Appendix A
Target Species List Review and Update

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APPENDIX A

Target Species List Review and Update

Acronym	Definition
2022 Update	2022 Update of Central Valley Flood Protection Plan Conservation Strategy
CESA	California Endangered Species Act
Conservation Strategy (or Strategy)	2016 Central Valley Flood Protection Plan Conservation Strategy
CSC	California Species of Special Concern
CVFPP	Central Valley Flood Protection Plan
Delta	Sacramento–San Joaquin Delta
ESA	Endangered Species Act
SB	State Bill
SPFC	State Plan of Flood Control
State	State of California
Strategy (or Conservation Strategy)	2016 Central Valley Flood Protection Plan Conservation Strategy
USFWS	U.S. Fish and Wildlife Service

Introduction

The preparation of the 2016 Central Valley Flood Protection Plan (CVFPP) Conservation Strategy (Conservation Strategy or Strategy) entailed a comprehensive review of available information and data. The purpose of that review was to identify target species and develop focused conservation plans, which are presented in Appendix G of the 2016 Conservation Strategy. This review has taken place again for the 2022 Update of the Conservation Strategy (2022 Update) to ensure the list of target species includes those that could benefit most from the implementation of the CVFPP and its Conservation Strategy through focused conservation planning.

This appendix provides the rationale for updating the list of target species, discusses the selection processes for target species and focused conservation plans, and presents three additions to the target species list for the 2022 Update. Attachment A.1 provides an update to the references listed in the 2016 Conservation Strategy for the identified target species.

Rationale for Updating the Target Species List

The list of target species has been updated for the following reasons:

- To incorporate new information and data that have become available since the 2016 Strategy.
- To include changes to species' regulatory statuses.
- To reflect changes in the conservation needs of native species that support the species' inclusion on the target species list.

Focused conservation plans have also been developed for the species added to the list of target species.

Selection of Target Species and Focused Conservation Plans

The target species identified in the 2016 Conservation Strategy were selected based on their ability to meet all three of the following criteria:

1. **Sensitive or special-status.** The species is identified as sensitive or special-status in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife, National Marine Fisheries Service, or U.S. Fish and Wildlife Service (USFWS). Sensitive or special-status species include those listed as threatened or endangered under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA); species identified as candidates for listing; species identified as fully protected under the California Fish and Game Code or as California Species of Special Concern (CSC); and species with California Rare Plant Rank 1A, 1B, or 2.
2. **Associated with target habitats.** The species requires riverine aquatic (including shaded riverine aquatic cover), riparian, marsh, or periodically inundated floodplain or associated habitats as the primary habitat for one or more life stages or ecological needs (e.g., reproduction or foraging).
3. **Potential CVFPP effect.** Implementing the CVFPP, including flood projects and operations and maintenance, could affect the species' populations in California either temporarily or permanently, based on the species' distribution, habitat associations, and ecology (effects may be adverse or beneficial).

Additional target species identified during the 2022 Update meet these criteria based on current information and data. These species will benefit the most from the implementation of the CVFPP and its Conservation Strategy through the restoration of ecosystem processes and habitats and the reduction of flood system stressors.

Appendix G of the 2016 Conservation Strategy presented focused conservation plans prepared for target species that meet three additional criteria:

1. **Existing or potential status as threatened or endangered.** The species is State-of-California (State)-listed or federally listed as threatened or endangered, or has high potential to be listed during the next five to 10 years (e.g., plant species with a California Rare Plant Rank of 1B.1, Rare or Endangered in California and elsewhere, Seriously Endangered in California).

2. **Specialized or localized conservation requirements.** The species has conservation needs that are unlikely to be met without focused measures because of the species' restricted range, specialized habitat requirements, or landscape-level habitat requirements (e.g., proximity of nesting and breeding habitat, connectivity of multiple habitats). Among the species subject to these respective restrictions and requirements are riparian brush rabbit (*Sylvilagus bachmani ripariu*), bank swallow (*Riparia riparia*), Swainson's hawk (*Buteo swainsoni*), and giant gartersnake (*Thamnophis gigas*).

3. **Need for additional conservation planning to support the Conservation Strategy.** Other conservation plans (such as species recovery plans) do not address the relationship between the species' conservation needs and flood management activities in sufficient detail to support the implementation of the CVFPP and its Conservation Strategy.

Focused conservation plans have also been developed for new target species identified by this re-evaluation, and are provided in Appendix B.

Additions to the Target Species List

The 2016 Conservation Strategy provides for amendments to the list of target species during the five-year update process to reflect changing conservation needs and habitats. The target species list in the 2016 Conservation Strategy was thoroughly reviewed and updated during development of the 2022 Update. Adopted conservation plans, status reviews and critical habitat designations, regional conservation planning references, and scientific literature were evaluated.

The three proposed additions to the target species list for the 2022 Update consist of a fish and two birds. This appendix provides rationales for their inclusion. The master list of potentially suitable animal species (Table 2.1 in Appendix G of the 2016 Conservation Strategy) that were considered for the target species list was also revised to include new species, as shown in Table A-1 (at the end of this appendix). No changes were made to the master plant table (Table 2.2 in Appendix G of the 2016 Conservation Strategy). No changes were made to the master plant table (Table G-2 in Appendix G of the 2016 Conservation Strategy).

Delta Smelt

The delta smelt (*Hypomesus transpacificus*) was screened as a potential target species for the 2016 Conservation Strategy. At that time, the species was listed as endangered under CESA and threatened under ESA; however, it was not included as a target species in Appendix G of the 2016 Strategy. In the period between the completion of the 2016 Conservation Strategy and this five-year update, the delta smelt was petitioned for uplisting from threatened to endangered under ESA. USFWS issued a "warranted-but-precluded" determination for uplisting the delta smelt in 2016 (U.S. Fish and Wildlife Service 2017). The delta smelt was one of the species specifically mentioned in the 2016 Conservation Strategy for potential future inclusion as a target species.

Introduction to the Species

Delta smelt are endemic to the San Francisco Bay-Delta estuary. The Bay-Delta consists of San Francisco Bay and the Sacramento–San Joaquin Delta (Delta), defined as the legal delta encompassing all waters east of Chipps Island. The range of the delta smelt extends from Berkeley in San Francisco Bay to the City of Napa on the Napa River, throughout Suisun Bay and the Delta, in the Sacramento River to Knights Landing, and in the San Joaquin River to the City of Lathrop (U.S. Fish and Wildlife Service 2017).

Historically, delta smelt were widely distributed throughout the Delta, Suisun Bay, Suisun Marsh, and western San Pablo Bay (Moyle et al. 2016). The abundance of delta smelt has declined dramatically, particularly since the pelagic organism decline in the early 2000s. In 2010, population estimates for delta smelt dropped to a low of 13,000 individuals (Moyle et al. 2016; U.S. Fish and Wildlife Service 2017).

With the decline in delta smelt abundance, along with changes in habitat conditions (e.g., drought, climate change, hydrology, turbidity, harmful algal blooms), the species' distribution became more restricted. Most delta smelt were confined to an arc of tidal habitat connected by Sacramento River flows from the Cache and Lindsay Slough Complex in the North Delta to Montezuma Slough in Suisun Marsh (Moyle et al. 2016).

Rationale

The following rationale addresses each target species criterion to further consider the delta smelt as a target species.

1. **Sensitive or special-status.** USFWS considered uplisting the delta smelt from threatened to endangered status under ESA (U.S. Fish and Wildlife Service 2017). USFWS determined the uplisting of delta smelt to endangered was warranted and assigned a listing priority number of 2 based on the high magnitude and immediacy of threats, but other higher-priority actions precluded the species' reclassification (U.S. Fish and Wildlife Service 2017). Because this species was considered warranted for federal uplisting to endangered between the 2016 Conservation Strategy and this five-year update, its re-examination as a target species is merited.

2. **Associated with target habitats.** Recent findings have indicated delta smelt may be food-limited, particularly in the spring and summer (Hamilton and Murphy 2018). Smelt collected in areas of greater tidal wetland influence have much greater stomach fullness than those collected in areas of little or no tidal wetland influence, suggesting food resources for delta smelt are more available when near tidal wetlands (Hammock et al. 2019). During the drought from 2012 through 2016, delta smelt were more abundant in the Yolo Bypass than in the previous 14 years, but were present in record low numbers in locations of the estuary where delta smelt were historically found. Delta smelt collected in the Yolo Bypass during the drought were compared to smelt captured elsewhere in the estuary; the findings indicated that smelt in the Yolo Bypass spawned earlier and offspring experienced both higher quality feeding conditions and faster growth rates (Mahardja et al. 2019). The aforementioned studies suggest delta smelt require a mosaic of habitat types that include inundated floodplains and wetlands, particularly because the species is experiencing serious decline. Thus, recent findings indicate a clear connection between the delta smelt and riverine aquatic habitats.

3. **Potential CVFPP effect.** The ecosystem processes targeted by the Conservation Strategy are riverine geomorphic processes and floodplain inundation, which are the natural, dynamic hydrologic and geomorphic processes that sustain target habitats and species. Based on the indications that the delta smelt evolved under these natural riverine processes in the Central Valley, this threatened species appears to be a suitable candidate for inclusion as a target species that would substantially benefit from the implementation of the CVFPP and its Conservation Strategy.

Summary

The rationale for including delta smelt as a target species is based on the following conditions:

- The recent precipitous decline of this species endemic to the San Francisco Bay-Delta estuary, which led to the "warranted-but-precluded" uplisting of the species from threatened to endangered under ESA after the completion of the 2016 Conservation Strategy.

- The demonstrated dependence of delta smelt on habitats with Central Valley riverine and bypass systems.

- The dependence of this species' recovery on existing and additional habitat in the State Plan of Flood Control's (SPFC's) river corridors, sloughs, and the Yolo Bypass.

Tricolored Blackbird

The tricolored blackbird (*Agelaius tricolor*) was screened as a potential target species for the 2016 Conservation Strategy. At that time, the species was a CSC, and it was not included as a target species in Appendix G of the 2016 Strategy. However, between the completion of the 2016 Conservation Strategy and this five-year update, the species was elevated from a CSC to being listed as threatened under CESA. The species was petitioned for listing as endangered

under ESA in 2006 and again in 2015. The federal finding on the petition was published in 2019, and found that listing was not warranted, partly due to the listing under CESA, which is reducing the severity of some existing threats (50 Code of Federal Regulations Part 17). The tricolored blackbird was one of the species specifically mentioned in the 2016 Conservation Strategy for potential future inclusion as a target species.

Introduction to the Species

Except for small nesting colonies found locally in Oregon, Washington, Nevada, and coastal Baja California, the tricolored blackbird occurs primarily in California, with more than 90 percent of the species' population present in California's Central Valley in most years (Hamilton 2000). Historically, populations of this colonial blackbird were present along the California coast and inland in Central and Southern California; however, the agricultural and urban development of these areas has eliminated all but a few of these populations.

Historically, breeding tricolored blackbirds inhabited primarily freshwater tule (*Schoenoplectus acutus*) and cattail (*Typha* spp.) marshes, with small numbers of breeding colonies occurring in willows (*Salix* spp.), California blackberries (*Rubus ursinus*), and other dense forbs (Neff 1937). In the first half of the 20th century, much of this freshwater marsh habitat was drained and converted to urban and agricultural land uses.

Vast flocks of these birds were once present in California; however, habitat loss, poisonings and shootings of blackbirds to protect crops, pesticide use, and large, persistent, and ongoing annual losses of nests and nesting habitat through agricultural practices have contributed to rapid declines of the species in California (Center for Biological Diversity 2015). In 2014, the tricolored blackbird population was the smallest ever recorded, consisting of only 145,000 birds. By comparison, in 1934, Neff (1937) observed as many as 736,500 tricolored blackbirds from just eight Central Valley counties, and 19th century accounts described flocks of thousands "numbering so many thousands as to darken the sky for some distance by their masses" (Heermann [1859], as conveyed by Beedy 2008).

Rationale

The following rationale addresses each target species criterion to further consider the tricolored blackbird as a target species.

1. **Sensitive or special-status.** The tricolored blackbird species was assigned a temporary (six -month) emergency endangered status under CESA in December 2015. The species was identified as a CSC in Appendix G of the 2016 Conservation Strategy, and it was listed as threatened under CESA on March 18, 2019. Therefore, the tricolored blackbird qualifies as a defined special-status species for a target species. Because this species was elevated from a CSC to being State-listed as threatened between the 2016 Conservation Strategy and this five-year update, the re-examination of its status as a target species is warranted.

2. **Associated with target habitats.** The species' basic breeding habitat requirements are access to water and suitable nesting substrate (e.g., marsh vegetation or thornyvegetation) with access to sufficient foraging habitat within a few kilometers of the colony (Beedy and Hamilton 1999). The tricolored blackbird forms the largest breeding colonies of any North American landbird, and in the Central Valley, as many as 20,000 to 30,000 nests have been recorded in cattail marshes of four hectares or less (Beedy 2008). The species also breeds in scrubby riparian and willow riparian habitats, as well as some upland habitats. Regarding ecological dependency on riparian habitat, Beedy (2008) notes:

   "The colonial breeding system of the tricolored blackbird probably evolved in the Central Valley, where the locations of surface waters and rich sources of insect food were ephemeral and varied annually (Orians 1961). Before its rivers were dammed and channelized, the Central Valley flooded in many years, forming a vast mosaic of seasonal wetlands, freshwater marshes, alkali flats, native grasslands, riparian forests, and oak savannas. Virtually all of these habitats once supported nesting or foraging tricolored blackbirds.

   Thus, the ecological dependence of this species is probably based in its geographic isolation and evolutionary adaptation to Central Valley riverine systems in their natural state. The Central Valley supports all of the state's largest colonies (greater than 20,000 individuals) except the Toledo Pits in Riverside County (Beedy 2008). Thus, there is a clear connection between this species and dependence on the riverine-associated habitats listed in the above criterion."

3. **Potential CVFPP effect.** The floodplain inundation and marsh habitats targeted by the Conservation Strategy represent the natural hydrologic process and vegetation that provide habitat for tricolored blackbirds. The restoration of, and increase in, nesting and foraging habitats for tricolored blackbirds (including marsh), as well as increased successional and scrub riparian vegetation in the flood system, would contribute to the recovery of the tricolored blackbird population. The primary conservation priorities for this species are to maintain and enhance existing habitat and to create and restore additional breeding habitats to support nesting and foraging (Tricolored Blackbird Working Group 2007).

Summary

The rationale for including the tricolored blackbird as a target species is based on the following conditions:

- The recent precipitous decline of this near-California-endemic species—of which the Central Valley holds the vast majority of the largest colonies—that led the species' status to be elevated from CSC to listed as threatened under CESA after the completion of the 2016 Conservation Strategy.
- The demonstrated dependence of the tricolored blackbird on habitats associated with Central Valley riverine systems.
- The importance to this species' recovery of existing and additional nesting habitat in the river corridors and bypasses of the SPFC.

Yellow-breasted Chat

The yellow-breasted chat (*Icteria virens*) was screened as a potential target species for the 2016 Conservation Strategy. The species was, and remains, a CSC, but it was not included as a target species in Appendix G of the 2016 Strategy.

Introduction to the Species

The yellow-breasted chat, a CSC, breeds in dense, shrubby, and some open habitats in North America, although the western population breeds primarily in riparian woodlands. The yellow-breasted chat winters from northern Mexico to Central America (Billerman 2020). In California, where this species occurs as a migrant and summer resident, it breeds primarily in early successional riparian habitats with a well-developed shrub layer and open canopy along the narrow borders of streams, creeks, sloughs, and rivers (Comrack 2008). This species skulks in dense vegetation and is often detected by its distinctive vocalizations.

The yellow-breasted chat has an interesting taxonomic history. The species was long considered an aberrant member of the New World warbler family, the Parulidae; however, the yellow-breasted chat has recently been recognized as a quite distinct taxon and placed in a monotypic family, *Icteriidae* (Billerman 2020).

Although still widely distributed in California, the yellow-breasted chat is now rare or absent from much of the Central Valley, as its breeding range has been reduced by approximately 35 percent (Comrack 2008). The destruction of riparian habitat has been implicated in the early decline of this species in the state (Remsen 1978).

Most yellow-breasted chat individuals in the Central Valley currently breed in the northern Sacramento Valley. The species is still considered as breeding in a few locations in the San Joaquin Valley (Comrack 2008; Dybala et al. 2017). Dybala et al. (2017) identified the population in the Sacramento Valley as small (fewer than 10,000 individuals), and the population in the Yolo-Delta region and the San Joaquin Valley as very small (fewer than 1,000 individuals). Small populations may be below a minimum viable population level and vulnerable to extirpation, and very small populations are expected to be well-below a minimum viable population level (Dybala et al. 2017). These population levels indicate likely extirpation in the Yolo-Delta and San Joaquin Valley regions, and possible extirpation in the Sacramento Valley, in the absence of additional riparian habitat.

Dybala et al. (2017) selected the yellow-breasted chat as one of seven focal species for population and habitat objectives for avian conservation in the Central Valley. This selection was based on the following species characteristics:

- The species' use of riparian vegetation as principal breeding habitat.
- Species status, as it warrants special management status or has experienced population declines or reductions in its breeding range in the Central Valley.
- The usefulness of the species for monitoring the effects of management actions in Central Valley riparian ecosystems.

Dybala et al. (2017) demonstrated the importance of increasing riparian habitat in the Central Valley to maintain a viable population of chats in the valley. The inclusion of the yellow-breasted chat as a target species in the 2022 Conservation Strategy aligns the Strategy's goals and objectives with those of the Central Valley Joint Venture regarding the conservation of riparian habitat for avian species.

Rationale

The following rationale addresses each target species criterion to further consider the yellow-breasted chat as a target species.

1. **Sensitive or special-status.** As a CSC, the yellow-breasted chat meets this criterion.
2. **Associated with target habitats.** The yellow-breasted chat is essentially an obligate riparian species in California. Because this species breeds primarily in early successional riparian habitats, it depends on events that lead to riparian succession, such as periodic flooding that leads to the regeneration of riparian vegetation, a goal of the Conservation Strategy.
3. **Potential CVFPP effect.** Loss of riparian habitat (caused by factors such as flood control infrastructure and management) has significantly reduced the yellow-breasted chat population in California, and particularly in the Central Valley. The dependence of the yellow-breasted chat on understory and shrubby riparian vegetation for nesting makes it vulnerable to habitat loss from vegetation removal along river channels during flood control maintenance. This species could benefit substantially from the implementation of the CVFPP and its Conservation Strategy, because it is very closely associated with riverine riparian habitat of the Sacramento and San Joaquin valleys and would benefit substantially from the addition of riparian habitat to the system (as modeled by Dybala et al. 2017). In particular, the species could benefit from the increase in successional riparian habitat associated with natural riverine processes that would be restored to the flood system.

Summary

The rationale for including the yellow-breasted chat as a target species is based on the following conditions:

- The species' status as a CSC.
- The status of the yellow-breasted chat as essentially a riparian-obligate species associated with early successional riparian habitat, which makes it a prime target species that would benefit from the implementation of the CVFPP and its Conservation Strategy. In addition, this species would be an appropriate indicator that the restoration of more natural, dynamic riverine systems has been implemented successfully, a goal of the Strategy.
- The occurrence and continuation of flood management activities that result in substantial adverse effects on this species. However, the Central Valley's yellow-breasted chat population would benefit from the implementation of the CVFPP and its Conservation Strategy, which is anticipated to result in a significant net positive outcome for the species and contribute to the recovery of this population.

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Table A-1. Screening of Animal Species Potentially Affected by the CVFPP (including the Conservation Strategy) for Target Species and Focused Conservation Planning

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Invertebrates	Conservancy fairy shrimp *Branchinecta conservatio*	USR, LSR, LSJR, USJR	Vernal pools, swales, and other ephemeral wetlands	E/None	No	No	No	Yes	Yes	No
	Lange's metalmark butterfly *Apodemia mormo langei*	LSR	Sand dunes	E/None	No	No	No	Yes	Yes	No
	Longhorn fairy shrimp *Branchinecta longiantenna*	USJR	Vernal pools, swales, and other ephemeral wetlands	E/None	No	No	No	Yes	No	No
	Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	USR, LSR, FR, LSJR, USJR	Elderberries in riparian woodlands or savannas	T/None	Yes	Yes	Yes	Yes	Yes	Yes
	Vernal pool fairy shrimp *Branchinecta lynchi*	USR, LSR, FR, LSJR, USJR	Vernal pools, swales, and other ephemeral wetlands	T/None	No	No	No	Yes	No	No
	Vernal pool tadpole shrimp *Lepidurus packardi*	USR, LSR, LSJR, USJR	Vernal pools, swales, and other ephemeral wetlands	E/None	No	No	No	Yes	No	No
	Crotch's bumblebee *Bombus crotchii*	USR, LSR, FR, LSJR, USJR	Grasslands and open oak woodlands; may occasionally forage in riparian areas with floral resources, but because species is ground-nesting, typically would nest outside flood zones; foraging habitat best characterized by upland grasslands in untilled areas with diverse or abundant floral resources	None/C	No	No	No	Yes	No	No
	Monarch butterfly *Danaus plexippus*	USR, LSR, FR, LSJR, USJR	Nearly any habitat with nectar flowers, milkweed plants, roosting sites, and access to water; riparian habitat with grassland openings is especially important in the Central Valley	C/None	Yes	Yes	Yes	Yes	Yes	No
Fish	California Central Valley steelhead DPS *Oncorhynchus mykiss*	USR, FR, LSJR, LSJR, USJR	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta	T/None	Yes	Yes	Yes	Yes	Yes	Yes
	Central California coast steelhead DPS *Oncorhynchus mykiss*	LSR	Spawns in freshwater streams; adults live and forage in oceanic waters	T/T	Yes	No	No	Yes	Yes	No
	Chinook salmon—Central Valley fall-/late fall-run ESU *Oncorhynchus tshawytscha*	USR, LSR, FR, LSJR, USJR	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally in inundated floodplains, rivers, tributaries, and the Delta	None/CSC	Yes	Yes	Yes	Yes	Yes	Yes

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Fish	Chinook salmon—Central Valley spring-run ESU *Oncorhynchus tshawytscha*	USR, LSR, FR, LSJR	Spawns in freshwater streams and rivers; smolts mature in freshwater streams and later estuarine areas; adults live and forage in oceanic waters and hold in cool, freshwater streams and rivers before spawning	T/T	Yes	Yes	Yes	Yes	Yes	Yes
	Chinook salmon—Sacramento River winter-run ESU *Oncorhynchus tshawytscha*	LSR, USR	Spawns in freshwater streams and rivers; smolts mature in freshwater streams and later estuarine areas; adults live and forage in oceanic waters and hold in cool, freshwater streams and rivers before spawning	E/E	Yes	Yes	Yes	Yes	Yes	Yes
	Delta smelt *Hypomesus transpacificus*	LSR, LSJR	Spawns in shallow, fresh, or slightly brackish water upstream of the mixing zone (saltwater-freshwater interface); adults live along the freshwater edge of the mixing zone when not spawning; before spawning, adults disperse widely into river channels and tidally influenced backwater sloughs	T/E	Yes	Yes	Yes	Yes	Yes	Yes
	North American green sturgeon—Southern DPS *Acipenser medirostris*	USR, FR, LSR, LSJR	Spawns in deep pools in large, turbulent, freshwater mainstem rivers; adults live and forage in oceanic waters, bays, and estuaries when not spawning	T/CSC	Yes	Yes	Yes	Yes	Yes	Yes
	White Sturgeon *Acipenser transmontanus*	USR, LSR, FR, LSJR, USJR	Spawns on deep gravel or rock substrate in moderate to fast currents in mainstem rivers; adults and subadults most abundant in brackish portions of the San Francisco Bay-Delta; adult long-distance marine migrations into estuary and river habitats in WA, OR, and northern CA sometimes occurs.	None/CSC	Yes	Yes	Yes	No	Yes	No
	Hardhead *Mylopharodon conocephalus*	USR, LSR FR, LSJR, USJR	Spawns in pools and side pools of rivers and creeks; juveniles rear in pools of rivers and creeks, and shallow to deeper water of lakes and reservoirs	None/CSC	Yes	No	No	Yes	No	No
	Longfin smelt *Spirinchus thaleichthys*	LSR, LSJR	Typically spawns in freshwater and moves downstream to brackish water to rear, but tolerant of highly saline water and known to spawn in the southern San Francisco Bay	None/T	Yes	No	Yes	Yes	No	No
	Sacramento splittail *Pogonichthys macrolepidotus*	FR, USR, LSR, LSJR	Generally lives in areas of low to moderate current; uses floodplain habitat for feeding and spawning	None/ None	Yes	Yes	Yes	No	No	No
	Central California roach *Lavinia symmetricus*	USR, LSR, FR, LSJR, USJR	Spawns in pools and side pools of small rivers and creeks; juveniles rear in pools of small rivers and creeks	None/CSC	Yes	No	No	Yes	No	No
Amphibians	California red-legged frog *Rana draytonii*	LSJR	Permanent or ephemeral water sources, including lakes, ponds, reservoirs, slow streams, marshes, bogs, and swamps from sea level to 5,000 feet in woodlands, grasslands, and riparian areas	T/CSC	Yes	No	No	Yes	No	No

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Amphibians	California tiger salamander *Ambystoma californiense*	LSR, FR, LSJR, USJR	Restricted to vernal pools and seasonal ponds, including many constructed stock ponds, in grassland and oak savanna plant communities, predominantly from sea level to 2,000 feet in elevation	T/T	No	No	No	Yes	Yes	No
	Foothill yellow-legged frog *Rana boylii*	USR	Streams and rivers with rocky substrate and open, sunny banks, in forests, chaparral, and woodlands from sea level to 6,700 feet; sometimes found in isolated pools, vegetated backwaters, and deep, shaded, spring-fed pools	None/T	Yes	No	No	Yes	No	No
	Northern leopard frog *Lithobates pipiens*	USJR	Grasslands, wet meadows, potholes, forests, woodland, brushlands, springs, canals, bogs, marshes, and reservoirs from sea level to 11,000 feet; generally prefers permanent water with abundant aquatic vegetation	None/CSC	Yes	No	No	Yes	No	No
	Shasta salamander *Hydromantes shastae*	USR	Mixed conifer, woodland, and chaparral habitats, especially near limestone	None/T	No	No	No	Yes	No	No
	Western spadefoot *Spea hammondii*	USR, LSR, FR, LSJR, USJR	Grasslands, scrub, chaparral, and occasionally oak woodlands near aquatic habitat such as vernal pools, wetlands, and low-gradient streams	None/CSC	No	No	No	Yes	No	No
Reptiles	Alameda whipsnake *Masticophis lateralis euryxanthus*	LSJR	Chaparral (northern coastal sage scrub and coastal sage), up to 500 feet into adjacent habitats, including grassland, oak savanna, and occasionally oak-bay woodland	T/T	No	No	No	Yes	No	No
	Blunt-nosed leopard lizard *Gambelia sila*	USJR	Semi-arid grasslands, alkali flats, and washes of the San Joaquin Valley and foothills	E/E, FP	No	No	No	Yes	No	No
	Coast horned lizard *Phrynosoma blainvillii*	LSR, FR, LSJR, USJR	Grasslands, brushlands, woodlands, and open coniferous forests	None/CSC	No	No	No	Yes	No	No
	Giant gartersnake *Thamnophis gigas*	USR, LSR, FR, LSJR, USJR	Marshes, sloughs, drainage canals, and irrigation ditches, especially around rice fields, and occasionally in slow-moving creeks from sea level to 400 feet; prefers locations with vegetation close to the water for basking	T/T	Yes	Yes	Yes	Yes	Yes	Yes
	San Joaquin coachwhip *Masticophis flagellum ruddocki*	USR, LSR, LSJR, USJR	Open, dry vegetation in valley grasslands and saltbush scrub	None/CSC	No	No	No	Yes	No	No
	Silvery legless lizard *Anniella pulchra*	LSJR, USJR	Moist, warm, loose soil with plant cover in sparsely vegetated areas of beach dunes, chaparral, woodlands, desert scrub, sandy washes, and stream terraces	None/CSC	Yes	No	No	Yes	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Reptiles	Western pond turtle *Actinemys marmorata*	USR, LSR, FR, LSJR, USJR	Ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches with abundant vegetation and either rocky or muddy bottoms, in woodland, forest, and grassland	None/CSC	Yes	Yes	Yes	Yes	No	No
Birds	American peregrine falcon *Falco peregrinus anatum*	USR, LSR, FR, LSJR, USJR	*Foraging:* A variety of open habitats, particularly marshes and other wetlands *Nesting:* High rocky cliffs or other high structures	D/D, FP	Yes	No	No	No	No	No
	Bald eagle *Haliaeetus leucocephalus*	FR	*Foraging:* Large bodies of water or free-flowing rivers with abundant fish and adjacent snags or other perches *Nesting:* Large, old-growth trees or snags in remote, mixed stands near water	D/E, FP, EPA	Yes	No	No	Yes	No	No
	Bank swallow *Riparia*	USR, LSR, FR	*Foraging:* Open riparian areas, grassland, wetlands, water, and cropland *Nesting:* Vertical banks and cliffs with fine-textured or sandy friable soils near streams, rivers, ponds, and lakes	None/T	Yes	Yes	Yes	Yes	Yes	Yes
	Black swift *Cypseloides niger*	FR, LSR, LSJR	*Foraging*: Over a wide variety of habitats, sometimes far from nests *Nesting:* Canyon walls near water and sheltered by overhanging rock or moss, preferably near waterfalls	None/ CSC	Yes	No	No	Yes	No	No
	Black tern *Chlidonias niger*	LSR, LSJR, USJR	*Foraging and nesting:* Freshwater emergent wetlands, marshes, lakes, ponds, moist grasslands, and agricultural fields	None/ CSC	Yes	No	No	Yes	No	No
	California black rail *Laterallus jamaicensis coturniculus*	LSR, LSJR	*Foraging and nesting:* Tidal emergent wetlands dominated by pickleweed, in the high wetland zones near the upper limit of tidal flooding, or in brackish marshes supporting bulrushes and pickleweed; in freshwater, usually found in bulrushes, cattails, and saltgrass adjacent to tidal sloughs	None/T, FP	Yes	Yes	Yes	Yes	Yes	Yes
	Ferruginous hawk (wintering) *Buteo regalis*	USR, LSR, FR, LSJR, USJR	*Foraging:* Open grasslands and agricultural fields *Nesting:* Does not breed in the SPA	None/ CSC	No	No	No	Yes	No	No
	Golden eagle *Aquila chrysaetos*	USR, LSR, FR, LSJR, USJR	*Foraging*: open shrublands, grasslands, and oak woodlands *Nesting*: forests, open valleys, oak savannah with large trees, cliffs	None/FP	No	No	No	No	No	No
	Grasshopper sparrow *Ammodramus savannarum*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Short to middle-height, moderately open grasslands with scattered shrubs	None/ CSC	No	No	No	Yes	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Birds	Greater sandhill crane *Grus canadensis tabida*	USR, LSR, FR, LSJR, USJR	*Foraging:* Open grasslands, grain fields, and open wetlands for roosting *Roosting:* In flocks standing in moist fields or in shallow water *Nesting:* Does not breed in the SPA	None/T, FP, EPA	Yes	Yes	No	Yes	Yes	Yes
	Least Bell's vireo *Vireo bellii pusillus*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Low, dense riparian growth along water or along dry parts of intermittent streams	E/E	Yes	No	Yes	Yes	Yes	Yes
	Least bittern *Ixobrychus exilis*	LSJR, LSR, USJR, USR	*Foraging and nesting:* Freshwater and brackish marshes with tall, dense emergent vegetation and clumps of woody plants over deep water	None/ CSC	Yes	Yes	Yes	Yes	No	No
	Lesser sandhill crane *Grus canadensis*	LSJR, LSR, FR, USJR, USR	*Foraging:* Pastures, moist grasslands, alfalfa and grain fields, and shallow wetlands for roosting *Nesting:* Does not breed in California	None/ CSC	Yes	Yes	Yes	Yes	Yes	No
	Little willow flycatcher *Empidonax traillii brewsteri*	FR, USR	*Foraging:* Willow thickets and adjacent meadows *Nesting:* Extensive thickets of low, dense willows at edge of wet meadows, ponds, or backwaters	None/E	Yes	Yes	Yes	Yes	No	No
	Loggerhead shrike *Lanius ludovidianus*	USR, LSR, FR, LSJR, USJR	*Foraging:* Grasslands and agricultural fields *Nesting:* Scattered shrubs and trees	None/ CSC	No	No	No	Yes	No	No
	Mountain plover *Charadrius montanus*	USR, LSR, USJR	*Foraging*: Fallow, grazed, or burned fields with short and sparse vegetation cover *Nesting:* Does not breed in California	None/ CSC	No	No	No	Yes	No	No
	Northern harrier *Circus cyaneus*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Tall grasses and forbs in emergent wetland, along rivers or lakes, grasslands, grain fields, or on sagebrush flats several miles from water	None/ CSC	Yes	No	No	Yes	No	No
	Purple martin *Progne subis*	LSJR, LSR	*Foraging:* Conifer, woodland, and riparian habitats *Nesting:* Snags in old-growth, multilayered, open forests and woodlands	None/ CSC	Yes	No	No	Yes	No	No
	Redhead *Aythya americana*	LSR, LSJR, USJR	*Nesting:* Freshwater emergent wetlands where dense stands of cattails and tules are interspersed with areas of deep, open water *Foraging:* Large, deep bodies of water	None/ CSC	Yes	Yes	Yes	Yes	No	No
	Short-eared owl *Asio flammeus*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Open prairies, coastal grasslands, marshes, bogs, savanna, and dunes	None/ CSC	Yes	No	No	Yes	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Birds	Suisun song sparrow *Melospiza melodia maxillaries*	LSJR, LSR	*Foraging:* Bare surface of tidally exposed mud among tules and along slough margins in brackish marshes *Nesting:* Along edges of tidal sloughs and bays supporting mixed stands of bulrush, cattail, and other emergent vegetation	None/ CSC	Yes	No	No	Yes	Yes	No
	Swainson's hawk *Buteo swainsoni*	USR, LSR, FR, LSJR, USJR	*Foraging:* Open desert, grassland, or cropland containing scattered large trees or small groves *Nesting:* Open riparian habitat, in scattered trees or small groves in sparsely vegetated flatlands and agricultural areas; often found near water in the Central Valley	None/T	Yes	Yes	Yes	Yes	Yes	Yes
	Tricolored blackbird *Agelaius tricolor*	USR, LSR, FR, LSJR, USJR	*Foraging:* On ground in croplands, grassy fields, flooded land, and along edges of ponds *Nesting:* Dense	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Western burrowing owl *Athene cunicularia hypugaea*	USR, LSR, LSJR, USJR	*Foraging and nesting*: Grasslands and agricultural fields	None/ CSC	No	No	No	Yes	No	No
	Western snowy plover *Charadrius alexandrinus nivosus*	LSR, USJR	*Foraging and nesting:* Above high-tide line on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, beaches at creek and river mouths, and salt pans at lagoons and estuaries	T/CSC	Yes	No	No	Yes	No	No
	Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Extensive deciduous riparian thickets or forests with dense, low-level, or understory foliage adjacent to slow-moving watercourses, backwaters, or seeps; willow is almost always a dominant component of the vegetation. In the Sacramento Valley, also rarely uses adjacent walnut orchards; prefers sites with a dominant cottonwood overstory for foraging. Occurs primarily in riparian habitat in migration in California, although can occur in a wider variety of habitats (e.g., gallery and secondary forests) in migration and winter in the neotropics	T/E	Yes	Yes	Yes	Yes	Yes	Yes
	White-tailed kite *Elanus leucurus*	USR	*Foraging:* Undisturbed, open grasslands, meadows, farmlands, and emergent wetlands *Nesting:* Large groves of dense, broad-leafed deciduous trees close to foraging areas	None/FP	Yes	No	No	No	No	No
	Yellow-breasted chat *Icteria virens*	USR, LSR, FR, LSJR, USJR	*Foraging and nesting:* Early successional thickets of willow and other brushy habitat near rivers, streams, or other watercourses	None/ CSC	Yes	Yes	Yes	Yes	Yes	Yes

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Birds	Yellow-headed blackbird *Xanthocephalus*	LSR, LSJR, USJR	*Foraging:* Freshwater emergent wetland and sometimes along shorelines and in nearby open fields, preferably on moist ground *Nesting:* Dense emergent wetland of cattails and tules, often along borders of lakes or ponds	None/ CSC	Yes	Yes	Yes	Yes	No	No
	Yellow warbler *Dendroica petechia*	USJR, USR, LSR,[i] FR, LSJR, USJR[i]	*Foraging and nesting*: Low- to mid-story, open-canopy riparian deciduous woodlands with a heavy brush understory; sometimes in montane shrubbery in open conifer forests	None/ CSC	Yes	Yes	Yes	Yes	No	No
Mammals	American badger *Taxidea taxus*	USR, LSR, FR, LSJR, USJR	Drier open states of most scrub, forest, and herbaceous habitats with friable soils	None/ CSC	No	No	No	Yes	No	No
	Fresno kangaroo rat *Dipodomys nitratoides exilis*	USJR	Alkali desert scrub habitats between 200 and 300 feet elevation	E/E	No	No	No	Yes	No	No
	Giant kangaroo rat *Dipodomys ingens*	USJR	Annual grasslands and shrub habitats with sparse vegetative cover	E/E	No	No	No	Yes	No	No
	Hoary bat *Lasiurus cinereus*	USR, LSR, FR, LSJR, USJR	*Foraging:* Over open forested and riparian areas *Roosting:* In the foliage of trees, prefers woodlands and coniferous forests; noncolonial	None/ None	Yes	No	No	No	No	No
	Nelson's antelope squirrel *Ammospermophilus nelsoni*	USR	Arid grasslands with loamy soils and moderate shrub cover	None/T	No	No	No	Yes	No	No
	Pallid bat *Antrozous pallidus*	USR, LSR	*Foraging:* On bare ground and in short grasses in a variety of habitats including chaparral, oak woodland, grassland, ruderal, and agricultural habitats *Roosting:* In crevices of rocky outcrops, hollow trees, cliffs, bridges, barns, and other anthropogenic structures	None/ None	Yes	No	No	No	No	No
	Ringtail *Bassariscus astutus*	FR, USR, LSR	Prefers riparian habitats in many situations, rocky talus slopes, and brushy habitats in most forests	None/FP	Yes	No	No	No	No	No
	Riparian brush rabbit *Sylvilagus bachmani riparius*	LSJR	Riparian woodlands dominated by oaks with a dense understory of wild roses, grapes, and blackberries	E/E	Yes	Yes	Yes	Yes	Yes	Yes
	Riparian (= San Joaquin Valley) woodrat *Neotoma fuscipes riparia*	LSJR	Riparian habitats with associated evergreen and deciduous oak with dense understories; willow thickets	E/CSC	Yes	Yes	Yes	Yes	Yes	Yes
	Sacramento Valley red fox *Vulpes patwin*	FR, USR	Grasslands	None/ None	No	No	No	No	No	No

Species	Common Name and Scientific Name	Regional Distribution in SPA [a]	Habitats	Status FED/CA [b]	Associated with Target Habitat [c]	Major Potential CVFPP Effect [d]	Potential Target Species [e]	T/E Listed or Potential for T/E Listing [f]	Focused Conservation Needs [g]	Target Species Chosen for Focused Conservation Planning [h]
Mammals	San Joaquin kit fox *Vulpes macrotis mutica*	USJR, LSJR	Saltbush scrub, grasslands, oak savannas, and freshwater scrub	E/T	No	No	No	Yes	No	No
	Salt-marsh harvest mouse *Reithrodontomys raviventris*	LSR, LSJR	Salt marsh dominated by pickleweed and saltgrass; requires non-submerged, salt-tolerant vegetation for escape during high tides	E/E, FP	Yes	No	No	Yes	No	No
	Spotted bat *Euderma maculatum*	USR, USJR	*Foraging:* Over water and along washes in deserts, grasslands, and mixed conifer forests from below sea level to above 10,000 feet *Roosting:* In rock crevices in cliffs	None/CSC	Yes	No	No	Yes	No	No
	Townsend's big-eared bat *Plecotus townsendii*	USR, LSR, FR, LSJR, USJR	*Foraging:* Along edges of a variety of habitats *Roosting:* In caves, tunnels, mines, cavernous trees, and buildings	None/C	Yes	No	No	Yes	No	No
	Western mastiff bat *Eumops perotis californicus*	USR, USJR	*Foraging:* Open aerial forager over many habitats and landscapes *Roosting:* In crevices of exposed vertical cliffs of any rock type, and rarely in bridges or tall buildings	None/CSC	Yes	No	No	Yes	No	No
	Yuma myotis *Myotis yumanensis oxalis*	LSR, LSJR	*Foraging:* On flat fresh and brackish waters, mostly in open areas *Roosting:* In tree cavities and in bridges, barns, and other anthropogenic structures	None/ Under State review	Yes	Yes	No	Yes	No	No
	Western red bat *Lasiurus blossevillii*	USR, LSR, FR, LSJR, USJR	*Foraging:* Includes oak woodlands, coniferous forest (at low elevations), along riparian corridors, among non-native trees in urban and rural residential areas, and within mature orchards *Roosting:* Maternity roosts in foliage of mostly old-growth riparian trees; distribution limited mostly to the edges of the mainstems of river systems and Delta waterways; winter roosts are often under leaf litter	None/ CSC	Yes	Yes	Yes	Yes	No	No

Sources: California Interagency Wildlife Task Group 2008; Shuford and Gardali 2008; California Department of Fish and Wildlife 2019.

[a] Regional Distribution in SPA:

FR = CVFPP Feather River Implementation Region
LSJR = Mid–San Joaquin River, Lower San Joaquin River, and Delta South CVFPP Implementation Regions
LSR = Lower Sacramento River and Delta-North CVFPP Implementation Regions
USJR = Upper San Joaquin River CVFPP Implementation Region
USR = Upper Sacramento River and Mid-Sacramento River CVFPP Implementation Regions
Distribution in upstream SPA aquatic and floodplain habitats is included in immediately downstream CVFPP Implementation Region.

[b] Status FED/CA:

Federal:
None = No listing
C = Candidate for listing under the federal ESA
E = listed as endangered under ESA
T = Listed as threatened under ESA
D = Delisted under ESA
California:
None = No listing
C = Candidate for listing under the CESA
E = Listed as endangered under CESA
T = Listed as threatened under CESA
FP = Fully protected under the California Fish and Game Code
CSC = California Species of Special Concern
D = Delisted under CESA

[c] Associated with Target Habitat:

Yes = Species is associated with riverine aquatic (including shaded riverine aquatic), riparian, perennial wetland, or periodically inundated floodplain habitats.
No = Species is not associated with any of these target habitats.

[d] Major Potential CVFPP Effect:

Yes = Implementation of the CVFPP (flood management and conservation actions) could substantially affect California populations of this species, based on distribution, habitat associations, and ecology of species. Effects may be adverse or beneficial.
No = Implementation of the CVFPP would not substantially affect California populations of this species.

[e] Target Species:

Yes = Species both associated with a target habitat and could be substantially affected by CVFPP implementation.
No = Species either not associated with a target habitat or not substantially affected by CVFPP implementation. Target species are species with greatest potential to benefit from or be adversely affected by CVFPP implementation.

[f] **Potential for T/E Listing:**

Yes = Species is currently State- or federally listed as threatened or endangered, or has high potential of being listed during the next five to 10 years.
No = Species is not State- or federally listed.

[g] **Focused Conservation Needs:**

Yes = Species has restricted distribution in SPA, requires habitat elements with restricted distribution (e.g., cut banks), or requires large-scale connectivity of habitat features for completion of life cycle.
No = Species does not have focused conservation needs.

[h] **Focused Conservation Planning:**

Yes = Species is a target species with listing potential and focused conservation needs.
No = Species is not a target species, or does not have listing potential or focused conservation needs. Focused conservation planning addresses specific conservation needs that otherwise may not be met by restoration of ecological processes and habitats within each region.

[i] Potential distribution is based on historic records or poorly known.

Notes:
CA = California
DPS = Distinct Population Segment
EPA = Bald and Golden Eagle Protection Act
ESU = Evolutionarily Significant Unit
FED = federal
SPA = Systemwide Planning Area

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Attachment A.1
Reference Update for the 2016 Conservation Strategy's Target Species

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ATTACHMENT A.1

Reference Update for the 2016 Conservation Strategy's Target Species

Acronym	Definition
CCV	California Central Valley
Conservation Strategy (or Strategy)	Conservation Strategy (or Strategy)
Delta	Sacramento–San Joaquin Delta
DPS	Distinct Population Segment
ESU	Evolutionarily Significant Unit
Strategy (or Conservation Strategy)	2016 Central Valley Flood Protection Plan Conservation Strategy

Introduction

The development of the 2016 Central Valley Flood Protection Plan (CVFPP) Conservation Strategy (Conservation Strategy or Strategy) entailed a comprehensive review and the synthesis of key reference materials used to inform its Appendix G, "Identification of Target Species and Focused Conservation Plans," and Appendix L, "Measurable Objectives Development: Summary of Conservation Needs and Scale of Restoration Opportunities." This attachment summarizes the relevant reference materials that have become available for the target species listed in the 2016 Strategy since its publication (the updated reference materials).

This information can help determine whether the 2016 Conservation Strategy's measurable objectives need to be updated, and whether the existing measures for multi-benefit projects to restore or enhance habitat for target species should be modified. Appendix G of the 2016 Strategy lists potentially suitable species that were considered for inclusion in the Strategy, and describes the evaluation process and criteria for selecting target species. The 2016 Strategy includes provisions for amending the list of target species as part of the five-year update process, to reflect changing conservation needs and habitats. Therefore, this update to the reference material also considered the potentially suitable species that were not selected as

target species in the 2016 Strategy (i.e., non-target species) but were considered for inclusion in the five-year update.

As part of the Conservation Strategy 2022 Update, three additional species are being added to the list of 17 target species:

1. Delta smelt (*Hypomesus transpacificus*).
2. Tricolored blackbird (*Agelaius tricolor*).
3. Yellow-breasted chat (*Icteria virens*).

Reference materials are included for these species in addition to references cited in the individual conservation plans (Appendix B). This attachment also lists updated reference materials for selected non-target species associated with target habitats.

Target Species References

The updated reference materials for target species are summarized as follows and organized into four categories:

1. **Adopted Conservation Plans.** Conservation plans adopted by government agencies may focus on one or more of the following areas: recovering species, managing land, or supporting an incidental take authorizations or permits.[1] Plans adopted since 2016 have been grouped into three categories: recovery plans, habitat conservation plans and natural community conservation plans, and regional conservation investment strategies. No other types of conservation plans applicable to the Conservation Strategy have been updated since 2016.

2. **Status Reviews and Critical Habitat Designations.** Agency reviews of the status of listed species frequently update the recommended actions or other content of recovery plans, and critical habitat designations add to federal agencies' recovery planning efforts. These references are grouped by target species.

3. **Regional Conservation Planning References.** Publications regarding conservation of species groups in the Sacramento and San Joaquin valleys and the Sacramento–San Joaquin Delta (Delta) address multiple target species and recommend actions based on recent science.

4. **Other Target Species References.** These references consist of scientific literature relevant to the conservation of target species and not included in one of the preceding categories. These references are grouped by target species.

[1] The 2016 Strategy defines "conservation" as the maintenance, enhancement, and restoration of populations, communities, and ecosystem functions to sustain the services, benefits, and values of public trust resources.

Adopted Conservation Plans

The following conservation plans have been developed for target species since the release of the 2016 Strategy.

Recovery Plans

National Marine Fisheries Service. 2018. *Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris).* Sacramento (CA): National Oceanic and Atmospheric Administration. August 8, 2018.

- Lists criteria for demographic and threat-based recovery.
- Presents 20 recovery actions aiming to restore passage and habitat; reduce mortality from fisheries, entrainment, and poaching; and address threats resulting from contaminants, climate change, predation, sediment loading, and oil and chemical spills.
- Contains 17 priority recovery actions and three secondary priority actions.
- Identifies 16 research priorities.
- Proposes monitoring and education and outreach programs.

U.S. Fish and Wildlife Service. 2017. *Recovery Plan for the Giant Gartersnake (Thamnophis gigas).* Sacramento (CA). September. 28, 2017.

- Focuses on identifying and protecting areas for habitat restoration, enhancement, or creation, including connectivity between populations.
- Defines nine recovery units corresponding with geographically and genetically distinct populations: the Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin, Delta Basin, Cosumnes-Mokelumne Basin, San Joaquin Basin, and Tulare Basin.
- Defines three objectives and criteria for achieving objectives:

    1. Establish and protect self-sustaining populations.
    2. Restore and conserve healthy Central Valley wetland ecosystems.
    3. Ameliorate or eliminate current and future threats.

- Proposes 10 recovery actions.

U.S. Fish and Wildlife Service. 2019. *Revised Recovery Plan for Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus).* Sacramento (CA). October 4, 2019.

- Focuses on loss and degradation of habitat.
- Defines three management units: Sacramento River, San Joaquin River, and Putah Creek.
- Describes two recovery objectives: preserve resilient populations across the historical range by maintaining occupancy in at least 80 percent of major river system subbasins; and protect and manage a system of connected habitat patches along each river or major drainage within subbasins.
- Presents five recovery criteria.
- Identifies two priority recovery actions, one secondary priority recovery action, and two tertiary priority recovery actions.

Habitat Conservation Plans and Natural Community Conservation Plans

U.S. Fish and Wildlife Service. 2018. Biological and Conference Opinion, Issuance of a Section 10(a)(1)(B) Permit for the Yolo County Habitat Conservation Plan and Natural Community Conservation Plan. File Number 08ESMF00-2017-F-3219-1. Sacramento (CA). August 2, 2018.

ICF International. 2018. Yolo Habitat Conservation Plan and Natural Community Conservation Plan.

Volume I and Volume II. Prepared for Yolo Habitat Conservancy. Sacramento (CA). April 2018.

- This document and the U.S. Fish and Wildlife Service (2018) document address six of the Conservation Strategy's target species: valley elderberry longhorn beetle, giant gartersnake, bank swallow (*Riparia riparia*), Least Bell's vireo (*Vireo bellii pusillus*), Swainson's hawk (*Buteo swainsoni*), and western yellow-billed cuckoo (*Coccyzus americanus*).

County of Sacramento, City of Rancho Cordova, City of Galt, Sacramento County Water Agency, Sacramento Regional County Sanitation District, and the Southeast Connector Joint Powers Authority. 2018. *Final South Sacramento Habitat Conservation Plan.* Volumes I and II. Sacramento (CA). January 2018.

- This document addresses five of the Conservation Strategy's target species—giant gartersnake, Swainson's hawk, valley elderberry longhorn beetle, greater sandhill crane, and tricolored blackbird—and several potential suitable non-target species.

Status Reviews and Critical Habitat Designations

The following status review reports and critical habitat designations have been developed for target species since the release of the 2016 Strategy.

California Central Valley Steelhead–Distinct Population Segment

National Marine Fisheries Service. 2016. *5-Year Review: Summary and Evaluation California Central Valley Steelhead Distinct Population Segment.* Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

- Recommends that California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*) Distinct Population Segment (DPS) remain listed as threatened.
- Gives an overview of listing history and determinations.
- Increases the recovery priority number from 7 to 5 because of an increase in recovery potential.
- Recommends adding the Mokelumne River Hatchery to the CCV steelhead DPS because of the near-identical genetic relationship with Feather River Hatchery fish, which are considered native and part of the DPS.
- Outlines the recovery plan, including success criteria, and discusses progress toward achievement.
- Summarizes relevant new information and presents new data on population trends and abundance.
- Reports an increase in hatchery returns from wild fish salvage; however, all concerns from the previous status review remain.
- Discusses genetic structure and population dynamics (including hatchery data), but with a caveat that there is a general lack of data on the status of wild populations.
- Conducts a five-factor analysis, including threats, conservation measures, and regulatory mechanisms. One major factor contributing to the species' threatened status remains a reduction in habitat quality or quantity caused by anthropogenic changes to the river systems.
- Describes restoration projects that have benefited and are expected to benefit habitat in the future.
- Discusses direct human impacts (e.g., commercial, recreational, scientific, or educational), disease and predation impacts, and the inadequacies of existing regulatory mechanisms.

- Details hatchery and harvest effects on the species' continued survival.
- Includes an extensive discussion of climate change, precipitation and drought, and oceanic conditions.
- Summarizes how each ESA listing factor has changed since the 2011 status review and lists eight recommendations for future actions.

Chinook Salmon–Central Valley Spring-run Evolutionarily Significant Unit

National Marine Fisheries Service. 2016. *5-Year Review: Summary and Evaluation of Central Valley Spring-run Chinook Salmon Evolutionarily Significant Unit.* April. Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

- Recommends that Central Valley spring-run Chinook salmon (*O. tshawytscha*) Evolutionarily Significant Unit (ESU) remain listed as a threatened species; however, the review suggests that its status has improved as a result of extensive restoration projects.
- Explains that drought conditions raise the level of concern for the species.
- Gives an overview of listing history and determinations.
- Describes critical habitats for the species, and outlines the recovery plan and criteria.
- Summarizes relevant new information regarding the ESU delineation, and presents new data on population trends and abundance.
- Conducts a five-factor analysis including threats, conservation measures, and regulatory mechanisms. Examines the effects of traditional habitat loss and remaining habitat degradation, particularly associated with dams and water projects.
- Summarizes several restoration and monitoring projects and touches upon flood management and the effects of "self-mitigating" levee maintenance.
- Discusses direct human impacts (e.g., commercial, recreational, scientific, or educational).
- Includes an extensive discussion on climate change, precipitation and drought, and oceanic conditions.
- Summarizes changes to ESA listing factors since the last review.
- Presents four priority near-term drought actions.
- Presents 11 priority actions for the recovery of Central Valley spring-run Chinook salmon.

Chinook Salmon–Sacramento River Winter-run Evolutionarily Significant Unit

National Marine Fisheries Service. 2016. *5-Year Status Review: Summary and Evaluation of Sacramento River Winter-Run Chinook Salmon ESU.* Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce. December 2016.

- Recommends that Sacramento River winter-run Chinook salmon ESU remain listed as an endangered species.
- Gives an overview of listing history and determinations.
- Describes critical habitats for the species, and outlines the recovery plan and criteria.
- Summarizes relevant new information regarding the ESU delineation, and presents new data on population trends and abundance.
- Discusses current threats to habitat and range, including the effects of flood management, Central Valley restoration project efforts, and climate change.
- Discusses seven recommendations for future actions.

Green Sturgeon

National Marine Fisheries Service. 2021. *Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris) 5-Year Review: Summary and Evaluation.* Sacramento (CA): National Oceanic and Atmospheric Administration, U.S. Department of Commerce. November 2021.

- Gives an overview of listing, rulemaking, and review history.
- Summarizes new information for the species including confirmed spawning in the Feather and Yuba rivers, and confirmed detection in the Stanislaus River and San Joaquin River at the mouth of the Merced River.
- Lists recovery criteria and discusses how each have or have not been met.
- Describes species ecology and status including new information since 2015 review.
- Presents five-factor analysis of threats, conservation measures and regulatory mechanisms including a discussion of the effects of barriers and flow in the Sacramento River system, levee projects, diversions, and climate change.
- Recommends no change to species status and lays out five recommendations to assist in improving the status of and available information about the species.

U.S. Fish and Wildlife Service. 2020. "Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for Eulachon, Yelloweye Rockfish, Bocaccio, and Green Sturgeon." Federal Register Volume 85: Pages 12,905 to 12,906.

- Presents a notice of the initiation of reviews and a request for information.

Giant Gartersnake

U.S. Fish and Wildlife Service. 2020. *Giant Gartersnake (Thamnophis gigas) 5-Year Review: Summary and Evaluation*. Sacramento (CA). June 2020.

- Gives an overview of listing history and determinations, and recommends no change to the species' status.
- Describes spatial distribution and abundance, including information for each recovery unit. Includes the notable discovery of giant gartersnakes at Liberty Farms in the Yolo Basin, where the population was previously presumed extirpated.
- Identifies four ongoing giant gartersnake studies being conducted by the U.S. Geological Survey.
- Discusses threats and conservation efforts, including habitat conservation plans.
- Outlines progress toward recovery criteria identified in the species recovery plan.

Riparian Brush Rabbit

California Department of Fish and Wildlife. 2020. *5-Year Status Review of Riparian Brush Rabbit (Sylvilagus bachmani riparius).* Report submitted to the California Fish and Game Commission. Sacramento (CA). February 21, 2020.

- Recommends no change to the species' status.
- Describes the species' life history, trends in abundance, threats and survival factors, distribution (current and historical), and habitat.
- Examines the degree and immediacy of threats.
- Discusses flood control projects (e.g., Paradise Cut) and effects on riparian brush rabbit in Lathrop, California.
- Discusses the effects of flooding on population and includes maps.
- Contains a large section on management activities and species recovery that includes recommendations (e.g., establishment of additional flood-secure populations, and the filling of data gaps).

Riparian Woodrat

U.S. Fish and Wildlife Service. 2020. *5-Year Review Riparian Woodrat (Neotoma fuscipes riparia).* Sacramento (CA). July 8, 2020.

- Retains the species' endangered status.
- Discusses the status, abundance, and taxonomy of two known populations of riparian woodrats.
- Presents current threats to the species.
- Describes current conservation efforts and mechanisms.

Valley Elderberry Longhorn Beetle

U.S. Fish and Wildlife Service. 2020. "Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 66 Species in California and Nevada." Federal Register Volume 85: Pages 4,692 to 4,694.

- Presents a notice of the initiation of reviews and a request for information for 66 species, including valley elderberry longhorn beetle.

Western Yellow-billed Cuckoo

U.S. Fish and Wildlife Service. 2020. "Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Western Distinct Segment of the Yellow-Billed Cuckoo." Federal Register Volume 85: Pages 11,458 to 11,594.

- Documents the current best assessment of the areas that meet the definition of critical habitat for western yellow-billed cuckoo.
- Presents a conservation strategy focused on breeding habitat including areas for nesting, foraging, and dispersal when breeding or food resources may not be optimal.
- Discusses how the determination was focused on areas known to have breeding or suspected breeding habitat.
- Describes the species' life history and habitat associations.
- Discusses climate change and hydrologic processes.
- Reduces the August 15, 2014, area of proposed critical habitat of 546,335 acres in 80 units to 493,665 acres in 72 units.
- Describes Unit 63, CA–1 Sacramento River: Colusa, Glenn, Butte, and Tehama counties.

Regional Conservation Planning References

The following conservation planning references for the Sacramento–San Joaquin Valley and Delta have been published since 2016.[2]

Dayer A, Meyers R. 2016. Central Valley Joint Venture Human Dimensions Chapter Manuscript. December 20, 2016.

- Assesses priority areas for the human dimensions inquiry for the Central Valley Joint Venture.
- Presents a literature review to identify and summarize the human dimensions research relevant to wildlife conservation, with an emphasis on the Central Valley.
- Provides recommendations to inform the revision of the Implementation Plan.
- Provides cross-over content related to flooding or flood control.

Dahm C, Kimmerer W, Korman J, Moyle PB, Ruggerone GT, Simenstad CA. 2019. *Developing Biological Goals for the Bay-Delta Plan: Concepts and Ideas from an Independent Scientific Advisory Panel.* A Final Report to the Delta Science Program. Prepared for Delta Stewardship Council, Delta Science Program. April 2019.

- Provides biological goals for:
  - Ecosystem structure and function.
  - Native fish species.
  - Salmonids.
- Uses a geographic scope that includes the following areas:
  - San Joaquin River and its major tributaries (including the Merced, Tuolumne, and Stanislaus rivers).
  - Sacramento River including Sacramento River tributaries and Delta eastside tributaries (Mokelumne, Cosumnes, and Calaveras rivers).
  - Delta and Suisun Marsh.

Dybala, KE, Clipperton N, Gardali T, Holet GG, Kelsey R, Lorenzato S, Melcer R Jr., Seavy NE, Silveira JG, Yarris GS. 2017. “Population and Habitat Objectives for Avian Conservation in California’s Central Valley Riparian Ecosystems.” San Francisco Estuary & Watershed

[2] Several sections of the Delta Stewardship Council’s 2013 Delta Plan (https://deltacouncil.ca.gov/delta-plan/) have been updated since 2016; however, those sections are not relevant to the Conservation Strategy.

Science Volume 15 (Issue 1): Article 5. Viewed online at: AvianConservation. Accessed: March 25, 2020.

- Defines the long-term conservation goal of establishing riparian ecosystems that provide sufficient habitat to support genetically robust, self-sustaining, and resilient bird populations.
- Selects 12 riparian landbird focal species as ecosystem indicators in four Central Valley Joint Venture planning regions.
  - Focal species include six Appendix G species (including three target species): western yellow-billed cuckoo, bank swallow, least Bell's vireo, yellow-breasted chat, yellow warbler (*Setophaga petechia*), and song sparrow (*Melospiza melodia*).
- Defines long-term (100-year) population objectives.
- Estimates long-term species density and riparian restoration objectives required to achieve long-term population objectives.
- Proposes short-term (10-year) objectives to track progress toward the long-term objectives.

National Marine Fisheries Service. 2019. Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations, Sacramento River Bank Protection Project Post Authorization Change Report. Action Agency, U.S. Army Corps of Engineers. National Marine Fisheries Service Environmental Consultation Organizer Number: WCRO-2019-01893. Sacramento (CA). August 30, 2019.

- Describes proposed levee protection measures and flood risk management improvements under the Sacramento River Bank Protection Project Post Authorization Change Reportthat encompass levees and weirs within the Sacramento River Flood Control Project.
- Covers 20,535 linear feet at 35 identified potential future erosion repair sites within Economically Justified Basins.
- Does not restrict the number of repair sites covered by the biological opinion, but limits linear footage to 30,000 linear feet.
- Identifies a framework for site selection and implementation.
- Describes five bank protection measures and designs:
  1. Setback levees.
  2. Bank fill stone protection with no on-site vegetation.
  3. Adjacent levee.
  4. Riparian benches with revegetation.
  5. Bank fill stone protection with on-site vegetation.

- Presents operations and maintenance measures, a compensation strategy, and conservation measures.
- Defines the biological opinion and incidental take assessment approach and rangewide status of the affected species and their designated critical habitat for:
  - Central Valley spring-run Chinook salmon ESU.
  - CCV steelhead DPS.
  - Southern DPS of North American green sturgeon.
  - Sacramento River winter-run Chinook salmon ESU.
- Establishes an environmental baseline including current land cover types, previous flood management actions, species and critical habitat status within the Action Area, and approved mitigation banks.
- Describes direct and indirect effects of the proposed action on the species and critical habitat, and discusses cumulative effects.
  - Cumulative effects include agricultural practices, aquaculture and fish hatcheries, increased urbanization, nonfederal and illegal rock revetment, and levee repair projects.
- Provides a synthesis of the effects, environmental baseline, cumulative effects, and status of the species and critical habitat.
- Indicates the proposed action is not likely to jeopardize the continued existence of the affected species or destroy or adversely modify its designated critical habitat.
- Provides 15 conservation recommendations.
- Recommends that U.S. Army Corps of Engineers complete a study of potential rock revetment removal sites on the Sacramento River where rock revetment does not serve a flood risk reduction purpose and can be removed to enhance green sturgeon and salmonid shoreline habitat.

National Marine Fisheries Service. 2021. Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the American River Watershed Common Features General Reevaluation Report Reiniation 2020. Action Agency, U.S. Army Corps of Engineers. National Marine Fisheries Service Environmental Consultation Organizer Number: WCRO-2020-03082. Sacramento (CA). May 12, 2021.

- Analyzes the effects of the American River Watershed Common Features General Reevaluation Report based on the final biological assessment for the project and the best available science for:
  - Sacramento River winter-run Chinook salmon ESU.
  - Central Valley spring-run Chinook salmon ESU.

  - Southern DPS of North American green sturgeon.
  - California Central Valley steelhead DPS.
  - The designated critical habitats of these species.
  - Essential fish habitat for Pacific Coast salmon.

- Summarizes the background and consultation history, and the proposed federal action to reduce flood risk caused by release of 160,000 cubic feet per second from Folsom Dam to the City of Sacramento, by adding support to the surrounding levees. Includes CVFPB and SAFCA as the project's nonfederal sponsors.

- Discusses designs, processes, and construction methods for American River, Natomas East Main Drain Canal and Arden Creek, Sacramento River, and Sacramento Weir and Fish Passage Facility infrastructure improvements.

  - Includes design, construction methods, and conservation measures for the Arden Pond mitigation site, which is intended to provide compensatory mitigation for impacts to salmonid species resulting from the Proposed Action.

- Requires the development and implementation of the Green Sturgeon Habitat, Mitigation, and Monitoring Plan (HMMP) to minimize adverse effects to green sturgeon habitat.

  - Provides a purpose, framework, and goals by which the Habitat, Mitigation, and Monitoring Plan will be developed.

- Lists 30 general minimization measures to be applied to the entire project, specific species, and/or specific locations within the project area.

- Includes an estimated three- to five-year maintenance schedule for riparian habitat mitigation.

- Requires compensatory mitigation for construction effects on listed species and their critical habitat and discusses on- and off-site compensatory mitigation associated with the Proposed Action.

- Provides Section 7 Biological Opinion.

  - Describes the Section 7 approach.

  - Reviews and analyzes the current status of the listed species and critical habitat; environmental baseline within action area; effects of the Proposed Action; effects of other activities caused by the proposed action; and cumulative effects.

  - Concludes with the biological opinion that the proposed action is not likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley

spring-run Chinook salmon, DPS North American green sturgeon, and California Central Valley steelhead or destroy or adversely modify their designated critical habitat.

- Provides Incidental Take Statement
  - Defines take, harm, and incidental take and how each will be determined within the Action Area and the thresholds for allowable take.
  - Includes five "Reasonable and prudent measures" that are nondiscretionary and necessary or appropriate to minimize the impact of the amount or extent of incidental take.
  - Recommends eight conservation measures.
- Describes the purpose of consultation under the Magnuson-Stevens Fishery Conservation and Management Act regarding conservation of Essential Fish Habitat.
- Defines Essential Fish Habitat affected by the Project and the aspects of the Proposed Action that are expected to have adverse effects within the Action Area.
- Recommends 13 conservation measures to avoid and minimize adverse effects.

Pandolfino ER, Handel CM. 2018. "Population Trends of Birds Wintering in the Central Valley of California." *In* Shuford WD, Gill RE Jr., Handel CM (eds.), *Trends and Traditions: Avifaunal Change in Western North America*. Studies of Western Birds 3. Camarillo (CA): Western Field Ornithologists.

- Documents the population trends for Central Valley wintering birds through the analysis of Christmas bird counts.

Shuford WD, Dybala KE. 2017. "Conservation Objectives for Wintering and Breeding Waterbirds in California's Central Valley." San Francisco Estuary & Watershed Science Volume 15 (Issue 1): Article 4. Viewed online at: Breeding-Birds. Accessed: March 25, 2020.

- Builds on previous efforts in the Central Valley Joint Venture to establish specific, quantitative population and habitat objectives for Central Valley waterbirds.
- Estimates the current extent, temporal availability, and distribution of suitable waterbird habitat in the Central Valley; describes the selection of 10 focal species; and summarizes new estimates of current population sizes.
  - Focal species include two Appendix G target species: California black rail (*Laterallus jamaicensis coturniculus*) and greater sandhill crane (*Antigone canadensis*).

- Defines short-term (10-year) and long-term (100-year) population objectives for each species and the corresponding habitat objectives to meet overarching waterbird needs in the Central Valley over these time frames.

- Recognizes fine-scale habitat needs and limiting factors of each focal species.

- Makes specific conservation recommendations to benefit focal species and a wide range of other waterbirds that breed or winter in the Central Valley.

Shuford WD, Hertel M. 2017. "Bird Species at Risk in California's Central Valley: A Framework for Setting Conservation Objectives." San Francisco Estuary & Watershed Science Volume 15 (Issue 1): Article 7. Viewed online at: Article7. Accessed: March 25, 2020.

- Identifies 38 at-risk species, subspecies, or distinct populations of birds that warrant heightened conservation efforts in the Central Valley.

- Contains the following six Appendix G target species: bank swallow, California black rail, greater sandhill crane, least Bell's vireo, Swainson's hawk, and western yellow-billed cuckoo.

- Includes non-target species identified in Appendix G:

  - Tricolored blackbird and yellow-breasted chat (both now included as target species).
  - Burrowing owl, bald eagle (*Haliaeetus leucocephalus*).
  - Black tern (*Chlidonias niger*).
  - Grasshopper sparrow (*Ammodramus savannarum*).
  - Lesser sandhill crane (*Antigone canadensis canadensis*).
  - Redhead (*Aythya americana*).
  - Suisun song sparrow (*Melospiza melodia maxillaris*).
  - Mountain plover (*Charadrius montanus*).
  - Western snowy plover (*Charadrius alexandrinus*).
  - Loggerhead shrike (*Lanius ludovicianus*).
  - Short-eared owl (*Asio flammeus*).
  - Yellow-headed blackbird (*Xanthocephalus xanthocephalus*).
  - Northern harrier (*Circus cyaneus*).
  - Purple martin (*Progne subis*).

- Evaluates subregional distribution, habitat, and threats in the Central Valley.

- Assesses the adequacy of approaches taken to establish conservation objectives.

- Discusses a conceptual framework for determining population or habitat objectives.

U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service. 2020. Near-term Restoration Strategy for the Central Valley Project Improvement Act Fish Resource Area FY2021–FY2025. Prepared for the Bureau of Reclamation and U.S. Fish and Wildlife Service. Sacramento (CA).

- Develops priorities to form a strategy to double anadromous fish populations in the Central Valley through the prioritization of restoration, research, and monitoring efforts that will be implemented during the 2021-2025 fiscal year cycle.
- Outlines focused prioritizations for the investment of restoration funds.
- Intended to facilitate the planning, design, and implementation of large-scale restoration efforts and the documentation of population-level effects on multiple anadromous fish species.
- Describes current efforts and future efforts, including restoration projects, monitoring programs, and targeted research, and provides an organizational framework to record, analyze, and repeat beneficial efforts toward increasing anadromous fish populations in the Central Valley.

U.S. Bureau of Reclamation. 2020. Record of Decision: Reinitiation of Consultation on the Coordinated Long-Term Modified Operations of the Central Valley Project and State Water Project. February. Region 10 – California Great Basin, Sacramento (CA).

- Approves the Bureau of Reclamation's preferred alternative, Alternative 1, to better integrate ESA compliance actions and water supply operations through an operational plan that improves its flexibility in managing the Central Valley Project, and best meets the authorized project purposes.
- Includes a significant commitment to improved coordinated operations with California Department of Water Resources to meet ESA requirements for Delta Smelt, North American green sturgeon, California Central Valley steelhead, Central Valley spring-run Chinook salmon, and Sacramento winter-run Chinook salmon and their habitat.
- Describes the alternatives and the key considerations for the decision to approve Alternative 1, the preferred alternative.

U.S. Bureau of Reclamation. 2021. Public Draft Workplan: Fiscal Year 2021 Obligation Plan for CVPIA Authorities, Central Valley Project, California. February. Region 10 – California Great Basin, Sacramento (CA).

- Describes the Bureau of Reclamation's Fiscal Year 2021 planned obligations using the authorities provided by the Central Valley Improvement Act, the Central Valley Project Restoration Fund, and other Federal appropriations.

U.S. Fish and Wildlife Service. 2017. Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle. Sacramento (CA).

Williams TH, Spence BC, Boughton DA, Johnson RC, Crozier LG, Mantua NJ, O'Farrell MR, Lindley ST. 2016. *Viability Assessment for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Southwest*. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-564.

- Suggests the extinction risk for the CCV steelhead DPS has not changed since 2010, but the extinction risk has increased for Sacramento River winter-run Chinook salmon ESU and Central Valley spring-run Chinook salmon ESU.

- Provides an overview of new information for consideration of boundary delineations for listed California ESUs and DPSs of Chinook salmon, coho salmon (*Oncorhynchus kisutch*), and CCV steelhead DPS.

  - Climate and ocean conditions.
  - Central Valley recovery domain.
  - Sacramento River winter-run Chinook salmon ESU.
  - Central Valley spring-run Chinook salmon ESU.
  - CCV steelhead DPS.

- Provides the following information for each species subsection:

  - DPS and ESU boundary delineation.
  - Summary of previous assessments.
  - Brief review of technical recovery team documents and previous findings.
  - New data and updated analyses; harvest impacts; summary and conclusions.

DiGaudio RT, Dybala KE, Seavy NE, Gardali T. 2017. "Population and Habitat Objectives for Avian Conservation in California's Central Valley Grassland–Oak Savanna Ecosystems." San Francisco Estuary & Watershed Science Volume 15 (Issue 1): Article 6. Viewed online at: Article6. Accessed: March 25, 2020.

- Lists 12 focal species that include four of the non-target species in Appendix G: western burrowing owl, grasshopper sparrow, loggerhead shrike, and northern harrier.

Regional Conservation Investment Strategies

ICF International Inc. 2020. *Yolo Regional Conservation Investment Strategy/Local Conservation Plan*. Final. (ICF 00723.16.) Sacramento, California. Prepared for Yolo Habitat Conservancy, Woodland (CA). October 2020.

- Provides mitigation and stewardship-driven conservation in Yolo County; describes the existing condition for the amount, location, and type of natural communities and focal species habitat in the document's strategy area.
- Recommends conservation actions to address land cover types, and focal species to direct project planning and conservation efforts.
- Includes 40 focal species and 97 conservation species. The focal species list includes 13 of the 2016 Strategy's target species, and the three new target species; multiple non-target species are identified as either focal or conservation species.

ICF International. 2020. Final Draft Mid-Sacramento Valley Regional Conservation Investment Strategy. (ICF 00428.17.) Sacramento (CA). Prepared for Reclamation District 108, Grimes, (CA). December 2020.

- Based primarily on the Mid- and Upper Sacramento Regional Flood Management Plan and the Feather River Regional Flood Management Plan, which provide regional frameworks for integrating conservation into the flood management system and operations.
- Identifies conservation and habitat enhancement actions that can be used to provide compensatory mitigation for flood management and other infrastructure projects in the regions.
- Identifies 12 focal species; of those, 10 overlap with the 2016 Strategy's target species, tricolored blackbird is a new target species, and western pond turtle (*Actinemys marmorata*) is a non-target species.

Other Reference Materials for Target Species

Updated reference materials are available for many of the target species, which are listed in this section.

Delta Button-celery

No updated reference materials have become available for Delta button-celery (*Eryngium racemosum)* since the release of the 2016 Strategy.

Slough Thistle

No updated reference materials have become available for slough thistle (*Cirsium crassicaule*) since the release of the 2016 Strategy.

Valley Elderberry Longhorn Beetle

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Dobbins MT, Holyoak M. 2021. "Population Viability and Management of the Valley Elderberry Longhorn Beetle." Biodiversity and Conservation Volume 30: pages 481 to 496. Viewed online at: Longhorn-Beetle. Accessed: October 2021.

- Investigates the valley elderberry longhorn beetle population's viability and sensitivity to environmental and anthropogenic stochasticity across five major Central Valley Rivers with known populations: American River, Cache Creek, Sacramento River, Cosumnes River, and Putah Creek.
- Assesses the effects of increased habitat loss, more frequent drought and wildfires, and increased juvenile mortality due to invasive predators.
- Finds that across all scenarios, the region-wide metapopulation was more robust to extinction than individual rivers, and that extinction probabilities were lower for larger rivers than smaller ones.
- Finds that modest increases in the annual probability of drought or wildfires and juvenile mortality greatly reduced population persistence at all spatial scales, often leading to rapid within-river extinctions, while increases in habitat loss had moderate impacts.
- Finds that increases in dispersal rates among rivers had negligible effects on improving population viability.
- Highlights the vulnerability of the species to further environmental and anthropogenic disturbance and emphasizes the importance of maintaining a healthy metapopulation structure with large tracts of suitable habitat for long-term valley elderberry longhorn beetle viability.

Rayburn AP, Rogner M, Frank P. 2018. "Abundance and Distribution of Blue Elderberry (*Sambucus nigra* ssp. *caerulea*) on Lower Cache Creek: Implications for Adaptive Floodplain Management." San Francisco Estuary & Watershed Science Volume 16 (Issue 3): Article 7. Davis (CA). Accessed: March 2020.Viewed online at: Blue-Elderberry. Accessed: March 2020.

- Describes a comprehensive field survey to map elderberry shrubs (the valley elderberry longhorn beetle's host plant) across the 904-hectare Cache Creek Resource Management Plan area, and to collect spatially explicit abundance and distribution data.
- Analyzes shrub distribution relative to floodplain inundation zones and associated vegetation, slope, and aspect.

California Central Valley Steelhead–Distinct Population Segment

Within this attachment, "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

Beakes M, Phillis C. 2021. "Monitoring Steelhead Populations in the San Joaquin Basin – Life-History Variation in Oncorhynchus mykiss." ResearchGate. Viewed online: Steelhead-Populations. Accessed: October 2021.

- Describes 14 alternative life-history pathways for Oncorhynchus mykiss and the complex interactions in the genetic makeup and internal conditions of individual fish.
- Discusses knowledge gaps in patterns and process related to Oncorhynchus mykiss life -history variations.
- Identifies the following knowledge gaps:
  - Importance of non-natal habitats in supporting divergent life-history types (e.g., intermittent streams and the Bay-Delta).
  - Genetics as a tool for management and predicting anadromy.
  - The effects of water management, salmon management, and climate change on the environmental and genetic controls of steelhead life-history diversity.

Buchanan RA, Buttermore E, Israel J. 2021. "Outmigration Survival of a Threatened Steelhead Population Through a Tidal Estuary." Canadian Journal of Fisheries and Aquatic Sciences (Author's Accepted Manuscript). Viewed online: Threatened-Steelhead. Accessed October 2021.

- Uses acoustic telemetry with multistate release-recapture models to investigate survival patterns during a key stage of the juvenile emigration of anadromous steelhead through the Delta over multiple years, including three drought years.
- Designed to address uncertainties in San Joaquin River steelhead survival through the Delta and its relationship with the seasonal water management strategies used by federal and state agencies in the Delta.
- Presents six year migration survival results, spatial patterns in survival estimates, survival patterns compared to water management and environmental conditions, and drought effects on survival modeling.
- Finds steelhead survival through the Delta varies considerably both between and within years.
- Suggests combination of habitat loss, reduced river flows, increased resource use, warming temperatures, and non-native aquatic community structure is intensified in the Delta

because of its southern latitude in the steelhead range and because of human development of the region.

- Discusses in detail water management in the San Joaquin River and its tributaries as it enters the Delta, and the way it affects steelhead movement and survival.
- Suggests the results have implications for management designed to support emigrant survival in the Delta, including timing the reservoir releases from the multiple tributaries to coincide with the juvenile migration, manipulating flow regimens, and restoring Delta habitat.
- Identifies the following factors for future investigation:
  - Factors driving route selection at various junctions in the Delta.
  - Juvenile steelhead residence time and the propensity of Delta rearing.
  - Reach-specific flow-survival relationships.
  - Survival differences between hatchery and run-of-river steelhead and between steelhead and Chinook salmon.
  - The role of non-native predators and non-native vegetation on survival patterns in different regions of the Delta.
  - The sensitivity of adult returns to estuarine and early marine survival.
- Identifies the need to estimate steelhead survival further downstream through the bays.

Moniz PJ, Pasternack GB, Massa DA, Stearman LW, Bratovich PM. 2019. "Do Rearing Salmonids Predictably Occupy Physical Microhabitat?" Journal of Ecohydraulics Volume 5 (Issue 2): Pages 132 to 150. Accessed: April 2020.Viewed online: Rearing-Salmonids.

- Further develops and applies a generalized bioverification framework to salmonid microhabitat suitability models.
- Develops water depth and velocity habitat suitability criteria functions for two size classes of rearing *Oncorhynchus tshawytscha* and *O. mykiss* using three years of snorkel survey data from the lower Yuba River.
- Accurately predicts both preferred and avoided habitat, using microhabitat suitability levels.
- Provides a generalized bioverification framework recommended for evaluating and comparing the accuracy and reliability of ecohydraulic models.

Chinook Salmon—Central Valley Fall and Late Fall-run Evolutionarily Significant Unit

Within this attachment, "Regional Conservation Planning References," provides more details.

Iglesias SI, Henderson MJ, Michel CJ, Ammann AJ, Huff DD. 2017. Chinook Salmon Smolt Mortality Zones and Influence of Environmental Factors on Out-Migration Success in the Sacramento River Basin. Prepared for D. Meier, U.S. Fish and Wildlife Service Anadromous Fish Screen Program Agreement Number F15PG00146. Sacramento (CA). April 2017.

- Incorporates a breadth of individual fish attributes, environmental covariates, and reach-specific habitat types into mark-recapture survival models to determine which factors are most influential to outmigration success for hatchery-origin, late fall-run yearling smolts.
- Examines the relationship of smolt survival to environmental factors influenced by broad-scale, basin-wide-level dynamics, as well as smaller-scale, reach-specific habitat features.
- Finds that mortality during outmigration is spatially heterogeneous, with a general trend of increased survival through lower reaches.
- Among the factors evaluated, correlates diversion density (structures for refugia), off-channel habitat availability, and sinuosity with survival; however, increased flow, smolt condition, swim speed, and release strategy exhibited the strongest correlations with outmigration success.
- Discusses limitations to the model and acknowledges that other variables not included in the model, such as turbidity, predation, and availability of large wood debris, could have improved the model fit-to-survival data and better explain the biological mechanisms causing mortality during outmigration.
- Cautions that results should be viewed in the context of a highly altered river system with severe reductions in historical flows and the elimination of vast expanses of rearing habitat, and that the study used hatchery-origin Chinook salmon, which may differ from natural-origin smolts in their behavior and vulnerabilities.

Chinook Salmon—Central Valley Spring-run Evolutionarily Significant Unit

Within this attachment, "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

Notch JJ, McHuron AS, Michel CJ, Cordoleani F, Johnson M, Henderson MJ, Ammann AJ. 2020. "Outmigration Survival of Wild Chinook Salmon Smolts through the Sacramento River during

Historic Drought and High Water Conditions." Environmental Biology of Fishes Volume 103: Pages 561 to 576.

- Describes the decline of wild spring-run Chinook salmon in the Central Valley and risks to outmigrating smolts associated with current conditions.
- Measures the movement and survival rates of acoustic-tagged wild Chinook salmon smolts from Mill Creek at fine spatial scales throughout Mill Creek and the Sacramento River over five consecutive years (2013 to 2017).
- Includes a research period of three consecutive years of drought, followed by an extremely wet year.
- Finds that higher flows resulted in increased survival rates.
- Suggests that supplying enough water instream for smolts during the critical migration window can lead to higher outmigration survival and increased returns of spawning adults.
- Proposes that managers consider tradeoffs between streamflows for agriculture and fisheries needs, with an emphasis on maintaining adequate streamflows during critical stages of the salmon life cycle and synchronizing managed flow increases with natural flow events occurring in natal tributaries.

Chinook Salmon—Sacramento River Winter-run Evolutionarily Significant Unit

Within this attachment, "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

National Marine Fisheries Service. 2016. "Species in the Spotlight: Priority Actions 2016–2020, Sacramento River Winter-Run Chinook Salmon 5-Year Action Plan." January 1, 2016. Chinook-Salmon. Accessed: January 2021.

- Summarizes status of Sacramento River winter-run Chinook salmon and key conservation efforts and challenges.
- Lays out five key actions needed for 2016 to 2020 and describes background, expected benefits, sources defining actions (e.g., recovery plans), and the current status of progress.
- Discusses improvements to Yolo Bypass fish habitat and passage.
- Provides options for the management of winter and early-spring Delta conditions to improve juvenile survival.

National Marine Fisheries Service. 2021. "Species in the Spotlight: Sacramento River Winter-run Chinook Salmon, Priority Actions 2021-2025." Viewed online: Chinook-Salmon. Accessed: October 2021.

- Summarizes the progress made on five major actions identified in the 2016 to 2020 action plan.
- Lays out six key actions needed for 2021 to 2025 and describes background, expected benefits, sources defining actions (e.g., recovery plans), and the current status of progress.

Phillis CC, Sturrock AM, Johnson RC, Webber PK. 2018. "Endangered Winter-Run Chinook Salmon Rely on Diverse Rearing Habitats in a Highly Altered Landscape." Biological Conservation Volume 217: Pages 358 to 362.

- Uses otolith strontium isotope ratios to reconstruct juvenile habitat use by winter-run Chinook that survived to adulthood.
- Finds that 44 to 65 percent of surviving adults reared in non-natal habitats, most of which are not designated as critical habitat.
- States that most non-natal habitats were not previously known to be demographically important.
- Suggests that non-natal habitats likely provide suitable growth and survival benefits and contribute to the adult population in demographically relevant numbers.
- Reports that all winter-run juveniles at the freshwater exit were comparable in size regardless of the type of rearing habitat.
- Concludes that diverse juvenile rearing habitats promote phenotypic diversity, but that the relative importance of non-natal rearing habitats to the population may fluctuate with California's hydraulic extremes.
- Proposes that protecting a diversity of habitat options can buffer against extinction risks and that failure to do so limits recovery opportunities and may increase extinction risk.

Chinook Salmon (General)

Hellmair M, Peterson M, Mulvey B, Young K, Montgomery J, Fuller A. 2018. "Physical Characteristics Influencing Nearshore Habitat Use by Juvenile Chinook Salmon in the Sacramento River, California." North American Journal of Fisheries Management Volume 38 (Issue 4): Pages 959 to 970.

- Analyzes associations between environmental characteristics and habitat occupancy in the lower Sacramento River.

- Evaluates habitat use by emigrating juvenile Chinook salmon relative to three different shoreline types:

    1. Rock revetment, defined as armored with rock and lacking additional features to enhance habitat.

    2. Mitigated, characterized by contoured, gradually sloping banks with a substrate of soil or fine sediment, deliberately planted vegetation, and anchored or embedded large wood debris.

    3. Natural, defined as not engineered, devoid of revetment, and dominated by native, naturally established vegetation.

- Finds that habitat use was significantly higher at natural shorelines and at those with mitigation features than those consisting of rock revetment.

- Explains that inundated terrestrial vegetation was associated with substantial increases in the probability of occupancy, presumably by providing cover and foraging. Shallow seasonally inundated habitat is often associated with high-quality nursery habitat and increased juvenile abundance.

- Discloses that Chinook salmon occupancy was lower in areas with large, rocky substrate and increased depth, and higher for non-native predators.

- Notes that lateral bank slope was also an important predictor of juvenile Chinook salmon presence while steep banks are less likely to be occupied.

- States that although higher mean velocity was associated with a decrease in occupancy, an increasing velocity gradient also increased habitat use, suggesting juvenile Chinook salmon preferentially occupy habitat that provides refuge from fast current, but is in proximity, to enable more efficient feeding.

- Explains that although the habitat value of mitigated shoreline habitats may be lower than that of large, seasonally inundated floodplains, nearshore habitats in the main channel are available to emigrating Chinook salmon year-round, in all years. By contrast, floodplains are only accessible for rearing in some years for relatively short periods of time, and therefore, are accessible to a comparatively small fraction of the overall juvenile salmonid population.

Lehman B, Huff DD, Hayes SA, Lindley ST. 2017. “Relationships between Chinook Salmon Swimming Performance and Water Quality in the San Joaquin River, California.” Transactions of the American Fisheries Society Volume 146 (Issue 2): Pages 349 to 358.

- Quantifies the swimming performance of juvenile hatchery-reared Chinook salmon in relation to water quality variables in controlled laboratory and field environments.

- Explains that trials were conducted during a six-week period that coincided with peak smolt outmigration. Water quality covariates included water temperature, turbidity, dissolved oxygen, and conductivity.

- Notes that the trials found negative relationships between maximum swim speeds and both temperature and turbidity.
- Acknowledges that other environmental factors likely influence the swimming performance of juvenile salmon in the San Joaquin River system that the researchers either did not measure or could not isolate.
- Recognizes that hatchery smolts were released in excellent health condition, but wild fish may travel longer distances with variable health conditions.
- Suggests that Delta water quality cannot be managed for salmon health solely by setting threshold temperatures, but freshwater turnover may be just as important for salmonid health.
- Proposes strategies to manage temperatures and concentrations of suspended sediment, such as coordinating dam and pump operations or restoring habitat structure, thereby improving water quality to optimize smolt swimming capacity.

Sabal M, Hayes S, Merz J, Setka J. 2016. "Habitat Alterations and a Nonnative Predator, the Striped Bass, Increase Native Chinook Salmon Mortality in the Central Valley, California." North American Journal of Fisheries Management Volume 36 (Issue 2): Pages 309 to 320.

- Assesses how striped bass and habitat alterations interact to influence the mortality of native juvenile Chinook salmon during their emigration from the lower Mokelumne River.
- Assesses aggregative responses of striped bass by their relative abundance and diet surveys across natural and human-altered habitats.
- States that per capita consumption of juvenile salmon and behavioral aggregation were elevated at a small diversion dam (Woodbridge Irrigation District Dam).
- Uses experimental striped bass removal, diet energetic analysis, and a before and after impact assessment to estimate the consumption of emigrating juvenile salmon by striped bass.
- Results illustrate how the synergistic relationship between habitat modification and non-native predators can exacerbate juvenile salmon mortality during emigration.
- Highlights the importance of considering interactions among stressors when planning local management strategies and assessing population-level impacts on salmon.

Sturrock AM, Carlson SM, Wikert JD, Heyne T, Nusslé S, Merz J, Sturrock HJW, Johnson R. 2020. "Unnatural Selection of Salmon Life Histories in a Modified Riverscape." Global Change Biology Volume 26: pages 1,235 to 1,247.

- Quantifies the expression and ultimate success of diverse salmon emigration behaviors in the Stanislaus River.
- Analyzes two decades of Chinook salmon monitoring data to explore the influence of regulated flows on juvenile emigration phenology, abundance, and recruitment.
- Follows seven cohorts into adulthood using otolith (ear stone) chemical archives to identify patterns in time- and size-selective mortality along the migratory corridor.
- Suggests management actions favoring any single phenotype could have negative evolutionary and demographic consequences, potentially reducing adaptability and population stability.
- Suggests that mimicking the natural hydrograph with flow variability should increase trait diversity and juvenile distribution, and that increased flow and habitat restoration should enhance productivity and phenological extremes among other benefits.

Green Sturgeon—Southern Distinct Population Segment

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Anderson, J. T., G. Schumer, P. J. Anders, K. Horvath, and J. E. Merz. 2018. Confirmed Observation: A North American Green Sturgeon Acipenser Medirostris Recorded in the Stanislaus River, California. Journal of Fish and Wildlife Management Volume 9 (Issue 2): Pages 624 to 630.

- Describes evidence of North American green sturgeon in the Stanislaus River based on visual and eDNA evidence.

Ulaski ME, Quist MC. 2021. "Filling Knowledge Gaps for a Threatened Species: Age and Growth of Green Sturgeon of the Southern Distinct Population Segment." Journal of Fish and Wildlife Management Volume 12 (Issue 1): Pages 234 to 240. Fish-Wildlife.

- Analyzes fin rays collected from the Sacramento–San Joaquin River basin, San Francisco Bay, and surrounding area, archived from 1984 to 2016, to explore age structure and growth; finds highly variable growth among individuals.
- Finds growth rates were similar to northern populations and detected age classes from 0 to 26 years.
- Compares age class structure with the Klamath and Oregon Coast River systems.

- Analysis reveals significant information gaps. Suggested research needs included estimating natural mortality, monitoring year-class strength and recruitment, and assessing trends in population abundance.
- Suggests that a lack of basic population information represents a barrier to effective management and recovery of the species.

Giant Gartersnake

Within this attachment, "Adopted Conservation Plans," "Status Reviews and Critical Habitat Designations," and "Regional Conservation Planning References," provide more details.

Halstead BJ, Valcarcel P, Wylie GD, Coates PS, Casazza ML. 2016. "Active Season Microhabitat and Vegetation Selection by Giant Gartersnakes Associated with a Restored Marsh in California." Journal of Fish and Wildlife Management Volume 7 (Issue 2): Pages 391 to 407.

- Examines the selection of microhabitats and vegetation composition by adult female giant gartersnakes (19 radio-tracked females) in restored marshes and rice agriculture in and around Gilsizer Slough, Sutter County.
- Finds that litter, emergent vegetation, terrestrial vegetation, and submerged vegetation microhabitats were positively selected and rock and rice were avoided.
- Finds that aquatic vegetation types were selected more strongly than terrestrial vegetation types. Tules, duckweed, water primrose, forbs, and grasses were positively selected and rice was avoided. Discusses various habitat and vegetation types and their relationships to selection by giant gartersnake and rice cultivation and its relationship to giant gartersnake.
- Lays out five aspects of the relationship between rice cultivation and giant gartersnake in need of future study.
- Suggests that maintaining a mosaic of cover and water is likely beneficial to giant gartersnakes during the active season including:
  - Promoting clumps of and maintaining emergent vegetation along canal and wetland margins; managing for tules; and managing primrose and cattails as habitat but preventing the formation of monocultures.

Halstead JB, Rose JP, Reyes GA, Wylie GD, Casazza ML. 2019. "Conservation Reliance of a Threatened Snake on Rice Agriculture." Global Ecology and Conservation Volume 19:e00681.

- Examines the extent to which giant gartersnakes use rice fields and whether the survival of adult giant gartersnakes was influenced by the amount of rice grown near their home ranges and daily movements.
- Suggests that understanding how surface water distribution in the Sacramento Valley, driven largely by changes in rice agricultural practices, will affect giant gartersnakes is the most pressing concern for the conservation of the species.

- Explains how radio telemetry was used to track 58 snakes at 11 locations on private rice farms in the Colusa, Butte, and Sutter basins.
- Discusses the benefits and detriments of rice cultivation and the rice agroecosystem on giant gartersnakes.
- Discusses the complex nature of rice as a commodity crop and fluctuating water supplies in California and the challenges this presents related to giant gartersnake conservation.
- Suggests that although giant gartersnakes are reliant on the rice agroecosystem, rice agriculture is likely suboptimal habitat for giant gartersnakes. However, the reduction of rice would likely be detrimental to giant gartersnake populations.
- Suggests there may be scenarios that benefit giant gartersnakes and rice farmers.

Halstead BJ, Valcarcel P, Kim R, Jordan AC, Rose JP, Skalos SM, Reyes GA, Ersan JSM, Casazza ML, Essert AM, Fulton AM. 2021 "A Tale of TWO Valleys: Endangered Species Policy and the Fate of the Giant Gartersnake." California Fish and Wildlife Special CESA Issue: Pages 264 to 283.

- Reviews giant gartersnake population, ecology, past and present habitat and conservation status.
- Discusses the influence of listing on giant gartersnake conservation.
- Lays out remaining challenges for protection and recovery.
- Compares and contrasts the Sacramento and San Joaquin Valleys.
- Describes a path forward for giant gartersnake conservation and recovery.

Hansen EC, Schere RD, Fleishman E, Dickson BG, Krolick D. 2017. "Relations between Environmental Attributes and Contemporary Occupancy of Threatened Giant Gartersnakes (*Thamnophis gigas*)." Journal of Herpetology Volume 51 (Issue 2): Pages 274 to 283.

- Explains that the study's objective was to evaluate hypothesized associations between the probability that a waterbody is occupied by giant gartersnake and the attributes of the waterbody and adjacent lands.
- States that the study sampled 159 sites in the American, Yolo, and southern Sutter basins with live traps and characterized the land cover, land use, and soil type at each site.
- Evaluates whether distance to historic tule marsh was associated with occupancy and assesses the strength of support for other hypotheses about components of habitat quality and selection for giant gartersnake.
- Uses statistics to predict the occupancy of giant gartersnake across a large portion of the northern Central Valley at a spatial extent consistent with regional management of the species and agricultural and urban expansion and operations.

- Contains color-coded maps for predicted occupancy and presence of giant gartersnake in the northern Central Valley.
- States that occupancy of giant gartersnake was strongly and negatively associated with elevation and strongly and positively associated with canal density and the proportion of rice and perennial wetland.
- Finds a strong and previously undescribed association between occupancy and soil order.
- Analysis results do not support the hypothesis that the estimated extent of historic tule marsh was the variable most strongly associated with giant gartersnake occupancy. At a finer scale, canal density, the proportion of adjacent rice agriculture and wetlands, and underlying soils appeared to be stronger drivers of occupancy.
- Suggests that the predictions made by the analysis be evaluated with additional data because of some inconsistencies and data gaps.
- Suggests that future work emphasize identification of soil-chemistry metrics, which could facilitate rapid assessment in the field to predict occupancy.

Reyes GA, Halstead BJ, Rose JP, Ersan JSM, Jordan AC, Essert AM, Fouts KJ, Fulton M, Gustafson KB, Wack RF, Wylie GD, Casazza ML. 2017. "Behavioral Response of Giant Gartersnakes (Thamnophis gigas) to the Relative Availability of Aquatic Habitat on the Landscape." U.S. Geological Survey Open-File Report 2017-1141. Viewed online at: Giant-Gartersnake. Accessed: December 30, 2020.

- Examines the relationship between rice fallowing, water availability, and the ecology of giant gartersnakes.
- States that the study aimed to determine how the extent of rice agriculture in the Central Valley landscape affects the spatial ecology (home range area, movement frequency, and movement rate) of radio-tagged giant gartersnakes, their selection of habitat components, health, and survival.
- Goes into great detail in its analysis of methods, statistics, and results.
- Indicates that giant gartersnakes make little use of rice fields themselves and avoid cultivated rice relative to its availability on the landscape, but suggests that rice is a crucial component of the modern landscape for giant gartersnakes.
- Finds that giant gartersnakes are strongly associated with the canals that supply water to and drain water from rice fields—providing a more stable habitat than rice fields because water is maintained longer and they support marsh-like conditions during most of the active giant gartersnake season.
- Suggests that maintaining canals without neighboring rice would be detrimental to giant gartersnake.

- States that rice may provide increased productivity of prey populations, dispersion of potential predators, and more secure water supply.
- Indicates that identifying how rice benefits giant gartersnakes in canals and the extentto which the rice agro-ecosystem could provide these benefits when rice is fallowed would inform the use of water for other purposes without harm to giant gartersnakes.
- Suggests that without this understanding, maintaining rice and associated canals is critical for sustainability of giant gartersnake populations in the Sacramento Valley.

Rose JP, Halstead BJ, Wylie GD, Casazza ML. 2018. "Spatial and Temporal Variability in Growth of Giant Gartersnakes: Plasticity, Precipitation, and Prey." Journal of Herpetology Volume 52 (Issue 1): Pages 40 to 49.

- Analyzes a long-term dataset on the growth of giant gartersnakes to characterize spatial and temporal variability and evaluate potential environmental predictors of growth.
- States that data were collected on snout-vent length over 22 years from eight sites throughout the Sacramento Valley.
- Finds that growth was positively related to the amount of precipitation that fell during the prior water year and the abundance of anurans at a site.
- Finds that fish and frog abundance interacted to affect snake growth.
- Results highlight the plasticity of growth in giant gartersnake, point to potential environmental drivers of growth, and provide valuable data for demographic modeling.

Rose JP, Ersan JSM, Reyes GA, Gustafson KB, Fulton AM, Fouts KJ, Wack RF, Wylie GD, Casazza ML, Halstead BJ. 2018. "Findings from a Preliminary Investigation of the Effects of Aquatic Habitat (Water) Availability on Giant Gartersnake (Thamnophis gigas) Demography in the Sacramento Valley, California, 2014–17." U.S. Geological Survey Open-File Report 2018-1114. Viewed online at: Giant-Gartersnake. Accessed: December 30, 2020.

- Summarizes the methods and findings of a study conducted by the U.S. Geological Survey, in cooperation with the California Department of Water Resources, to investigate the effect of the availability of aquatic habitat on the demography of giant gartersnakes inhabiting rice growing areas in the Sacramento Valley, California.
- Presents estimates of the abundance, somatic growth, fecundity, and survival of giant gartersnakes from eight sites in the Sacramento Valley studied in 2014 to 2017.
- Presents data on the area of rice growing at each of the eight sites in 2014 to 2017.

Rose, JP, Ersan JSM, Wylie GD, Casazza ML, Halstead BJ. 2018. "Construction and Analysis of a Giant Gartersnake (Thamnophis gigas) Population Projection Model." U.S. Geological Survey

Open-File Report 2017-1164. Viewed online at: Gartersnake-Population. Accessed: December 30, 2020.

- Summarizes the methods and findings of a study conducted by the U.S. Geological Survey, in cooperation with the California Department of Water Resources, to investigate the demography of giant gartersnakes in the Sacramento Valley from 1995 to 2016. The report presents vital rate models of growth, fecundity, and survival of giant gartersnakes, as well as an Integral Projection Model that integrates these component models into a demographic population model.

Bank Swallow

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

California Black Rail

Within this attachment, "Regional Conservation Planning References," provides more details.

Evens J. 2020. "Temporal Response of California Black Rails to Tidal Wetland Restoration." Western Birds Volume 51: Pages 111 to 121.

- Reports that the study monitored three sites that were formerly isolated from tidal influence and converted to farmland that were restored to tidal wetlands.
- Finds that black rails colonized all three sites within 3 to 10 years.
- Finds that all three sites had sources of prospective colonists adjacent to the restored sites.

Tsao DC, Melcer RE Jr., Bradbury M. 2015. "Distribution and Habitat Associations of California Black Rail (*Laterallus jamaicensis cortuniculus*) in the Sacramento–San Joaquin Delta." San Francisco Estuary and Watershed Science Volume 13 (Issue 4).

- Recognizes the lack of California black rail surveys in the Delta.
- States that call–playback surveys were conducted to assess the status of the taxon within a wide range of wetland habitats of the central Delta region.
- Explains that black rails were detected at 21 of 107 discrete wetland habitats in the Delta.
- States that the study developed a model of habitat suitability and a fine-scale vegetation and land use dataset.
- Finds that black rail presence differed from other regions in California, in that it was positively associated with tall (1- to 5-meter) emergent vegetation interspersed with riparian shrubs.

Greater Sandhill Crane

Within this attachment, "Regional Conservation Planning References," provides more details.

Donnelly JP, King SL, Knetter J, Gammonley JH, Dreitz VJ, Grisham BA, Nowak MC, Collins DP. 2021. "Migration Efficiency Sustains Connectivity Across Agroecological Networks Supporting Sandhill Crane Migration." Ecosphere Volume 12 (Issue 6). e03543. 10.1002/ecs2.3543.

- Examines flyway connectivity and monitors long-term trends in agricultural resources and wetland stopover networks with remote sensing, to identify important ownership and landscape factors structuring bird distributions.

Ivey GL, Herziger CP, Hardt DA, Golet GH. 2016. "Historic and Recent Winter Sandhill Crane Distribution in California." Proceedings of the North American Crane Workshop Volume 13: Pages 54 to 66. Accessed: March 2020.Viewed online at: Sandhill-Crane. Accessed: March 2020.

- Maps the observed flock and night roost locations and reviews records of historical occurrences of cranes in California.
- Discusses the expansion and contraction of the crane's range and the contributing factors.
- Suggests that the primary cause of site abandonment is loss of suitable foraging habitat (small grain crops) and that range expansion is principally attributable to expansion of public wildlife refuges, private sanctuaries, and improvement of management.
- Recommends management actions to improve habitat conditions for cranes across the Central Valley wintering range and lists four priority conservation strategies.

Least Bell's Vireo

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Dybala KE, Walsh RG, Seavy NE. 2016. Monitoring Least Bell's Vireo and Comparing Breeding Landbird Populations at the Dos Rios Ranch Restoration Site and San Joaquin River National Wildlife Refuge 2015–2016. Point Blue Contribution No. 2101. Petaluma (CA): Point Blue Conservation Science.

- Describes monitoring objectives, methods, and results for bird surveys and vegetation monitoring at point count stations; riparian landbird response to restoration; and least Bell's vireo monitoring.
- Offers seven recommendations for riparian restoration and evaluation and the management and monitoring of least Bell's vireo and other species at Dos Rios Ranch.

Preston KL, Kus BE, Perkins E. 2021. *Modeling Least Bell's Vireo Habitat Suitability in Current and Historical Ranges in California.* U.S. Geological Survey Open-File Report 2020-1151. Least-Bell-Vireo.

- Develops habitat suitability model for least Bell's vireo across its current and historical range in California.
- Constructs models based on the current range to predict suitable habitat in historical range; constructs alternative models with different combinations of important environmental variables; and selects best-performing models to predict suitable riparian habitat.

Swainson's Hawk

Within this attachment, "Adopted Conservation Plans," and "Regional Conservation Planning References," provide more details.

Fleishman E, Anderson J, Dickson BG, Krolick D, Estep JA, Anderson RL, Elphick CS, Dobkin DS, Bell DA. 2016. "Space Use by Swainson's hawk (*Buteo swainsoni*) in the Natomas Basin, California." Collabra Volume 2 (Issue 1): Pages 5, 1 to 12.

- Describes how satellite-based remote sensing was used to estimate the home ranges of 23 Swainson's hawks on Natomas Basin breeding grounds.
- Evaluates whether the species' space use intensity was associated with land cover, sex, reproductive success, or life stage of offspring.

Western Yellow-billed Cuckoo

Within this attachment, "Adopted Conservation Plans"; "Status Reviews and Critical Habitat Designations"; and "Regional Conservation Planning References," provide more details.

Johnson JJ, Hatten JR, Holmes JA, Shafroth PB. 2017. "Identifying Western Yellow-billed Cuckoo Breeding Habitat with a Dual Modelling Approach." Ecological Modelling Volume 347: Pages 50 to 62. Viewed online at: Yellow-Billed-Cuckoo. Accessed: March 27, 2020.

- Investigates yellow-billed cuckoo habitat on the Lower Colorado River with aerial- and satellite-based models.
- Uses a dual modeling approach to provide a more complete picture of habitat requirements.
- Discusses the benefits and shortcomings of a satellite-based approach.

Riparian Brush Rabbit

Within this attachment, "Status Reviews and Critical Habitat Designations," provides more details.

Kelly PA. 2018. "Reintroduction of the Riparian Brush Rabbit in the San Joaquin Valley, California, USA." Pages 210–215 *in* Soorae PS (ed.), *Global Reintroduction Perspectives: 2018, Case Studies from Around the Globe.* Gland, Switzerland, and Abu Dhabi, United Arab Emirates: IUCN/SSC Reintroduction Specialist Group and Environment Agency–Abu Dhabi.

- Summarizes the species' history and the captive-breeding and reintroduction program.
- Summarizes major difficulties faced by the captive-breeding and reintroduction program including vulnerability to flooding. Describes measures implemented to reduce threats from flooding: construction and vegetation of 34 flood refugia, and vegetation of 19.3 kilometers of river levees formerly kept free of vegetation other than grasses.
- States that the species easily breeds in large semi-natural outdoor enclosures; a quantitative habitat suitability assessment is warranted before initiating reintroduction; an adaptive management approach should be adopted; the need exists to plan for the long term; and it is necessary to involve all stakeholders.
- Discusses the availability of a second population as a captive-breeding source; the cooperative nature of the effort; the availability of public land to anchor reintroduction program (San Joaquin River NWR); the availability of major funding from supportive programs and agencies; the hard work and dedication by team members and California State University, Stanislaus staff, and the support of the Endangered Species Recovery Program.

Matocq M, Kelly P, Rippert J, Phillips S. 2017. Population Genetic Structure of the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*): Using Multiple Marker Systems to Gain Insight into Historic and Ongoing Genetic Connectivity. Prepared for the CVPIA Habitat Restoration Program. Grant Agreement Award F13AP00564. Stanislaus (CA) and Reno (NV). May 15, 2017.

- Identifies the genetic diversity and population genetic structure of four natural remnant populations of riparian brush rabbit and evaluates structural and functional connectivity across the species' range.
- Finds that management and recovery efforts are increasing both structural and functional connectivity for the species.
- Suggests approaches to measure progress toward the recovery goal of re-establishing connectivity and inform planning.

Rippert J. 2017. Population Genetics and Functional Connectivity of the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*): Implications for the Conservation of an Endangered Lagomorph. Thesis. University of Nevada, Reno.

- Assesses genetic diversity, population genetic structure, and structural and functional connectivity of riparian brush rabbits.
- Presents findings that suggest the presence of three genetic clusters within the subspecies corresponding to geographic locations, indicating limited gene flow caused by habitat fragmentation.
- Finds that the augmented population at San Joaquin River National Wildlife Refuge (NWR) retained high levels of diversity and functional connectivity.
- Discusses the value of patch connectivity and wildlife corridors, and restoration implications as they relate to gene flow between populations of riparian brush rabbit.

Tarcha CM. 2020. Behavior and Ecology of the Riparian Brush Rabbit at the San Joaquin River National Wildlife Refuge as Determined by Camera Traps. Master's thesis, California State University Stanislaus. May 2020.

- States that camera traps were monitored from February to August 2017.
- Investigates activity patterns, behavior, and resource use of riparian brush rabbit at restored plant communities and artificial feed sites.
- Discusses effects of flooding on riparian brush rabbit.

Riparian (San Joaquin Valley) Woodrat

Tarcha CM. 2020. *Behavior and Ecology of the Riparian Brush Rabbit at the San Joaquin River National Wildlife Refuge as Determined by Camera Traps. Master's thesis, California State University Stanislaus*. May 2020.

- States that more than 300 pictures of riparian woodrats were obtained at six locations on the San Joaquin River NWR.

New Target Species for the Conservation Strategy Update

These references for delta smelt and tricolored blackbird are in addition to the references cited in the focused conservation plans prepared for each of these species as part of the 2022 Strategy Update.

Delta Smelt

California Natural Resources Agency. 2016. "Delta Smelt Resiliency Strategy 2016." Viewed online at: Delta-Smelt. Accessed: October 26, 2021.

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Tricolored Blackbird

Within this attachment, "Regional Conservation Planning References," provides more details.

Barr K, Beichman AC, Kalhori P, Rajbhandary J, Bay RA, Ruegg K, Smith TB. 2021. "Persistent Panmixia Despite Extreme Habitat Loss and Population Decline in the Threatened Tricolored Blackbird (*Agelaius tricolor*)". Evolutionary Applications Volume 14: Pages 674 to 684.

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U.S. Fish and Wildlife Service. 2019. "Endangered and Threatened Wildlife and Plants; 12-Month Findings on Petitions to List Eight Species as Endangered or Threatened Species." Federal Register Volume 84: Pages 41,694 to 41,699.

U.S. Fish and Wildlife Service. 2019. *Special Status Assessment for the Tricolored Blackbird (Agelaius tricolor), Version 1.1.* February 2019. Sacramento (CA).

U.S. Fish and Wildlife Service. 2019. "Species Assessment and Listing Priority Assignment Form". Region 8, Pacific Southwest Region, Sacramento (CA).

Yellow-Breasted Chat

No additional references are available for this species beyond those provided in Appendix B.3, "Focused Conservation Plan: Yellow-Breasted Chat," and within this attachment, "Regional Conservation Planning References."

Non-target Species

Because the conservation needs of sensitive species change, as do the habitats on which they depend, the 2016 Strategy included provisions for amending the list of target species as part of the five-year update process, using the same criteria as described in Appendix G. Therefore, the potentially suitable species that were not selected as target species (i.e., non-target species) for the 2016 Strategy have been considered for the 2022 Update if they met the criteria in Appendix G of the 2016 Strategy. These species include but are not limited to the delta smelt, western pond turtle, tricolored blackbird, western red bat (*Lasiurus blossevillii*), yellow--breasted chat, and western burrowing owl. As noted above, three additional species have been added to the list of target species for the 2022 Strategy Update. Updated reference materials for non-target species are provided in the following sections.

Western PondTurtle

Within this attachment, "Regional Conservation Planning References," provides more details.

Davidson KA, Alvarez JA. 2020. "A Review and Synopsis of Nest Site Selection and Site Characteristics of Western Pond Turtles." Western Wildlife Volume 7: Pages 42 to 49.

Thomson RC, Wright AN, Shaffer HB. 2016. *California Amphibian and Reptile Species of Special Concern.* Oakland (CA): University of California Press.

Burrowing Owl

Within this attachment, "Regional Conservation Planning References," provides more details.

Ocken MA. 2017. Seasonal Habitat Requirements and Use by the Western Burrowing Owl (*Athene cunicularia hypugaea*) in the Northern Sacramento Valley, Chico. Thesis. California State University, Sacramento.

Other Non-targetSpecies

Literature searches were conducted for the following non-target species that were designated in Appendix G as "associated with target habitat" and "major potential CVFPP effect." Other than those included in the documents described in the "Regional Conservation Planning References," section of this report, no updated reference materials for these species have become available since the release of the 2016 Strategy:

- Western red bat.
- Redhead.
- Yellow warbler.
- Least bittern (*Ixobrychus exilis*).
- Little willow flycatcher (*Empidonax traillii*).

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