U.S. Fish and Wildlife Service

Recovery Outline for Santa Ana sucker (*Catostomus santaanae*)

Santa Ana sucker habitat, Santa Ana River.
Photo credit Christine Medak (USFWS).

Listing Status	Threatened; April 12, 2000 (65 FR 19686)
Critical Habitat Designated	December 14, 2010 (75 FR 77962)
Lead Regional Office	Region 8; Pacific Southwest
Lead Field Office	Carlsbad Fish and Wildlife Office 6010 Hidden Valley Road, Suite 101 Carlsbad, CA 92011 760-431-9440
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Purpose of the Recovery Outline:

This document lays out a preliminary course of action for the survival and recovery of Santa Ana sucker (*Catostomus santaanae*). This document is meant to serve as interim guidance to direct high priority recovery efforts and inform consultation and permitting activities until a comprehensive recovery plan is completed. Recovery outlines are intended primarily for internal use by the U.S. Fish and Wildlife Service (USFWS), and formal public participation in recovery planning will be invited upon the release of the draft recovery plan. However, we will consider any new information or comments that members of the public may wish to offer in response to this outline during the recovery planning process. For more information on Federal survival and recovery efforts for Santa Ana sucker or to provide additional comments, interested parties may contact the Carlsbad Fish and Wildlife Office at the address and telephone number on the front page.

Scope of Recovery and Available Information:

The scope of this recovery outline is a single species, the Santa Ana sucker; however, many of the actions recommended in this outline that will contribute and lead to the conservation of Santa Ana sucker are ecosystem-based. Although this recovery outline does not distinguish actions by watershed, our intent is to evaluate and identify specific actions for each watershed in the draft recovery plan. This recovery outline is based on the best available scientific information contained in the listing decision (USFWS 2000), the proposed listing rule (USFWS 1999), revised critical habitat for Santa Ana sucker (USFWS 2010), the 5-year review (USFWS 2011), and information in our files. Most of the major threats to the species are attributed to hydrological modification and other threats associated with urban development. While some research has been conducted on Santa Ana sucker, little information is available beyond current status and existing threats. Additional research is needed to fully understand what is required for the recovery of this species, especially with regard to management actions that can be implemented to ensure that sufficient suitable habitat is available throughout the species' range. Uncertainties associated with feasible management actions and biology will be resolved to the extent possible through the course of the recovery process and may result in modifications to the USFWS's recovery strategy over time.

I. Status Assessment

A. Biological Assessment

1. Species Description and Life History

Figure 1. Juvenile Santa Ana sucker. Photo credit Christine Medak (USFWS).

Santa Ana sucker is a small, short-lived member of the sucker family of fishes (Catostomidae), named so primarily because of the downward orientation and anatomy of their mouth parts which allow them to suck up small invertebrates, algae, and other organic matter with their fleshy, protrusible (or extendable) lips (Moyle 2002, p. 179) (Figure 1). Santa Ana suckers are generally less than 6.3 inches (in) (16 centimeters (cm)) in length; however, they have been collected at lengths up to 8 in (20.3 cm) (Russell 2010, p. 3). Males and females appear to grow at an equivalent rate (Greenfield *et al.* 1970, p. 174; Moyle 2002, p. 183). Their jaws have cartilaginous scraping edges inside the lips. Their color is silvery-white on the belly and dark gray on the sides and back, with irregular dorsal blotches on the sides and faint patterns of pigmentation arranged in lateral stripes. Membranes connecting the rays of the caudal (tail) fin are pigmented, but the anal and pelvic fins usually lack pigmentation (Moyle 2002, p. 182).

Spawning tubercles (raised growths on sexually mature fish), particularly at the beginning of the breeding season, are present on most parts of the body of breeding males and are heaviest on the anal fin, caudal fin, and lower half of the caudal peduncle (narrow region of body immediately in front of the caudal fin). Female suckers grow tubercles on the caudal fin and caudal peduncle (Moyle 2002, pp. 182–183). Spawning may occur between mid-March to early-July, with peak activity usually in April (Moyle 2002, p. 183). For a small species of the sucker family, fecundity (number of eggs or offspring produced by an individual) of Santa Ana suckers is high and increases linearly with body weight (Greenfield *et al.* 1970, p. 170; Moyle 2002, pp. 183–184). Spawning takes place over gravelly-riffles where fertilized eggs adhere to the substrate and hatch within 360 hours. Larvae measure approximately 0.28 in (7 millimeters (mm)) at hatching (Greenfield *et al.* 1970, p. 169; Moyle 2002, p. 184). Greenfield *et al.* (1970, p. 170) found no gravid female Santa Ana suckers smaller than 1.9 in (49 mm) or 0.07 ounce (2.05 grams). Santa Ana suckers in the Santa Clara River generally mature during their second summer and die at the end of their third summer at 3 to 4.3 in (75 to 110 mm) standard length (Greenfield *et al.* 1970, p. 172). However, some individuals have been observed to survive through a fourth summer reaching a size of 5.5 to 6.3 in (140 to 160 mm) standard length (Moyle 2002, p. 183) and those in the San Gabriel River may survive into their fifth summer (Drake 1988, p. 56). Maximum age appears to vary among the watersheds, for unknown reasons, possibly due to the suitability of habitat and overall fish condition. Further investigation of age structure using otolith (inner ear "bones") analysis is necessary to fully understand the age, growth, and size relationship of Santa Ana sucker across its range.

2. Historical and Current Distribution and Abundance

The Santa Ana sucker's historical range includes the rivers and larger streams in southern California emanating from the San Gabriel and San Bernardino Mountains in Ventura, Los Angeles, Orange, Riverside, and San Bernardino Counties, including the mainstems and tributaries from near the Pacific Ocean to the uplands of the Los Angeles River, Santa Ana River, and San Gabriel River watersheds or hydrologic systems (USFWS 2000, p. 19686). However, information about the distribution of the Santa Ana sucker in many tributaries within its historical range is likely incomplete. For instance, Santa Ana suckers were recently found in San Dimas Creek, a tributary to the San Gabriel River that is isolated by development from the remaining occupied habitat in the San Gabriel River (Chambers Group 2008, pp. 1–3) and had no previous survey reports. Further, it is likely that the species' historical occupancy varied depending on suitability and access (water availability) to these different areas.

The listing rule states that approximately 80 percent of the Santa Ana sucker's historical range has been lost in the Los Angeles River watershed, 75 percent in the San Gabriel River watershed, and 70 percent in the Santa Ana River watershed (USFWS 2000, pp. 19687–19688). Rangewide surveys have not been conducted for this species; however, repeated surveys within portions of the currently occupied range indicate a decline in habitat availability and abundance. The spatial distribution of Santa Ana sucker has further constricted from the range at listing due to habitat modifications mostly attributed to urbanization. The Santa Ana sucker is currently known from all three watersheds and is extant at six of the nine historical occurrences within those watersheds, including the recently documented occurrence in the San Dimas Wash (within the San Gabriel River Watershed) (see Appendix):

1) Santa Ana River Watershed
   - Extirpated: Upper Santa Ana River and Tributaries-Upstream of S. La Cadena Avenue
   - Extant: Middle Santa Ana River and Tributaries-S. La Cadena to Prado Dam
   - Extant: Lower Santa Ana River and Tributaries-Prado Dam to near California State Highway 90

2) San Gabriel River Watershed
   - Extant: San Gabriel River-East Fork
   - Extant: San Gabriel River-West and North Forks
   - Extant: San Dimas Wash
   - Extirpated: Below San Gabriel Dam-San Gabriel River Watershed

3) Los Angeles River Watershed
   - Extant: Big Tujunga Creek
   - Extirpated: Los Angeles River

A population of the Santa Ana sucker is also found in the Santa Clara River. However, we determined at the time of listing, because of its presumed introduced status, not to include the Santa Clara River population in the listed entity of Santa Ana Sucker (USFWS 1999, p. 3916;

USFWS 2009, p. 65058). We have no new information that clarifies the status of this species as native or nonnative to this river. A genetic analysis of the populations in all four watersheds (Santa Clara, Santa Ana, San Gabriel, and Los Angeles) would assist in determining the origin of the species in the Santa Clara River; however, this analysis has not been completed at this time.

The upper limit of the distribution of Santa Ana sucker is likely determined by the in-stream gradient and the inability to physically swim upstream when a certain gradient is exceeded. In an attempt to estimate the maximum slope or gradient that a Santa Ana sucker is capable of passing, we used GIS to analyze the slope of occurrence polygons and known observation points in all three watersheds where listed Santa Ana suckers occur. Results from this analysis indicate that Santa Ana suckers do not occur above areas where the in-stream slope exceeds 7 degrees (USFWS 2009, p. 65061). All tributaries have not been mapped but this information could be useful in determining where to focus future surveys.

Comprehensive surveys and population estimates for the historically or currently occupied geographic area of Santa Ana sucker are lacking. Moyle and Yoshiyama (1992, p. 204) postulated in 1992 that both the Big Tujunga and Santa Ana populations were reduced to below 1,000 individuals per population and that only the San Gabriel population can be considered relatively viable and persisting. More recent survey reports indicate that locations may harbor tens (Drake 1988, p. 52; Baskin *et al.* 2005, p. 1; Swift 2009, p. 3; Ecorp Consulting 2010b, p. 9) to hundreds (Saiki 2000, pp. 11–12; Chambers Group 2004, p. 3; Ecorp Consulting 2007, p. 9) of Santa Ana sucker adults, young-of-year, or larvae. Repeated monitoring has occurred in the Santa Ana River and the San Gabriel River, but has not been repeated in Big Tujunga Creek. In all watersheds that Santa Ana suckers inhabit, abundance is reduced because of the decrease in range (Moyle and Yoshiyama 1992, p. 204).

3. Habitat and Ecosystem

Santa Ana suckers occur in the watersheds draining the San Gabriel and San Bernardino Mountains of southern California. Their historical distribution extended from upper watershed areas to the Pacific Ocean; hence, they are capable of occupying habitats as diverse as mountain streams and rivers in alluvial floodplains (relatively flat landform created by the deposition of sediment over a long period of time from one or many rivers) (Swift *et al.* 1993, pp. 119–121; Moyle 2002, p. 183).

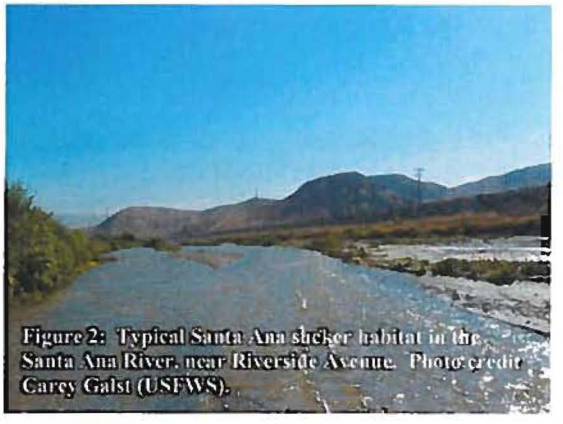


Figure 2: Typical Santa Ana sucker habitat in the Santa Ana River, near Riverside Avenue. Photo credit: Carey Galst (USFWS).

The streams that the Santa Ana sucker inhabits are generally perennial streams (Figure 2) with water ranging in depth from a few inches to several feet and with currents ranging from slight to swift (Smith 1966, p. 57). These streams are naturally subject to periodic, severe flooding (Moyle 2002, p. 183) and may experience extended periods of low flow as a result of drought conditions that are typical of southern California climate cycles (CRWQCB 1995, p. 1-4). However, there are also areas within the range of Santa Ana sucker that experience periods of no flow as a result of the past and current hydrological

modifications (for example dams, diversions, or recharge basins) of the watershed (CRWQCB 1995, p. 1-4). Adequate water quantity and quality are important for the persistence of the Santa Ana sucker throughout urbanized areas. Not only is the presence of water vital to the Santa Ana sucker, the volume and flow rate are important in shaping the watershed and facilitating delivery of coarse substrates to occupied areas. Periodic high flow (flood flows) events are essential because they deliver new sources of coarse (gravel and cobble) substrate to currently occupied areas. Additionally, constant flows within the occupied areas are important to the maintenance of the availability of coarse substrate because these constant lower flows are capable of moving sand and silt but leaving the preferred gravel and cobble substrate.

Santa Ana sucker utilize different substrate types throughout each life stage. The presence of coarse substrates, including gravel, cobble, and a mixture of gravel or cobble with sand and a combination of shallow riffle areas and deeper runs and pools provides optimal stream conditions (Haglund *et al.* 2001, p. 60; Haglund and Baskin 2003, p. 55; Thompson *et al.* 2010, p. 329). This species also prefers habitat containing in-stream or bank-side riparian vegetation that provides shade and cover, especially for larvae and juveniles. However, vegetation is less important for adults because they utilize larger, deeper pools, while riffles are more frequently utilized by than larvae and juveniles (Moyle and Yoshiyama 1992, p. 202; Moyle 2002, p. 183). Open stream reaches with shifting sandy substrates are typically less suitable for development of algae, an important food source (Saiki *et al.* 2007, p. 98) and hence, less suitable as habitat for Santa Ana suckers. Therefore, a stream system that contains the appropriate quantity of coarse substrates with some larger cobbles or boulders to provide the space for Santa Ana sucker's successful reproduction and juvenile development and growth of algae as a primary food source is important for a viable population of Santa Ana suckers.

Specific tolerances to water quality variables such as water temperature, dissolved oxygen, and turbidity have not been determined for Santa Ana sucker. However, they are most abundant in unpolluted, clear water, at temperatures that are typically less than 72 °F (22 °C) (Moyle 2002, p. 183). The continued presence of Santa Ana suckers in the Santa Ana River demonstrates that they are able to tolerate elevated temperatures and turbid conditions (Chadwick and Associates, Inc. 1992, p. 37; Saiki 2000, p. 25; Moyle 2002, p. 183), at least until a threshold level is reached. Mortality has been observed in conjunction with extremely high air and water temperatures in both the Santa Ana River (water temperature of 91.0°F (32.8°C) during summer 2010; SMEA 2010b, pp. 1–2) and Big Tujunga Creek (water temperature in the low to mid-80°F (26.7°C) during summer 2011; C. Galst pers. obs. 2011; T. Hovey pers. comm. 2011).

Tributaries, particularly those located near the confluence of occupied areas of the mainstem of the river, may also provide important habitat for Santa Ana suckers. Surveys have repeatedly reported the presence of adult Santa Ana sucker in breeding condition (tuberculated) and larvae and fry along the margins in tributaries of the Santa Ana River (Chadwick and Associates, Inc. 1992, p. 49; Chadwick Ecological Consultants, Inc. 1996, p. 16; Haglund *et al.* 2002, pp. 54–60, SMEA 2011, p.1). This indicates that tributaries may provide shallow-water refuge for larvae and fry from larger predatory fish and may similarly act as refuge for juvenile and adult Santa Ana suckers during storms. Additionally, the species may be attracted to tributaries due to the relatively colder water temperatures that are typically found in these higher order streams (Swift 2001, p. 26).

4. Taxonomy

Santa Ana sucker was described in 1908 by Snyder as *Pantosteus santa-anae* from the Santa Ana River near Riverside, California (Snyder 1908, p. 33). Smith (1966, pp. 53–58) amended the specific name to eliminate the hyphen and relegated *Pantosteus* to a subgenus of *Catostomus*, which represented a new combination. Currently, the taxonomic classification of Santa Ana sucker is *Catostomus santaanae* and has not changed since it was listed.

5. Genetics

The Santa Clara River population was not included in the listed entity of Santa Ana suckers because there is insufficient evidence that this population was native to the River. However, a study is currently being conducted to address whether the population in the Santa Clara River is native (USFWS 2010c, p. 1–5; see **Species-specific Research** below). This population is also in question because hybrids between the Santa Ana sucker and the Owens sucker have been documented in the Santa Clara River since the 1940s (Hubbs *et al.* 1943, p. 47). Hybrids have been observed in the lower Santa Clara River in the vicinity of the City of Fillmore and within Sespe Creek (Moyle 2002, p. 183). The Owens sucker is endemic to the Owens River watershed in southeastern California and was introduced to the Santa Clara River through transfers of Owens River water via the Owens Aqueduct (Bell 1978, p. 14). Recently, genetic introgression (backcrossing of hybrid offspring with one of its parent species) was detected in both Santa Ana and Owens suckers within the Santa Clara River (Chabot *et al.* 2009, p. 24); however, implications of this hybridization are yet to be determined.

6. Summary Biological Assessment

Santa Ana sucker is one of only a few native fishes currently extant in southern California watersheds. In the three watersheds where Santa Ana suckers occur, their distribution has been reduced. Throughout these watersheds Santa Ana sucker populations appear to experience frequent fluctuations of low and high abundance. This may be characteristic of Santa Ana sucker populations due to the unpredictable fluvial systems (areas of flowing water) they inhabit. Winter flood events may contribute to catastrophic decreases (Greenfield *et al.* 1970, pp. 174–175). Conversely, summer droughts may strand Santa Ana suckers in isolated pools where they may be exposed to unsuitable water quality conditions (Andresen 2001, p. 1). The combination of early sexual maturity, protracted spawning period, and high fecundity allows Santa Ana sucker to quickly repopulate streams following extreme flooding or drought events that may decimate populations (Greenfield *et al.* 1970, p. 177; Moyle 2002, p. 183). However, surveys of gravel and cobble throughout the Santa Ana River indicate that the available suitable habitat areas for successful breeding and feeding are in decline (see discussion above in **Habitat and Ecosystem**; Thompson *et al.* 2010). The ability of Santa Ana sucker to repopulate areas of suitable habitat is high, but if this habitat continues to decline, the ability to repopulate areas decreases and the overall abundance of the species will continue to decline.

B. Threats Assessment

1. Listing Factors/Primary Threats to Santa Ana sucker

The final listing rule (USFWS 2000, pp. 19686–19698) identified the following threats to Santa Ana sucker: habitat destruction, natural and human-induced changes in stream-flow, urban development and related land-use practices, intensive recreation, introduction of nonnative competitors and predators, and demographics associated with small population size. Each threat is classified according to the five listing/delisting factors identified in section 4 of the Endangered Species Act ("Act"; 16 USC 1531 *et seq.*).

The last 5-year review for Santa Ana sucker (USFWS 2011, pp. 1–74) identified the following threats to Santa Ana sucker: modification, fragmentation, and loss of habitat attributed to dams, changes in water allocations, and other hydrological modifications; water quality degradation, impacts to habitat from recreation; loss of habitat from economic development; increased wildfire frequency; and potential effects of nonnative vegetation and predators, which are described below. Of these threats, the impacts attributed to water quality degradation from treated wastewater and increased wildfire frequency are considered new since the time of listing. The primary threat to Santa Ana sucker is attributed to modification, fragmentation, and loss of habitat through hydrological modifications rangewide. A detailed evaluation of all threats is described in the 2011 5-year review (USFWS 2011). In this document, we summarize the threats to Santa Ana sucker.

a. Factor A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Currently, the threats to Santa Ana sucker's habitat or range are primarily attributed to urbanization and the repercussions of human population growth in Los Angeles, Orange, Riverside, and San Bernardino Counties. Modification, fragmentation, and loss of habitat have been the primary reasons for the decline in Santa Ana sucker populations throughout its range and continue to be significant threats to the recovery of the species. At the present time, it appears that there is insufficient suitable habitat within the currently occupied range for the species to recover (Thompson *et al.* 2010). We categorize Factor A threats (all of which are attributable to urbanization) to Santa Ana sucker's habitat or range into the following categories: (1) Hydrological modifications, (2) water quality, (3) increased fire frequency, (4) off-highway vehicle (OHV) use, (5) mining activities, and (6) nonnative vegetation.

Throughout Santa Ana sucker's range, the hydrology of the watershed has been modified through human activities such as: (1) Construction and operation of dams or other barriers that interrupt dispersal and modify habitat near the flood basin such that it is no longer suitable, and (2) water diversion and channelization of streambeds or construction of roads and other permanent impervious surfaces that modify stream processes and degrade habitat. Although no additional barriers to dispersal or further fragmenting Santa Ana sucker populations have been built since its listing, impacts to habitat have been amplified as a result of the permanent modifications to the watersheds and the Santa Ana sucker remains in a very small portion of its historical range. For example, in the Santa Ana River, flood control construction and

maintenance, water diversions, and impediments, such as drop structures and dams, have modified the hydrological process throughout the watershed. This in turn, has further impacted the suitability of available habitat for Santa Ana sucker since the time of listing.

Current and permitted future water diversions for human uses have appropriated nearly all of the available water in the Santa Ana River watershed (CRWQB 2010, p. 2). As in-stream water quantity continues to diminish, water quality will become increasingly important to the habitat for continued survival and recovery of the Santa Ana sucker. Water quality may be degraded by point and non-point sources of pollution associated with urbanization. Pollutants may include oil, gas, metals, and other anthropogenic chemicals and nutrients. Wastewater-dominated rivers, like the Santa Ana River, are subject to increased inputs of regulated contaminants including inorganics (for example, chlorine, nitrates, ammonia, sulfides and metals), plasticizers, organochlorine insecticides, polynuclear aromatic hydrocarbons, solvents, and non-ionic detergent metabolites (Kolpin *et al.* 2002, pp. 1202–1211). Wastewater-dominated rivers are also subject to inputs of as yet unregulated "emerging" contaminants including new generation pesticides, steroids and hormones, personal care products, prescription and non-prescription drugs, antibiotics, household disinfectants, insect repellants, fire retardants and others (Kolpin *et al.* 2002, pp. 1202–1203). Water quality is important rangewide, as there are both point source and non-point source inputs in all three of the watersheds that may adversely impact habitat for the Santa Ana sucker.

Increased frequencies of wildfire may impact riparian vegetation throughout occupied and unoccupied reaches of all three watersheds. The loss of riparian vegetation may impact water transport, sediment transport, water quality, and flow regime. Although increased frequencies of wildfire may have devastating impacts on Santa Ana sucker locally, wildfire is currently not considered a substantial threat but has the potential to have rangewide detrimental impacts.

OHVs impact both riparian and in-stream habitat that is important for Santa Ana suckers. Users of OHVs may drive along the banks of rivers, which can degrade bank stability and lead to erosion, and damage riparian plant communities that provide shade over the river and increase bank stability. OHVs may also drive through the river and disturb sediments, create increased turbidity, potentially crush Santa Ana suckers, and otherwise disturb substrates that Santa Ana suckers require for feeding and rearing young. The threat of OHV use is currently not considered a substantial threat but has the potential to have rangewide impacts.

Sand and gravel are used as construction aggregate for public works projects such as roads and highways and a multitude of other commercial uses (Kondolf 1997, p. 540). In-stream mining alters the channel geomorphology and bed elevation, and can require water diversion, clearing, and excavation (Kondolf 1997, p. 541). The practice of in-stream mining may induce channel incision and erosion, but more importantly for Santa Ana suckers, mining for gravel and sand removes necessary substrates from the watershed and discharges fine residual sediment back into the watershed. Additionally, suction dredging to find precious minerals is generally a recreational activity that occurs most frequently on U.S. Forest Service (USFS) lands. As of August 6, 2009, California Department of Fish and Game (CDFG) imposed a moratorium on in-stream suction dredging until the State of California completes a court-ordered environmental review, and adopts a permitting program (CDFG website viewed October 14, 2010). Sluicing

and high banking, techniques also used to find precious minerals, are likely occurring in the San Gabriel River and to a lesser extent in Big Tujunga Creek (Welch 2010, pers. comm.). However, the threat of impacts from mining operations is currently not considered a substantial threat but has the potential to have rangewide impacts.

Aquatic habitat may be modified by the presence of nonnative vegetation in a variety of ways. *Arundo donax* is an aquatic plant in the genus of perennial reed-like grasses (Poaceae). It is a nonnative giant reed species that is often found growing along lakes, streams, and other wetted areas. Compared to other riparian vegetation, it is known to use excessive amounts of water to supply its exceptionally high growth rates (Bell 1997, p. 104). This species is considered a primary threat to riparian corridors because of its ease of establishment and ability to alter the hydrology of the system. *Arundo donax* tends to form large, continuous, clonal root masses that stabilize the banks of the river or stream, which alters the flow regime of the system and prevents natural dynamic processes of stream meandering and deposition and scouring of sediments to occur (Bell 1997, p. 106).

As a consequence of increasing urbanization throughout the range of Santa Ana sucker, the threats identified at listing have not been ameliorated and Santa Ana sucker's habitat has continued to be modified in each of the watersheds. Impacts from these threats are increasing and new threats have been identified that impact Santa Ana sucker and its habitat. Impacts attributed to modification, fragmentation, and loss of habitat, a result of dams and other hydrological modifications, combined with the threat of water quality degradation, modification of habitat for recreation and development, increased wildfire frequency, and potential effects of nonnative vegetation and predators have a cumulative effect on Santa Ana sucker and its habitat. Though two of the six Santa Ana sucker occurrences are addressed in management plans, the threat of habitat modification, fragmentation, and loss is considered substantial and has increased since listing.

b. Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The 2000 listing rule indicated that CDFG reported the illegal harvest of Santa Ana suckers with gill and throw nets in the Santa Ana River below Prado Dam (M. Maytorena, CDFG, pers. comm. 1997). Since listing, we received information that Santa Ana suckers may be a food source for people living in encampments along the Santa Ana River and there may be a correlation of this illegal activity to the observed decline in Santa Ana suckers with proximity to these camps (Russell 2007, p. 13). However, the relative impact of illegal harvesting of the species is unknown. We have no information indicating that overutilization of Santa Ana sucker in the San Gabriel or Big Tujunga Creek watersheds has historically or is currently a substantial threat to Santa Ana sucker.

c. Factor C: Disease or Predation

Disease

We have no information indicating that disease is a substantial threat to the continued existence of Santa Ana suckers throughout most of its range.

Predation

The abundance of nonnative predators has risen dramatically throughout the currently occupied range of Santa Ana sucker. Throughout Santa Ana sucker's range, voracious piscivorous (habitually feeding on fish) predators such as bass and sunfish (Family Centrarchidae), tilapia (Family Cichlidae), carp (Family Cyprinidae), and catfish (Family Ictaluridae) are regularly reported. An increase of nonnative predators suggests predation pressures may significantly impact Santa Ana sucker. Additionally, nonnative vegetation (*Arundo donax* (giant reed) and *Tamarix ramosissima* (saltcedar)) may be present in all three watersheds and may modify in-stream habitats (Zembal and Hoffman 2000, p. 69), potentially leading to changes in fish assemblages. *Arundo donax* is very common in the Santa Ana River watershed (Zembal and Hoffman 2000, p. 69), and may be present in the lower reach of Big Tujunga Creek, and in the San Gabriel River. Flows may become diminished and sandy pools may form in areas where *A. donax* is common. Slow moving flows and pools are preferred habitat for nonnative predators such as largemouth bass (*Micropterus salmoides*) and green sunfish (*Lepomis cyanellus*), which have been suggested to prey heavily on Santa Ana suckers (Moyle 2002, p. 185; Saiki 2007 *et al.* p. 97). Though impacts appear to be increasing, further study is needed to determine the quantity of Santa Ana suckers consumed by nonnative predators to better describe the magnitude of this threat.

d. Factor D: Inadequacy of Existing Regulatory Mechanisms

In the listing rule, regulatory mechanisms thought to have some potential to protect Santa Ana sucker included: (1) California Endangered Species Act (CESA) (where the Santa Ana sucker occurred in areas where state-listed species are located), (2) California Environmental Quality Act (CEQA), (3) National Environmental Policy Act (NEPA), (4) Clean Water Act (CWA), (5) the Act (where, prior to listing, Santa Ana sucker co-occurred with other federally listed species), and (6) land management or conservation measures by Federal, State, or local agencies or by private groups and organizations (USFWS 2000, pp. 19686–19698). The listing rule provides an analysis of the potential level of protection provided by these regulatory mechanisms.

The status of regulatory mechanisms and their adequacy for protection of Santa Ana sucker remains largely unchanged since listing; however since listing, critical habitat has been designated for the species, and one habitat conservation plan, the Western Riverside County Multiple Species Habitat Conservation Plan (Western Riverside County MSHCP; see **Conservation Assessment – Habitat Conservation Plans** below for a description of this HCP), for which Santa Ana sucker is a covered species, was permitted and is currently being implemented. Several State and Federal mechanisms provide a conservation benefit to Santa Ana sucker. However, the Act is the primary Federal law that provides protection for this

species since its listing as threatened in 2000 (see **Conservation Assessment – Section 7 Consultations and Critical Habitat** sections below). Critical habitat was revised in 2010 (see **Conservation Assessment – Critical Habitat** below) and was designated throughout the range of the listed Santa Ana sucker, including unoccupied areas essential for the conservation of the species. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. One of the six extant Santa Ana sucker occurrences (Middle Santa Ana River and Tributaries – S. La Cadena Avenue to Prado Dam) has a management plan (Western Riverside County MSHCP) in place that directly affords protections for impacts to the species and its habitat. Therefore, in absence of the Act, other laws and regulations have limited ability to protect the species. Inadequacy of existing regulatory mechanisms is not considered a threat to the species.

e. Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

Threats associated with small population size affect Santa Ana suckers rangewide. Small population size may be the result of several conditions, including local extirpations or ongoing natural or artificial factors limiting establishment and survival of the taxon. Stochastic events represent a significant threat to small populations. In the case of Santa Ana suckers, consecutive survey data over the last 10 years indicate that fish density is decreasing in areas in the Santa Ana River and San Gabriel River (SMEA 2009, p. 1; Ecorp Consulting 2010b, p. 14) and fish density tends to be variable in Big Tujunga Creek (Ecorp Consulting 2010a, p. 5; Haglund and Baskin 2010, Appendix 1). Stochastic events that could destroy these smaller occurrences include flood, fire, or drought. Given the impact these events could have on any of the three watersheds where Santa Ana suckers exist, they represent a potential threat to the species as a whole.

Threats associated with degraded water quality affect this species primarily in the Santa Ana River, but may increase with added recreational use and continued development in the other watersheds. Potential impacts to individual Santa Ana suckers based on water quality include (but are not limited to): elevated temperatures attributed to global climate change, low oxygen levels attributed to increased nutrients causing algal blooms and increased ammonia levels that are toxic to fish. Each of these scenarios may result in degradation of water quality in occupied habitat that may result in elevated stress of the fish, lower reproductive input, or death. Additionally, water quality may be decreased due to elevated levels of chemicals that may result in disease or damage to their anatomy and physiology (for example, gills, endocrine disruption). Few chemicals have been specifically tested on Santa Ana suckers to evaluate direct impacts to the individual. We note that while many chemicals are regulated, there are many that are unregulated. More information is needed to adequately assess the impact of chemical pollutants on Santa Ana sucker; however, this threat has the potential to impact the species rangewide.

A newly identified potential threat from degraded water quality that may have direct impacts to Santa Ana suckers in the Santa Ana River is the presence of residual chemicals found in treated wastewater and urban run-off that is released into the watershed (see examples listed above under Factor A). The multiple wastewater treatment plants along the Santa Ana River that discharge treated (generally tertiary treated) water directly into the river may contain residual

chemicals that may be harmful to Santa Ana suckers. There are approximately 17 different permitted, publicly-owned treatment works (POTWs) in the Santa Ana River Basin that provide treated wastewater to the occupied reaches of the Santa Ana River. Five of the POTWs discharge treated wastewater 100 percent of the year and make up a majority of the water present in the mainstem of the Santa Ana River during the dry summer months (Mendez and Belitz 2002, p. 1; CRWQCB 2008, p. 1-11; D. Woelfel, CRWQCB, pers. comm. 2010; USFWS 2008, pp. 2–3). A recent study conducted by Jenkins *et al.* (2009, p. 1) indicated that there is a significant potential for impacts to endocrine and reproductive systems in western mosquitofish (*Gambusia affinis*), a co-occurring species of Santa Ana sucker, from the presence of residual chemicals (such as endocrine disrupting compounds and organic wastewater components) in released wastewater. These results have led to a subsequent study using Santa Ana suckers that will investigate their tolerance to many chemicals commonly found in wastewater and urban run-off; tolerance levels will also be compared to other species normally tested and used to develop water quality criteria and objectives (USFWS 2008, p. 4; see **Conservation Assessment – Species-specific Research**). Habitat quality impacts as a result of degraded water quality from water discharged from POTWs may be amplified because of the limited availability of cleaner, natural water to flush out or dilute residual chemicals. The extent that water quantity may threaten the Santa Ana sucker in the San Gabriel River or Big Tujunga Creek is not well known, but is assumed to be lower than in the Santa Ana River, because these populations are located upstream of developed urban areas and POTWs are not common in these upper watershed areas.

There is a great deal of uncertainty in determining the lethal upper temperature limit of individual Santa Ana sucker and more information is necessary to determine the possible impacts from global climate change. Santa Ana suckers are capable of withstanding temporal changes in water temperature (Saiki *et al.* 2007, pp. 98–99); however, fish may not have access to areas with cool, clean water because of lack of water or barriers to dispersal. Furthermore, the current disconnectedness of watersheds may be exacerbated by the predicted decreases in annual precipitation. All life stages of Santa Ana suckers require cool water (Saiki *et al.* 2007, pp. 99–100). Increasing air temperatures and decreasing precipitation levels, predicted to occur as a result of global climate change, are likely to impact the availability of suitable cooler-water habitat. Though difficult to quantify, change in global climate may impact all occurrences of Santa Ana sucker and poses a significant threat to this species in the future.

Due to the threat of vulnerability of small populations from stochastic processes, degraded water quality, and potential impacts from global climate change, Factor E threats continue to threaten Santa Ana sucker.

2. Summary Threats Assessment

The primary threat to Santa Ana sucker is attributed to habitat loss, degradation, and modification through hydrological modifications rangewide. This threat is likely to continue to increase and may result in further impacts to the species. The impacts attributed to loss of available habitat (caused by dams, changes in water allocations, and other hydrological modifications) combined with increasing secondary threats (such as water quality degradation, impacts to habitat from recreation, loss of habitat from development, increased wildfire frequency, and potential effects of nonnative vegetation and predators) have a cumulative effect

on Santa Ana sucker and its habitat, thereby increasing the potential extirpation of the fish in all watersheds. Additionally, all Santa Ana sucker occurrences are isolated by impassable barriers or unsuitable habitat, which limits gene flow among occurrences, thus increasing the vulnerability of small populations to a range of environmental and genetic stochastic factors.

Threats have not been abated and have continued to increase within each of the three occupied but heavily impacted watersheds. The increasing pressure for water conservation (storage) for human use through dams and water diversions, urbanization, recreation, degraded and fragmented habitat, degraded water quality, the vulnerability of small populations, and global climate change indicate that Santa Ana sucker faces increasing threats throughout much of the range. The Santa Ana sucker faces a high degree of threat with a low recovery potential and proactive efforts are needed to aid in the continued survival and recovery of this threatened species.

Immediate work through cooperation with our partners could be conducted to help reduce impacts from several current threats. In particular, work could be done to investigate impacts to habitat from hydrological modifications by identification of barriers and potential structural modifications to reduce impacts to fish passage and water and sediment transport, quantification of water allocations including water inputs and diversions, and sediment transport throughout each watershed. Studies could be conducted to determine age class structure in each of the watersheds and implement rangewide monitoring to better assess population sizes and fluctuations. Efforts could also be initiated to reduce impacts from predators and OHVs in occupied areas. Finally, habitat restoration could be conducted in occupied tributaries. Actions to help alleviate these threats are identified below in the preliminary action plan where we discuss the immediate actions we believe are necessary to arrest and reverse the general population decline. These actions are feasible and would help to reverse the population decline and increase the available suitable habitat occupied by Santa Ana sucker.

C. Conservation Assessment

1. Species-specific Research

Since listing, many entities have undertaken yearly surveys of the taxon throughout its range; however, there has not been a coordinated, consistent effort among the three watersheds. Species-specific projects and activities have been conducted in each of the three watersheds where Santa Ana sucker occur. There have been studies exploring life history parameters, population dynamics and demographics, habitat assessments, environmental conditions, and possible restoration sites. These studies have been important for making decisions regarding the status of the species and the current conditions within each of the watersheds. Other activities have also occurred for the benefit of Santa Ana sucker such as nonnative vegetation and nonnative predator removals.

There are currently 17 individuals (or companies) permitted to conduct recovery activities under section 10(a)(1)(A) of the Act for Santa Ana sucker. Most recovery permits cover presence/absence surveys that generally allow for capture, handling, and release of individuals encountered while conducting authorized surveys. Additionally, some permittees are authorized

to conduct more invasive activities, such as collecting biological samples (fin clips), measuring/weighing individuals, or collecting specimens.

Santa Ana Sucker Conservation Program (SAS Conservation Program)

The Santa Ana Sucker Conservation Program (SAS Conservation Program; a multi-agency partnership of Federal, State, and local governmental agencies and the private sector) has funded fish surveys since 2001 and habitat assessments since 2006 in the Santa Ana River, both of which are expected to continue indefinitely. The Orange County Water Control District (a participant in SAS Conservation Program) has regularly conducted predator removals, experimental habitat enhancements, and habitat surveys. The SAS Conservation Program has also supported and funded projects to better understand fish health and water quality, distribution, movement, spawning, impacts of wastewater treatment facility operational discharge regimes, and potential restoration sites within the middle and lower Santa Ana River (see Table 1 below; Swift 2001, pp. 23–36; Allen 2003, pp. 10–11; Saiki *et al.* 2007, pp. 93–95; SMEA 2010, pp. 1–12).

Riverside-Corona Resource Conservation District (Riverside-Corona RCD)

A native fish stream was constructed by the Riverside-Corona Resource Conservation District (Riverside-Corona RCD) in 2000 as a location to mimic natural habitat for native fishes and aid in recovery efforts (Russell 2008, p. 3). They have since built five research scale raceways or artificial streams where Santa Ana suckers are successfully housed and reared, although they are currently only used for research and not for raising fish to release into the wild. The site continues to collect data and information on native fish augmentation success and reproduction.

Santa Ana suckers have been successfully reared in captivity at the Riverside-Corona RCD site since 2009. The use of artificial streams has enabled researchers to learn more about the life history and basic biology of Santa Ana suckers, which will contribute to a better understanding of its biological needs in the wild. Rearing all life stages of Santa Ana suckers in captivity provides for the ability to conduct various research projects and allows researchers to work with specimens of known age and origin.

USFWS Funded Investigations – Environmental Contaminants

A research project investigating the contaminant sensitivity of Santa Ana sucker to pollutants is being conducted by the USFWS's Environmental Contaminants Program in coordination with the Riverside-Corona RCD and the U.S. Geological Survey's (USGS) Columbia Environmental Research Center (USFWS 2008, p. 2). The main objective of the project is to provide resource managers with information to help ensure that the water quality of streams currently occupied or potentially occupied by Santa Ana sucker are of sufficient quality to ensure this species' continued existence and recovery (USFWS 2008, p. 2). This project was designed to investigate the effects of both regulated and unregulated chemicals on Santa Ana suckers. Specifically, the study will investigate five standard chemicals used from previous studies (such as carbaryl,

Table 1: Actions funded and carried out by the SAS Conservation Program

Year	Action	Outcome
1999	Comparative study on fish health and water quality between the Santa Ana and San Gabriel Rivers	Report (Saiki 2000); Journal Article (Saiki *et al.* 2007)
1999-2000	Study on distribution, abundance, spawning areas, and nonnative predators	Report (Swift 2001)
2001	Studies to assess reproductive monitoring and migration	Yearly report
2001-2010	Population estimates (3-4 locations in SAR)	Yearly report
2002-2003	Study on spawning success of Santa Ana sucker and potential effects of temporary shutdowns at the Rapid Infiltration and Extraction (RIX) Facility	Report (Allen 2003)
2002-2004	Pit tagging to determine movement patterns	Yearly report
2002-2004	Study on habitat utilization and preferences of all lifestages	Yearly report
2004	Study on predation of young Santa Ana suckers	Yearly report
2004	Habitat enhancement project - addition of gravel substrate to Sunnyslope Creek	Failed project - gravel washed out by large storm event
2006-2010	Riverwalk - Habitat surveys	Journal article (Thompson *et al.* 2010)
2009	Updated Conservation Plan	Biological Assessment (SAS Team 2009)
2010	Sunnyslope Creek Restoration - Feasibility study	Report (SAWA 2010)
2010	Survey of suitable habitat in drains	SMEA 2010
2011	Pre- and Post-Seven Oaks Dam test-release habitat survey	Meeting presentation; Yearly report
2011	Sunnyslope Creek Restoration	On-going

copper, 4-nonylphenol, pentachlorophenol, permethrin), two pharmaceuticals that are prevalent in wastewater-influenced water bodies (such as ibuprofen and triclosan), and four substances typically considered for waste discharge permit requirements (such as chlorine, ammonia, nitrite, and sulfides). When completed, results of this study are expected to provide critical information regarding the sensitivity of the Santa Ana sucker relative to other commonly tested species used to derive water quality objectives (USFWS 2008, p. 4).

USFWS Funded Investigations – Showing Success Program

A genetics project investigating the origin of the Santa Clara River population of Santa Ana sucker and the uniqueness of the populations in the three watersheds where Santa Ana sucker is listed is being conducted by the USGS (USFWS 2010, pp. 1–5). The results from this study will contribute to our understanding of the origin of the Santa Clara population. It will also determine whether, and to what extent, populations are genetically separated and determine their uniqueness. When completed, results of this research will help to guide future potential reintroduction actions for the conservation of the species (USFWS 2010, pp. 1–2).

Los Angeles County Department of Public Works

In Big Tujunga Creek, the Los Angeles County Department of Public Works funded 2 years of work to survey habitat suitability and monitor fish populations (Haglund and Baskin 2010, p. 1). This work provides detailed and fine-scale information on habitat suitability and availability in Big Tujunga Creek. Survey results were disseminated in a Google Earth format that is efficient for use and provides for easy updating/modifying when consecutive year's survey results become available (LACDPW 2009, Google Earth kmz file). This will facilitate use by stakeholders and provide a direct benefit to Santa Ana sucker by making its presence readily known in the watershed. This agency also conducts regular predator removals from the Big Tujunga Mitigation Bank in an effort to maintain suitable habitat for Santa Ana sucker.

U.S. Forest Service (USFS)

USFS has conducted native fish surveys for Santa Ana sucker on USFS lands (Tennant 2004; Tennant 2006) and conducts yearly monitoring within the San Gabriel Canyon OHV area (Ecorp Consulting 2007; Ecorp Consulting 2010b). Additionally, they have implemented nonnative plant removals in some areas where Santa Ana sucker will benefit from this activity. The removal of nonnative vegetation in riparian areas where Santa Ana sucker occurs will provide space for native vegetation to persist and natural processes to occur.

California Department of Fish and Game (CDFG)

CDFG conducted Santa Ana sucker presence/absence surveys and a habitat utilization study in the San Gabriel River (Ally 2003, pp. 1–22; Hernandez 1997, pp. 1–7) and Big Tujunga Creek (O'Brien and Stephens 2009, pp. 1–9). CDFG has also identified current threats within Big Tujunga Creek and continues to monitor the status of Santa Ana sucker throughout the watershed (O'Brien and Stephens 2009, pp. 1–9). The continued monitoring and identification

of occupied areas throughout the Angeles National Forest in the San Gabriel River and Big Tujunga Creek provides important information on Santa Ana sucker.

2. Habitat Conservation Plans

Since the time of listing only one Habitat Conservation Plan (HCP) has been completed that addresses non-federal projects (evaluated under section 10(a)(1)(B) of the Act) that may result in incidental take of the Santa Ana sucker. The Western Riverside County MSHCP was permitted on June 22, 2004, and is a regional, multi-jurisdictional HCP encompassing about 1.26 million ac (510,000 ha) in western Riverside County, which covers the Middle Santa Ana River occurrence of Santa Ana suckers. This Western Riverside County Multiple Species HCP (Western Riverside County MSHCP) addresses 146 listed and unlisted "covered species," including the Santa Ana sucker, and was designed to establish a multi-species conservation program that minimizes and mitigates the effects of expected habitat loss and associated incidental take of covered species. The Western Riverside County MSHCP will establish approximately 153,000 ac (61,917 ha) of new conservation lands to complement the approximately 347,000 ac (140,426 ha) of pre-existing natural and open space areas to form the overall Western Riverside County MSHCP Conservation Area over the 75-year permit period (USFWS 2004, p. 2).

The Western Riverside County MSHCP is intended to reduce the threats to Santa Ana sucker and its habitat by placing large blocks of habitat into preservation throughout the Conservation Area. The Western Riverside County MSHCP identifies five conservation objectives that will be implemented to contribute to the long-term conservation of the Santa Ana sucker (Dudek and Associates, Inc. 2003, pp. F-19–F-20; USFWS 2004, p. 258). As outlined in the Western Riverside County MSHCP, the goal is to conserve 3,480 ac (1,408 ha) of habitat for the Santa Ana sucker (USFWS 2004, p. 258). This goal relies primarily on coordinated management between multiple landowners of existing Public/Quasi-Public lands (existing lands with many landowners that provide conservation value within the HCP area) and new reserve lands gained through acquisition or other dedications of land assembled from within the plan area.

The Western Riverside County MSHCP permittees are required to implement management and monitoring activities. For the Santa Ana sucker, the Western Riverside County MSHCP specifically identifies conservation objectives to: (1) provide long-term conservation for the species, (2) develop a management and monitoring plan for the species, and (3) mitigate for impacts to Santa Ana sucker habitat that are associated with permittee activities (Dudek and Associates, Inc. 2003, pp. 6-24, F-19–F-20; USFWS 2004a, p. 258). Although conservation measures detailed in the plan and subsequent biological opinion have not yet been completed, we recognize that they are anticipated through the implementation of the Western Riverside County MSHCP and should be fully realized within the 75-year permit period.

3. Projects Evaluated Under Section 7 of the Act

Federal projects (evaluated under section 7 of the Act) may result in incidental take of Santa Ana sucker. Since the time of listing, we conducted 17 formal consultations under section 7 of the Act on projects that resulted in incidental take of Santa Ana sucker and impacts to habitat or the riparian area that is currently designated as critical habitat. Twelve informal consultations were

conducted on projects that were determined not likely to adversely affect Santa Ana sucker or the area that is currently designated as critical habitat for the Santa Ana sucker. Formal consultations addressed project impacts to Santa Ana sucker or designated critical habitat as a result of: dam operations; flood control activities such as levee installation or repair, bridge repair, replacement or modification, sediment removal, and bank stabilization; wastewater treatment releases; and nonnative vegetation removals. None of the biological opinions that were issued as a result of the formal consultations determined jeopardy to the species or an adverse modification of critical habitat. Incidental take was issued for 372 fish within the impacted areas, of which at least 266 were confirmed to have died. A total of 1,329 fish were translocated from the impacted areas, although survival and long-term survival of these fish in their new habitats is difficult to assess and unknown at this time. A total of 13 ac (5 ha) of in-stream habitat and 750 ac (304 ha) of riparian habitat were impacted as a result of the activities addressed in the formal consultations.

Santa Ana Sucker Conservation Program (SAS Conservation Program)

Many permittees of the Western Riverside County MSHCP are also participants in the SAS Conservation Program. This program was intended by the Western Riverside County MSHCP permittees to address activities not covered by the Western Riverside County MSHCP. Although not formally an HCP, the SAS Conservation Program was developed over a 10-year period and is the result of a multiagency partnership of Federal, State, and local governmental agencies and the private sector that encourages a river-wide approach to conservation of the Santa Ana sucker and its habitat. The Program encompasses the Santa Ana River and the lower reaches of its tributaries extending generally from Tippecanoe Avenue in San Bernardino County to Chapman Avenue in Orange County; a distance of approximately 31 miles (48.3 kilometers) (Santa Ana Watershed Project Authority 2008, pp. 13–18). The CWA section 404 application submitted to the Army Corps of Engineers (ACOE) by the agencies participating in the SAS Conservation Program addresses operation and maintenance activities proposed in the Santa Ana River and implementation of the SAS Conservation Program; this application is currently under review by the ACOE. The activities addressed in this program are currently being analyzed by the Service under section 7 of the Act and a biological opinion will be prepared that addresses the on-going operation and maintenance activities in the Santa Ana River conducted by program participants. Implementation of the SAS Conservation Program is intended to remove and reduce threats to this species and the features essential to its conservation by reducing project impacts to the Santa Ana sucker, such as establishing vehicle crossings, ensuring that wastewater treatment facilities maintain flows for the Santa Ana sucker, and conducting habitat restoration and predator removal. The program also funds various research and monitoring activities for the Santa Ana sucker (see above Species-specific Research: *Santa Ana Sucker Conservation Program (SAS Conservation Program)*).

4. Critical Habitat

On December 14, 2010 (75 FR 77962–78027), critical habitat was revised for Santa Ana sucker, designating critical habitat in Los Angeles, Orange, Riverside, and San Bernardino Counties, California. The designated critical habitat includes approximately 9,331 ac (3,776 ha) of Federal, State, and private lands. Three units were designated (Unit 1: Santa Ana River, Unit 2:

San Gabriel River, and Unit 3: Big Tujunga Creek (Los Angeles River)). Designated areas that were occupied by the Santa Ana sucker at the time of listing contain the physical and biological features essential to the conservation of Santa Ana sucker and may require special management considerations or protection. Additionally, certain areas have been designated critical habitat that are outside the areas occupied by Santa Ana sucker at the time of listing that are essential for the conservation of the species. These areas are essential because they contribute to the maintenance of the physical and biological features within the occupied critical habitat by providing sources of water and coarse sediments necessary to maintain all life stages of the Santa Ana sucker.

There are significant regulatory and educational benefits to designation of critical habitat within areas both occupied and unoccupied by Santa Ana sucker (December 14, 2010, 75 FR 77962–78027). The principal benefit to the species of critical habitat designation is the requirement that Federal agencies consult with the Service under section 7 of the Act to ensure actions they fund, authorize, or carry out do not result in the destruction or adverse modification of any designated critical habitat. We anticipate that a Federal nexus for section 7 consultation (with the ACOE under the Clean Water Act) will exist for most activities within the designated critical habitat areas (see **Projects Evaluated Under Section 7 of the Act**).

The educational benefit of designating critical habitat can be significant because the process of proposing critical habitat provides the opportunity for peer review and public comment on areas we propose to designate as critical habitat, our criteria to assess those lands, potential impacts from the proposal, and information on the taxon itself. Public education regarding the potential conservation value of an area may also help focus conservation and management efforts on areas of high conservation value for certain species.

5. Summary Conservation Assessment

There have been studies on the Santa Ana sucker exploring life history parameters, population dynamics and demographics, habitat assessments, environmental conditions, and possible restoration sites, but there have not been large-scale assessments of the effects of hydrological modifications on the species throughout its range. The small-scale efforts that have been on-going need to be expanded to be effective in informing our recovery planning. Continued coordination and partnerships among Federal partners and permittees and participants of the Western Riverside County MSHCP and SAS Conservation Program, respectively, are essential for guiding recovery actions for Santa Ana sucker.

D. Summary of Recovery Status and Needs

Historical Santa Ana sucker habitat has been drastically degraded and fragmented from hydrological modifications, resulting in the species' reduced geographic range and vulnerability to stochastic events. Increased distance between suitable habitats has likely resulted in reduced genetic exchange between populations and reduced ability to colonize new or previously occupied habitat. Life history traits of the sucker (for example, early sexual maturity, protracted spawning period, high fecundity) are conducive to re-colonization; however, it appears that there is insufficient suitable habitat within the currently occupied range for the species to recover (Thompson *et al.* 2010). As successful captive breeding programs have already been developed by

partners, reintroduction to existing or restored habitat may be a viable option to increase distribution and abundance if suitable habitat is available. The sucker is dependent on a habitat that has been, and continues to be, under developmental pressures. Its habitat requires protection and active management to improve and restore suitable habitat in order to prevent further decline and to enable recovery of the species. Additionally, research, monitoring, and nonnative species removal already underway by the USFWS and partners should be expanded throughout the species range. Key challenges will be developing a recovery strategy that can be implemented in a system where there are continuing human-use water needs and requirements for flood control operation to maintain human health and safety.

II. Preliminary Recovery Strategy

A. Recovery Priority Number

The recovery priority number for Santa Ana sucker is 5C according to the USFWS's 2011 Recovery Data Call for the Carlsbad Fish and Wildlife Office and 2011 5-year review, on a scale of 1C (highest) to 18 (lowest; the "C" indicates the potential for conflict with human economic activities) (USFWS 1983, pp. 43098–43105). This number indicates the species faces a high degree of threat, has a low potential for recovery, and has taxonomic status as a species. The high degree of threat is due to potential loss of water supply, pollution, the highly urbanized nature of the Santa Ana River, significant pressure placed on the population by recreational use and flood control restrictions, predation by introduced predators, and susceptibility of small populations to random catastrophic events. The low potential for recovery is due to the significant amount of effort needed to secure the required water supply, restore habitat, and secure funding for research and water quality standard revisions needed to protect Santa Ana sucker from pollution. The "C" indicates conflict with construction or other development projects or other forms of economic activity, specifically water allocations/appropriations projects including water conservation infrastructure such as dams, diversions, and drop structures.

B. Recovery Vision Statement

We envision recovery for Santa Ana sucker as sizable, stable populations that are maintained in managed and conserved suitable habitat, free of barriers to dispersal to ensure gene flow and maximum dispersal of individuals. Populations will be monitored and maintained to provide sufficient representation, resiliency, and redundancy across the species' historical range so that the Santa Ana sucker no longer requires the protections of the Act. Threats impacting the species will be sufficiently understood and abated to ensure long-term conservation of Santa Ana sucker. A rangewide monitoring and adaptive management approach will be in place to address unforeseen events and threats.

C. Action Plan

We recognize that the conservation of Santa Ana sucker will not be achieved without extensive cooperation and coordination among many entities. This action plan does not assign responsibility of any partner to undertake the recommended actions. However, we believe that working with Federal, State, and local agencies (such as the U.S. Forest Service and the California Department of Fish and Game); and our other partners, while coordinating across the Service is essential to effectively conserve Santa Ana sucker.

Below, we outline the overall primary objectives of the recovery effort for the Santa Ana sucker and include both immediate actions and longer-term actions. These actions may be used to guide recovery planning, prioritize actions, minimize impacts from projects that may affect the species or its critical habitat, and plan for future recovery actions.

1. Primary Objectives

The recovery effort should build upon conservation and monitoring efforts described in detail above, in previous documents, such as the 2011 5-year review, revised critical habitat designation, and listing determination, and continue to build strong relationships with partners. The primary objectives for recovery will be to:

a) Survey and monitor rangewide to accurately document populations, occupied habitat, and local threats;
b) Protect existing populations in the Santa Ana River, San Gabriel River, and Los Angeles River watersheds;
c) Conduct research projects specifically designed to inform management actions and recovery;
d) Identify threats rangewide and implement management actions that ameliorate current threats and prevent future threats from becoming widespread; and
e) Provide measures for expansion of habitat or population augmentation in the Santa Ana River, San Gabriel River, and Los Angeles River watersheds.

2. Immediate Actions

The goal of the initial phase of recovery is to arrest and reverse the general population decline and increase the available suitable habitat and range occupied by Santa Ana sucker. These are recommended actions to occur in the interim between the recovery outline finalization and completion of the recovery plan. These immediate actions will inform future research, restoration, threats abatement, and other conservation actions:

- Continue to coordinate with local partners and stakeholders to: (1) gather existing historical and recent hydrologic data (water and sediment conditions, including water allocations, points of diversion, and points of input); (2) synthesize these data into one usable source; (3) identify existing areas with suitable habitat for Santa Ana sucker; and (4) identify future information needs related to water and sediment transport for the conservation benefit of Santa Ana sucker.
- Investigate age class structure by evaluating growth rates through comparisons of otoliths and fin rays and condition index of Santa Ana sucker in each of the watersheds where it currently persists.
- Restore and maintain historically occupied tributaries (for example, Sunnyslope Creek, Arroyo Tequesquite, Lake Evans drain, and Anza Park drain).
- Coordinate with local partners and land managers to: (1) educate public on the impacts of recreational dams to native fishes and (2) initiate a program with the fisheries resource volunteer corps to remove recreational dams throughout the Los Angeles, San Gabriel, and San Bernardino Mountains.
- Design a rangewide monitoring scheme and begin its implementation throughout all three watersheds.
- Initiate activities to abate threats related to unauthorized OHV use in areas such as Rialto Drain and the Santa Ana River near Riverside Avenue.

- Continue existing predator removal efforts and design a rangewide predator removal plan and begin its implementation throughout all three watersheds.

3. Long-term Comprehensive Actions

Although this list of actions will likely change during the recovery planning process, we recommend the following actions as a more comprehensive list using all available methods to lead to the conservation of Santa Ana sucker. Specific actions that should be undertaken to meet the primary objectives are outlined below.

a) Survey and monitor rangewide to accurately document populations, occupied habitat, and local threats

- Develop a rangewide population monitoring or survey protocol that will lead to a better understanding of life history strategies such as patterns of migration, growth, reproduction, and recruitment.
- Conduct rangewide population monitoring of currently occupied watersheds.
- Conduct rangewide monitoring and assessment of potentially occupied habitat, including tributaries.
- Monitor habitat to identify locations within currently occupied areas, where habitat suitability can be improved (increase gravel and cobble substrate available, clear cool water, and in-stream habitat with food sources available).
- Conduct fish population assessments throughout the Santa Ana sucker's range that quantify nonnative species (predators, competitors, etc.).

b) Protect existing populations in the Santa Ana River, San Gabriel River, and Los Angeles River watersheds

- Ensure persistence of existing populations through conservation easements, management in perpetuity, and cooperative planning with landowners, partners, and stakeholders.

c) Conduct research projects specifically designed to inform management actions and recovery

- Assess and evaluate water allocations rangewide to determine habitat limitations and limitations on recovery, if any.
- Determine amount, velocity, and quality of water that is needed to support Santa Ana sucker in each watershed.
- Assess and evaluate sediment transport rangewide to determine habitat limitations.
- Evaluate how sediment composition and channel gradient will change over time within occupied habitat using techniques such as LIDAR (light detection and ranging) or point intercept repeated measures.
- Evaluate variation and changes in water temperatures (thermal profiles) using techniques such as FLIR (forward-looking infrared) or in-situ data sondes.
- Evaluate the effects of nonnative predators (for example, implement monitoring and analysis of stomach contents of predators) and nonnative riparian vegetation (for example, quantify habitat modification due to nonnative vegetation) that impact Santa Ana suckers, and recommend management actions to ameliorate impacts.

- Assess the sensitivity of Santa Ana sucker relative to standard test organisms used to determine water quality standards. This may include investigation of impacts from chemicals such as perchlorate, nitrates/nitrites, chlorine, sulfides, ammonia, various metals, and other organic compounds in treated wastewater (currently in progress).
- Determine if genetic distinctness exists among the three watersheds where the listed entity occurs and determine the status of the Santa Clara River occurrence (currently in progress).

d) Identify threats rangewide and implement management actions that ameliorate current threats and prevent future threats from becoming widespread

- Ameliorate Factor A threats associated with present or threatened destruction, modification, or curtailment of habitat or range.
    - To the extent practicable, restore (or mimic) natural hydrological functions rangewide.
    - Reduce impacts from hydrological modifications that impair water and coarse sediment transport and availability.
        - Evaluate the effect of the in-stream flow conditions on Santa Ana suckers.
        - Identify water diversions or catch basins that may influence transport of water and coarse sediment.
            - Ensure sufficient water is available for Santa Ana sucker in each watershed through securing water rights or other means.
            - Assess Environmental Protection Agency's (EPA) proposal to reduce discharge of treated water within occupied areas where such discharges provide a significant portion of total water flow, and following assessment, work with EPA to minimize or mitigate this threat.
            - Ensure transport of sufficient quantities of coarse sediment to occupied reaches in each watershed.
            - Evaluate potential reductions in water quality from water diversions or catch basins.
        - Identify the feasibility of changes in dam operations that may contribute to restoration of a more natural system of water and sediment transport.
            - Work with partners to review and identify flexibilities of dam operations within the Santa Ana sucker's range (Hansen, Big Tujunga, Cogswell, San Gabriel, San Dimas, Morris, Seven Oaks, and Prado Dams).
            - Evaluate flood control operations in each watershed.
            - Evaluate methods to minimize potential reductions in water quality from changing dam operations.
        - Identify barriers that impact sucker dispersal and transport of water and coarse sediment.
            - Evaluate and potentially modify barriers to Santa Ana sucker dispersal and transport of water and coarse sediment.
                - Modify permanent flood control structures or bridges in each watershed.

        - Review status of recreational dams to determine how to support sucker dispersal and restore transport of water and coarse sediment.
        - Evaluate potential reductions in water quality from barriers.
    - Identify channelized sections of mainstem and tributaries that may influence transport of water and coarse sediment.
        - Evaluate potential reductions in water quality from channelization.
    - Ensure velocity and amount of water is sufficient to maintain suitable habitat characters.
        - Enhance coarse sediment transport.
        - Minimize accumulation of fine sand and silt.
        - Minimize any potential reductions in water quality.
  - Reduce impacts associated with increased fire frequency that affect water transport, sediment transport, water quality, and flow regime.
    - Minimize reductions in water quality from fire.
    - Implement management actions to minimize ash and debris deposition that may reduce available habitat by physically altering streambeds and pools.
    - Implement management actions that minimize scour of riparian and aquatic vegetation, and increased water temperature from the short-term loss of canopy shading associated with fire.
  - Reduce impacts to riparian and in-stream habitats from recreational OHV use.
    - Implement management actions to minimize impacts from authorized recreational activities associated with OHV use.
    - Enforce prohibition of unauthorized OHV use.
    - Evaluate and minimize reductions in water quality such as increased temperatures from loss of riparian vegetation, increased turbidity from disturbance of sediment, or destabilization of banks that leads to increased erosion.
  - Reduce impacts from mining activities that reduce availability of coarse sediment.
    - Identify commercial or recreational mining operations in each watershed.
        - Evaluate, and if feasible, modify commercial mining operations.
        - Encourage inter-agency coordination on developing and enforcing regulations for recreational mining on public land.
    - Minimize reductions in water quality from mining.
  - Ensure habitat is not modified by presence of nonnative vegetation.
    - Remove nonnative vegetation (*Arundo donax*, *Tamarix ramosissima*) in each watershed.
    - Minimize reductions in water quality from nonnative vegetation.
- Ameliorate Factor C threats associated with predation.
  - Reduce impacts of nonnative or introduced predators.
    - Remove nonnative or introduced predators in each watershed.
    - Modify or restore habitat to deter nonnative or introduced predator preference.
- Ameliorate Factor E threats associated with other natural or manmade factors affecting Santa Ana sucker's continued existence.
  - Reduce the potential risk of small population sizes in each watershed.

        - Maintain populations through restoration and expansion of suitable habitat in each watershed.
        - Establish refugia populations for each watershed in the event of a catastrophic event.
        - Reintroduce or augment populations of Santa Ana sucker, if necessary.
    - Reduce the impacts of impaired water quality.
        - Evaluate thresholds of non-regulated contaminants that are harmless to fish survival and reproduction.
        - Evaluate and potentially modify water quality regulations for chemicals that negatively impact survival and reproduction.
    - Identify potential risks associated with global climate change.
        - Monitor habitat characters, and species responses to changes in environmental conditions, that can be attributed to global climate change.
        - Adaptively manage any threats that manifest as a result of global climate change such as decreased water flows, decreased sediment transport, or increased water temperatures.

e) Provide measures for expansion of habitat or population augmentation in the Santa Ana River, San Gabriel River, and Los Angeles River watersheds

- Determine if reintroduction/population augmentation is necessary and develop a comprehensive plan to move forward.
- Assess areas within the historical range that are currently suitable for population augmentation or reintroduction.
- Assess areas within the historical range that can be restored and made suitable for population augmentation or reintroduction.
- Implement a rangewide habitat restoration plan.
    - Increase water flow in Santa Ana sucker habitat to improve habitat quality (such as increase water quantity, coarse substrate, and native vegetation).
    - Restore or maintain important tributaries or areas of the floodplain (such as abandoned golf courses, abandoned wetlands) that have been disconnected from the mainstem (for example, Sunnyslope Creek) or are currently urban outfalls that have been channelized (for example, Day Creek, Evans Drain).
    - Purchase lands within the floodplain (such as abandoned golf courses) and restore to provide for essential processes.

III. Preplanning Decisions

A. Planning Approach

A recovery plan for Santa Ana sucker will be prepared pursuant to section 4(f) of the Endangered Species Act. The recovery plan will include objective, measurable criteria which, when met, will ensure the conservation of the species and may result in a determination that the species be removed from the Federal List of Endangered and Threatened Animals. Recovery criteria should address the five listing factors, including elimination or management of threats. Preparation of the recovery plan will be under the leadership of the Carlsbad Fish and Wildlife Field Office. This species may warrant appointment of a recovery team, which would be appointed at a later date. Meetings would be held regularly to share information and ideas to promote recovery of the Santa Ana sucker.

B. Information Management

All information relevant to recovery of Santa Ana sucker will be housed in administrative files found at the Carlsbad Fish and Wildlife Field Office in Carlsbad, California. The lead Fish and Wildlife Biologist will be responsible for maintaining the official record for the recovery planning and implementation process. Copies of new study findings, survey results, records of meetings, comments received, and other relevant information should be forwarded to this office (see Listing and Contact Information section above).

Information needed for annual accomplishment reports, the Recovery Report to Congress, expenditure reports, and implementation tracking should be forwarded to the Carlsbad Fish and Wildlife Office (see Listing and Contact Information section above). Copies of the completed reports can then be disseminated to all contributors upon request.

C. Proposed Recovery Plan Schedule

Regional Office Review Draft	Fiscal Year 2014
Public Review Draft	Fiscal Year 2014
Public Comment Period	60 Days
Final Recovery Plan	Fiscal Year 2015

D. Stakeholder Involvement

Key land managers, land owners, or other stakeholders:

- U.S. Army Corps of Engineers, Los Angeles District
- U.S. Forest Service
- Bureau of Land Management
- California Department of Fish and Game
- Western Riverside County Regional Conservation Authority
- City of Riverside
- Orange County Water District

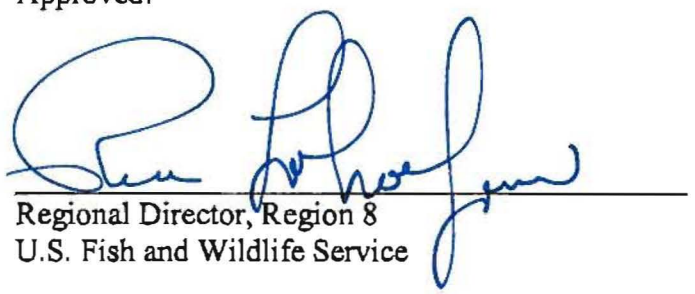
- Riverside County Flood Control and Water Conservation District
- San Bernardino County Flood Control District
- County of Los Angeles Department of Public Works
- Private landowners
- Center for Biological Diversity

E. Stakeholder Involvement Strategy

Landowners and land or resource managers who may contribute to or be affected by the listing and recovery of Santa Ana sucker will be invited to participate in the recovery planning process. A mailing list will be maintained and the Carlsbad Fish and Wildlife Office will attempt to foster open and ongoing communications with all interested parties. Field biologists working on Santa Ana sucker and other Santa Ana sucker resource management issues will continue to develop strong one-on-one working relationships with interested parties. Early in the recovery planning process, a meeting with interested stakeholders will be held to exchange status information, identify recovery issues, and identify additional cooperators in recovery efforts for this species. The information emanating from this discussion will provide the initial platform for proceeding with recovery planning. It will help identify private landowners who could participate in recovery efforts and interested stakeholders will be asked to participate on an ongoing basis in the recovery planning and implementation effort. As needed, additional meetings or conference calls will be held to discuss particular issues, and stakeholders will be invited to participate as warranted by the purposes of the meeting. Advantage will be taken of all opportunities to interact with stakeholders in a productive and meaningful way.

Stakeholders will be afforded an opportunity to review and comment on a draft of the recovery plan in conformance with the Endangered Species Act. Stakeholders may also be asked to contribute directly in developing recovery implementation strategies for planned actions. Strong working relationships with experts and stakeholders will be maintained and developed over time with new stakeholders.

Approved:



Regional Director, Region 8
U.S. Fish and Wildlife Service

March 30, 2012
Date

Citation

U.S. Fish & Wildlife Service. 2012. Recovery Outline for Santa Ana sucker. Sacramento, California. 38 pp.

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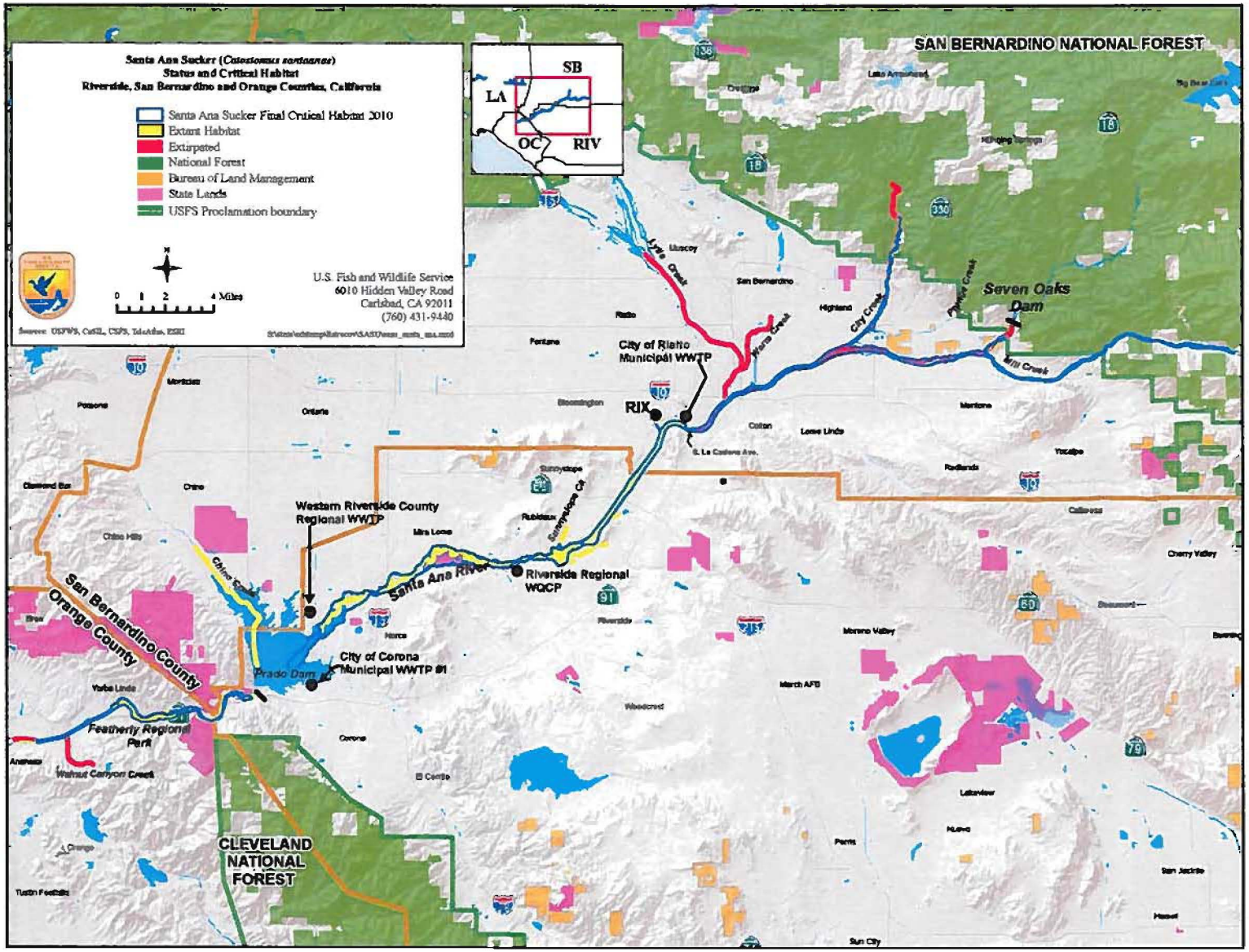
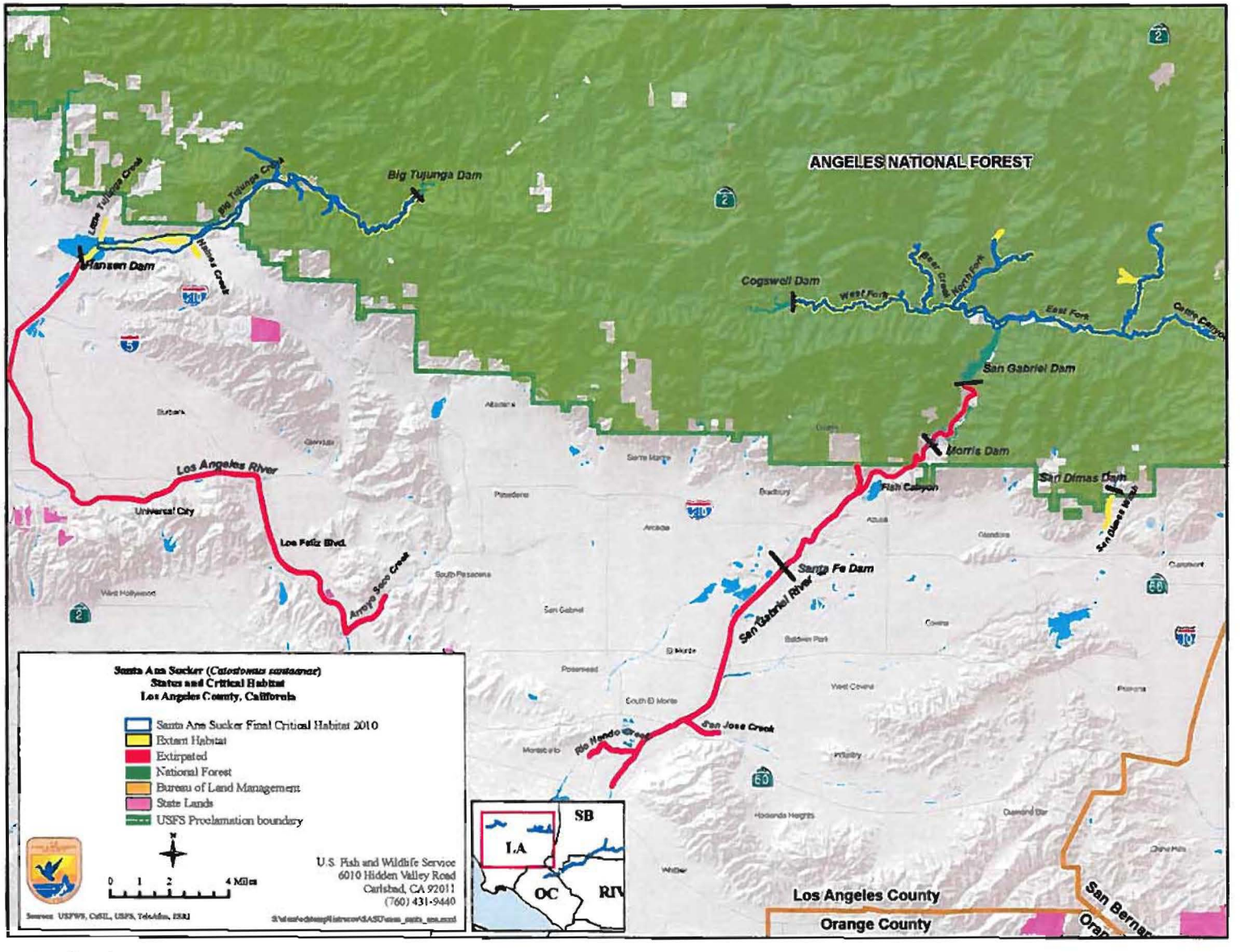
Appendix: Santa Ana sucker (*Catostomus santaanae*) status and critical habitat; Prepared for 2012 Recovery Outline.



Distribution, status, and critical habitat for the Santa Ana sucker in the Santa Ana River watershed.



Distribution, status, and critical habitat for the Santa Ana sucker in the Los Angeles River and San Gabriel River watersheds.