site (Kern County 2023, entire; Service 2025, entire).

The implementation of these four HCPs, all of which are in Kern County, contributes to subspecies recovery.

Recovery criteria:
The Service provided downlisting and delisting criteria for the subspecies in the San Joaquin Valley Upland Species Recovery Plan (Service 1998, Table 4) which we summarize below:

Downlisting criteria
The three core populations: Carrizo Natural Area, Western Kern County, and Ciervo-Panoche Area; and three additional satellite populations are secured and protected from incompatible uses
All protected areas have approved and implemented management plans which include survival of the species as an objective
Population monitoring in protected areas show stable or increasing populations in the three core populations through one precipitation cycle AND show population interchange between one or more core populations and the three satellite populations
Delisting criteria
The three core populations: Carrizo Natural Area, Western Kern County, and Ciervo-Panoche Area; and several additional satellite populations (population number to be determined by research) encompassing as much as possible of the environmental and geographic variation of the historic geographic range are secured and protected from incompatible uses
All protected areas have approved and implemented management plans which include survival of the species as an objective
Population monitoring in protected areas show stable or increasing populations in the three core populations and three or more satellite areas through one precipitation cycle

At the time of the SSA report (Service 2020b, pp. 26–53) and the Service's previous review (Service 2020a, p. 3) the subspecies had not met the downlisting criterion for protection of the three core populations, though management plans had been implemented for portions of these three core areas. In general, there is insufficient monitoring to establish whether total populations in the three core populations were all stable or increasing through one precipitation cycle. In summary, the subspecies has not met downlisting criteria.

Conclusion:
After reviewing the best available scientific information, we conclude that the San Joaquin kit fox remains an endangered species. The evaluation of threats affecting the subspecies under the factors in 4(a)(1) of the Endangered Species Act and analysis of the status of the subspecies in the Service's most recent status review (Service 2020a, entire) remains an accurate reflection of the subspecies' current status.

RECOMMENDATIONS FOR FUTURE ACTIONS

Population reintroduction: We recommend assessments of the feasibility of reintroduction of individuals from robust populations to extirpated areas outside of the southern San Joaquin Valley to promote redundancy of the subspecies. Robust populations require a consistently abundant prey base and thus assessments of reintroduction feasibility should assess prey availability. Similarly, assessments of reintroduction feasibility should analyze reintroduction

locations for the potential of relocated individuals of this wide-ranging subspecies to conflict with nearby development or road use. Cypher (2024, p. 135) provides suggestions for restoration of agricultural lands for San Joaquin kit fox use.

Sarcoptic mange management: We recommend further research on effective treatments for sarcoptic mange in wild foxes. Following the Service's most recent status review (Service 2020a, entire) sarcoptic mange infection rates in the Bakersfield population have decreased and population abundance has stabilized as described above. However, this reduction in the prevalence of sarcoptic mange was not the result of intervention by the Service or its partners as the only known attempt to treat infected kit foxes with an acaricide (flumethrin) in the wild found no difference between treatment and control groups as described above in the Disease subsection. Thus, without effective treatments for wild foxes sarcoptic mange will remain a threat to the subspecies and the abundant Bakersfield population in particular.

Development of survey protocols: We recommend development of a rangewide survey protocol for the subspecies which can be used to assess population abundance rather than individual presence or absence. The current survey protocol in use (Service 1999, pp. 2–3) was designed to evaluate only presence or absence of the subspecies near proposed project sites in the northern portion of the subspecies' range. Development of a rangewide survey protocol that can assess population abundance would allow comparison of abundances between populations and provide greater detail and accuracy to inform management decisions.

Evaluation of conservation opportunities in the northern range: We recommend developing a working group with our partners to evaluate conservation opportunities in the northern portion of the subspecies' range. Conservation opportunities include, but are not limited to, conducting a habitat assessment, evaluating roads and the need for wildlife crossings, assessing prey availability, and evaluating connectivity with other populations.

Acting Field Supervisor, Sacramento Fish and Wildlife Office

Approve KIM TURNER-OLAH Digitally signed by KIM TURNER-OLAH Date: 2025.08.18 08:40:38 -07'00' **Date** _____

LITERATURE CITED

Alipio, C., McCullah-Boozer, M., Gaete, C., Hall, L. 2024. Spatiotemporal partitioning between the endangered San Joaquin kit fox and a novel mesocarnivore community in the urban environment as revealed by camera traps. Global Ecology and Conservation. 54:e03184.

[CNDDB] California Natural Diversity Database. 2025. Rarefind V.5 search for Vulpes macrotis mutica. Accessed January 29, 2025.

Center for Natural Lands Management. 2024. Annual Report for the Panoche Valley Preserve (C018 & C021) Fiscal Year 2022–2023. Center for Natural Lands Management, Temecula, California. 33 pp.

Constable, J. L., Cypher, B. L., Phillips, S. E., and Kelly, P. A. 2009. Conservation of San Joaquin Kit Foxes in Western Merced County, California. Fresno, California.

Cypher, B. 2024. The San Joaquin Kit Fox: Biology, Ecology, and Conservation of an Endangered Species. Comstock Publishing Associates: Ithaca, New York. 248 pp.

Cypher, B., Phillips, S., Kelly, P. 2013. Quantity and distribution of suitable habitat for endangered San Joaquin Kit Foxes: Conservation implications. Canid Biology & Conservation. 16:25–31.

Cypher, B., Westall, T., Kelly, E., Deatherage, N., Van Horn Job, C., Saslaw, L. 2022a. Final Report on Demographic and Ecological Patterns of Endangered San Joaquin Kit Foxes in the Carrizo Plain National Monument. Prepared for the Carrizo Plain National Monument, U.S. Bureau of Land Management. 27 pp.

Cypher, B., Westall, T., Kelly, E., Deatherage, N. 2022b. Final Report on Demographic and Ecological Responses of Endangered San Joaquin Kit Foxes to the Panoche Valley Solar Farm. Prepared for Con Edison Clean Energy Businesses. 63 pp.

Cypher, B., Deatherage, N., Westall, T., Kelly, E. 2022c. Intraguild competition between Endangered Kit Foxes and a Novel Predator in a Novel Environment. Animals. 12: 2727.

Cypher B. Deatherage, N., Westall, T., Kelly, E., Foley, J., Clifford, D., Rudd, J. 2023a. Movements by San Joaquin kit foxes (Vulpes macrotis mutica) between urban and nonurban habitats: implications for interpopulation disease transfer. Journal of Wildlife Diseases. 59:269–280.

Cypher, B., Noel, E., Kelly, E., Westall, T., Deatherage, N., Gabaldon, A. 2023b. Response of San Joaquin kit foxes to road construction sites. Prepared for the California Department of Transportation. 53 pp.

Cypher, B., Kelly, E., Van Horn Job, C., Westall, T. 2024. A novel hazard for an endangered fox in a novel environment. Journal of Wildlife Diseases. 60:519–525.

Cypher, B., Gabaldon, A., Kelly, E. Westall, T., Deatherage, N. 2025. Den use patterns of endangered San Joaquin kit foxes in urban environments may facilitate disease transmission. Animals. 15: 239–255.

Department of the Interior. 1967. Native Fish and Wildlife; Endangered Species. Federal Register 32:4001.

Dudek. 2023. Biological Resources Report for the Pelicans Jaw Hybrid Solar Project. Prepared for Pelicans Jaw Solar LLC, Redwood City, California. 86 pp.

ICF. 2019. Aera Block 12 Development Project Draft Environmental Assessment. Prepared for U.S. Fish and Wildlife Service, Sacramento, California. 69 pp.

Kern County. 2022. Draft Environmental Impact Report. SCH# 2021090602 Volume 1 Chapters 1 through 11. Azalea Solar Project by SF Azalea, LLC (PP21401). 762 pp.

Kern County. 2023. Draft Environmental Impact Report. SCH# 2021100003 Volume 1 Chapters 1 through 10. Chalan Solar and Storage Project by Chalan CA Solar and Storage, LLC (PP21402). 812 pp.

McGrew, J. 1979. Vulpes macrotis. Mammalian Species. 123:1–6.

Morrell, S. 1971. Life history of the San Joaquin Kit Fox. Final report prepared for the California Department of Fish and Game. 25 pp.

Parker L., Campana, M. Quinta, J. Cypher, B., Rivera, I., Fleischer, R., *et al.* 2021. An efficient method for simultaneous species, individual, and sex identification via in-solution single nucleotide polymorphism capture from low-quality scat samples. Molecular Ecology Resources. 22:1345–1361.

Ralls, K., Wilbert, T., Cypher, B., Can Horn Job, C., Maldonado, J. 2024. Social and genetic relationships among individuals in urban kit fox social groups. Canadian Journal of Zoology. 859–870.

Rudd, J., Clifford, D., Cypher, B., Hull, J., Foley, J. 2020a. Use of flumethrin-impregnated collars to manage an epidemic of sarcoptic mange in an urban population of endangered San Joaquin kit foxes (Vulpes macrotis mutica). Journal of Zoo and Wildlife Medicine. 51:631–642.

Rudd, J., Clifford, D., Cypher, B., Hull, J., Riner, A., Foley, J. 2020b. Molecular epidemiology of a fatal sarcoptic mange epidemic in endangered San Joaquin kit foxes (*Vulpes macrotis mutica*). Parasites & Vectors. 13: 456.

[Service] U.S. Fish and Wildlife Service. 1983. The San Joaquin Kit Fox Recovery Plan. Prepared by Dr. Thomas O'Farrell under interagency contract DE-ACOB-76NV01183 with the U.S. Department of Energy. 90 pp.

[Service] U.S. Fish and Wildlife Service. 1998. Recovery plan for upland species of the San Joaquin Valley, California. U.S. Fish and Wildlife Service, Portland, Oregon. 319 pp.

[Service] U.S. Fish and Wildlife Service. 1999. San Joaquin kit fox survey protocol for the Northern range. U.S. Fish and Wildlife Service, Sacramento, California. 7 pp.

[Service] U.S. Fish and Wildlife Service. 2020a. San Joaquin kit fox (*Vulpes macrotis mutica*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 6 pp.

[Service] U.S. Fish and Wildlife Service. 2020b. Species Status Assessment Report for the San Joaquin kit fox (*Vulpes macrotis mutica*) version 1.0. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 74 pp.

[Service] U.S. Fish and Wildlife Service. 2020c. Intra-Service Consultation on the Issuance of a Section 10(a)(1)(B) Incidental Take Permit to Aera Energy, LLC for the Block 12 Development Project Habitat Conservation Plan, Kern County, California. 18 pp.

[Service] U.S. Fish and Wildlife Service. 2024a. Intra-Service Consultation on the Issuance of a Section 10(a)(1)(B) Incidental Take Permit to Pelicans Jaw Solar, LLC for the Pelicans Jaw Hybrid Solar Project Habitat Conservation Plan, Kern County, California. 28 pp.

[Service] U.S. Fish and Wildlife Service. 2024b. Intra-Service Consultation on the Issuance of a Section 10(a)(1)(B) Incidental Take Permit to SF Azalea, LLC for the Azalea Hybrid Power Project Habitat Conservation Plan, Kern County, California. 19 pp.

[Service] U.S. Fish and Wildlife Service. 2025. Intra-Service Consultation on the Issuance of a Section 10(a)(1)(B) Incidental Take Permit to Chalan CA Solar Storage, LLC for the Chalan Solar and Storage Project Habitat Conservation Plan, Kern County, California. 18 pp.

Smith, D.A., K. Ralls, B.L. Cypher, H.O. Clark, Jr., P.A. Kelly, D.F. Williams, and J.E. Maldonado. 2006. Relative abundance of endangered San Joaquin Kit Foxes (*Vulpes macrotis mutica*) based on scat-detection dog surveys. The Southwestern Naturalist 51:210–219.

Wilbert, T., Maldonado, J., Tsuchiya, M., Sikaroodi, M., Cypher, B., *et al.* 2020. Patterns of MHC polymorphism in endangered San Joaquin kit foxes living in urban and non-urban environments. Pages 269–298 in Conservation Genetics in Mammals, eds. Jorge Ortega and Jesus Maldonado, Springer, Cham, Switzerland.

Woollett, D. S. 2019. Scat Detection Dog Surveys for the San Joaquin Kit Fox on the Lawrence Livermore National Laboratory's Experimental Test Site (Site 300) and the Corral Hollow Ecological Reserve, Alameda and San Joaquin Counties, California (No. LLNL-SR-768323). Lawrence Livermore National Lab (LLNL), Livermore, CA (United States).

IN LITTERIS

Cypher, B. 2023. Report of activities conducted under U.S. Fish and Wildlife Service Permit TE-825573-7; 16 January 2022 to 15 January 2023. Report to the U.S. Fish and Wildlife Service, Sacramento, California. 14 pp.

Jimenez, Kathryn. 2025. Wildlife Biologist, U.S. Fish and Wildlife Service, Wasco, California. Report transmitted to Katherine Bocskor, Senior Fish and Wildlife Biologist, US Fish and Wildlife Service, Sacramento, California. Titled: "San Joaquin Kit Fox: 5-Year Review Data Guide", dated December 11, 2024.

Knowlton, Will. 2024. California Flats Designated Biologist, Althouse and Meade, Inc., Paso Robles, California. Electronic mails to Joseph Brandt, Assistant Field Supervisor, US Fish and Wildlife Service, Ventura, California. Subject: "Cal Flats Kit Fox Den Notification for Incidental Take Permit No. 2081-2015-027-04", dated April 16, 2024 to October 30, 2024.

Swanson, Brandon. 2025. Wildlife Biologist, California Department of Fish and Wildlife, San Luis Obispo, California. Electronic mail to Dou-Shuan Yang, Senior Fish and Wildlife Biologist, US Fish and Wildlife Service, Sacramento, California. Subject: "Recent information on San Joaquin kit fox", dated January 22, 2025.