

Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2022, and Summary Data by Site and Watershed-wide, 2000-2022

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ABSTRACT

The Santa Ana Watershed is the largest coastal river system in Southern California. The Santa Ana Watershed Association (SAWA) is committed to the protection and improvement of natural areas within the watershed with major focus on the removal of invasive species, native habitat enhancement, and the monitoring and protection of endangered, threatened, and other sensitive species. Since 2000, populations of endangered Least Bell's Vireo (*Vireo bellii pusillus*) have been monitored and managed during the breeding season. Data were collected on status, distribution, breeding chronology, reproductive success, and nest site characteristics. Additionally, Brown-headed Cowbird (*Molothrus ater*) trapping was conducted concurrently in or near riparian habitat as well as during the fall and winter of 2021-2022 at two dairies in Prado Basin, three dairies in San Jacinto, and one dairy in Temescal. SAWA biologists documented 1,393 Least Bell's Vireo (hereafter "vireo") territories in the Santa Ana Watershed (excluding Prado Basin) in 2022, of which 688 were known to be paired. This represents a 1% increase in territories from 2021 (n=1,378); however, in 2022, Chino Hills State Park was surveyed for the first time since 2019 and an additional 48 territories were documented. Without accounting for the survey conducted in Chino Hills State Park, a 2% decrease in overall abundance would be shown in 2022 as compared with 2021. One thousand five fledglings were also documented. Prado Basin reported another 683 vireos in 2022, a 15% increase from the 596 documented in 2021. Excluding Prado Basin, watershed-wide nesting success was 55% overall and 190 well-monitored pairs had a 2.7 reproductive success rate. Ninety-four percent of 408 vireo nests were placed in native vegetation.

In 2022, the watershed-wide cowbird parasitism rate of vireo nests was 7%, down from 11% in 2021. San Jacinto, Hidden Valley – North, and Hidden Valley – South were sites in which parasitism was documented in 2022. During the nesting season, 1,469 cowbirds were removed from 51 traps in the watershed. Additionally, 5,046 cowbirds were removed from the watershed during the fall and winter of 2021-2022. Over 153,000 cowbirds have been removed from the watershed by SAWA since cowbird management began.

Breeding Southwestern Willow Flycatchers (*Empidonax traillii extimus*) were not detected by SAWA biologists in 2022; however, twelve individual migrant Willow Flycatchers (*Empidonax traillii* ssp.) were documented within the watershed. All wildlife species detected (164 avian, 21 mammalian, 17 herpetofauna, and four fish) were incidentally reported by site.

INTRODUCTION

As the largest coastal river system in southern California, the Santa Ana Watershed is home to more than six million people and includes portions of San Bernardino, Riverside, Orange, and Los Angeles Counties. The Santa Ana Watershed Association (SAWA) is committed to the protection and enhancement of natural habitat within the Santa Ana River Watershed. Major focuses of SAWA are the removal of invasive species, native habitat enhancement, and protection of endangered, threatened, and other sensitive species. A large threat to the Santa Ana River Watershed is the extremely prolific invasive weed, *Arundo donax* (hereafter “arundo”). Arundo chokes riverine systems while out-competing native vegetation, resulting in a loss of habitat for native species and hampering flood control efforts. It can consume at least twice the amount of water as native plants, thereby stressing a region that already has little available water. In addition, arundo may contribute to the spread of fire due to its highly flammable nature. SAWA is dedicated to the restoration of the Santa Ana River Watershed with the interest of reestablishing natural riverine functions and enhancing riparian habitat in an effort to aid in the recovery of the endangered Least Bell’s Vireo (*Vireo bellii pusillus*; LBVI) and Southwestern Willow Flycatcher (*Empidonax traillii extimus*; SWFL).

The Least Bell’s Vireo (hereafter “vireo”) is a small, insectivorous bird that occupies riparian habitat in southern California and northern Baja Mexico. This sub-species is listed as endangered by both the State of California and the federal government due to the loss of riparian habitat and brood parasitism by the Brown-headed Cowbird (*Molothrus ater*; hereafter “cowbird”). Vireo monitoring and cowbird control began in 1986 with only 19 known vireo pairs in the Prado Basin (Pike et al., 2005). The Prado Basin population has since increased to a high of 719 territorial males in 2020 (Pike, 2020). The Southwestern Willow Flycatcher occupies riparian habitat throughout the southwest. It too is listed as endangered by state and federal governments due to habitat loss and cowbird parasitism. Unfortunately, this species has not shown a similar recovery rate and is still in severe decline. These two endangered species and several other sensitive species have been monitored and managed in the Prado Basin annually since 1986 by the Orange County Water District (OCWD) and throughout the rest of the watershed by SAWA since 2000.

The work reported herein is an expansion upon the Prado Basin efforts into other portions of the watershed from 2000-2022 through the implementation of the Santa Ana Watershed Program by SAWA and OCWD. Data collected in Prado Basin are reported separately by OCWD. Monitoring is conducted during the avian nesting season to determine the number of vireos and SWFL present, breeding status, and nesting outcomes. Cowbird trapping in or near riparian habitat is conducted concurrently, as well as during the fall and winter at several dairies in the watershed. Past efforts have included nest monitoring in the major riparian corridors of the

watershed. In 2022, nest monitoring occurred at several locations discussed here as monitored sites: San Timoteo Canyon, San Jacinto, proposed and current restoration areas within Santa Ana River (SAR – Upstream) from Riverside Avenue downstream to I-15, Norco Bluffs, and the Santa Ana Canyon (SAC) below Prado Dam. Hidden Valley - North in SAR - Upstream and 36 additional peripheral drainages within the watershed were sampled (≥ 3 visits) for abundance and distribution, and incidental sightings were documented at three sites visited on one or two occasions.

METHODS

Study Location

The Santa Ana Watershed covers nearly 3,000 square miles in Southern California and includes parts of San Bernardino, Riverside, Orange, and Los Angeles Counties (Figure 1). The watershed includes a diversity of terrain including mountains, foothills, valleys, and the coastal plain. The main river is the Santa Ana River, which contains more than 50 tributaries.

Study sites contain typical southern California riparian vegetation including tall canopies of Fremont cottonwood (*Populus fremontii*) and Goodding's black willow (*Salix gooddingii*), sub-stories of arroyo and red willow (*Salix lasiolepis* and *Salix laevigata*, respectively), and mulefat (*Baccharis salicifolia*). Vegetation classifications follow nomenclatures listed in A Manual of California Vegetation (Sawyer et al., 2009). Lush riparian habitat is abundant throughout the study sites; however, dispersed stands of invasive arundo are still abundant in many locations of the middle watershed. Other non-native plants found dispersed among the sites include perennial pepperweed (*Lepidium latifolium*), castor bean (*Ricinus communis*), poison hemlock (*Conium maculatum*), and tamarisk (*Tamarix ramosissima*). Other than natural storm flow, the river's water comes from discharged treated water, urban runoff, very limited natural springs, upwelling in the Prado Basin, and releases from the Seven Oaks and Prado Dams. The river is subjected to heavy human impacts from homeless encampments, horseback riding, creation of unauthorized trails, swimming, fishing, off-highway vehicle (OHV) use, construction projects, and trash dumping.

Monitored Sites

Monitored sites, for the purposes of this study, are those sites where territories were well-monitored (> eight visits) and regular nest monitoring occurred. Vireos were monitored in the Santa Ana River and tributaries from Riverside Avenue in the city of Riverside downstream

through the Santa Ana Canyon to Weir Canyon Road, excluding Prado Basin. These sites included Anza/Old Ranch Creek, Lower Hole Creek, Hidden Valley – South side of the river (San Bernardino Valley Municipal Water District (SBVMWD) restoration sites and a control site), Goose Creek mitigation areas, Norco Bluffs, and SAC (Upper Canyon, Green River Golf Course, and Featherly Regional Park). San Timoteo Canyon, a tributary of the Santa Ana River, was also monitored (Figure 2). See Appendix A for specific restoration area coordinates.

Sampled Sites

Sampled sites were surveyed three or more times anytime throughout the breeding season, and no or minimal nest monitoring was conducted. A subset of sampled sites, referred to as assessment sites, were surveyed exactly three times during designated time frames at the peak of the vireo breeding season. In 2022, the first assessment surveys were conducted between April 22-May 6, the second surveys between May 20- June 6, and the third between June 21-July 12. At all sites, the objectives were to document vireo occupancy and quantify a minimum number of territories. Territorial males were documented as well as incidental observations of females and fledglings.

Incidental Sites

Incidental sites, for the purposes of this study, are those sites that were visited on one or two occasions and in which no nest monitoring occurred. Sites were visited in an attempt to obtain number of territories, pairs, and fledglings.

San Jacinto (Monitored)

The San Jacinto survey area includes four sections, all located within the San Jacinto Valley in Riverside County: San Jacinto River from Lake Park Drive to State Street, the San Jacinto River from State Street to Sanderson Avenue, the San Jacinto River from Sanderson Avenue to Bridge Street, and the San Jacinto Wildlife Area. The San Jacinto Wildlife Area is managed by the California Department of Fish and Wildlife (CDFW) and the San Jacinto River is managed by multiple authorities.

The riparian zone in the San Jacinto River is classified as a *Populus fremontii* Forest Alliance, with narrowleaf willow (*Salix exigua*) and mulefat as co-dominants (Sawyer et al., 2009). The habitat is also interspersed with Goodding's black willow, which is more prominent in the area between Sanderson Avenue and Bridge Street. The dominant invasive plant in the riparian zone is tamarisk. The riparian zone in the San Jacinto Wildlife Area is classified as a *Salix*

gooddingii Woodland Alliance with Fremont cottonwood as a co-dominant (Sawyer et al., 2009). The area is also interspersed with red willow and mulefat. Dominant non-natives in the adjacent upland are perennial pepperweed and Russian thistle (*Salsola tragus*). Dense stands of perennial pepperweed are now present in the section of the river from Sanderson Avenue to Bridge Street. Stinknet (*Oncosiphon pilulifer*) is increasing in prevalence in the riparian sections from Sanderson Avenue through the San Jacinto Wildlife Area. To date, SAWA's non-native management efforts have been limited to the removal of tamarisk from Mystic Lake. The lands surrounding these sites include upland coastal sage scrub, grasslands, dairy farms, agricultural land, golf courses, and residential development.

San Timoteo Canyon (Monitored)

San Timoteo Canyon is located near the city of Redlands within the counties of San Bernardino and Riverside. San Timoteo Creek originally contained many invasive plant species, most notably arundo and tamarisk. A program initiated by SAWA removed 239 acres of invasive plants from 1997 to 2001 and continues a maintenance program to control regrowth. Restoration of the native plant community through natural recruitment has taken place throughout the canyon resulting in a healthy riparian understory, the effects of natural storm cycles notwithstanding. The canyon's immediate uplands contain citrus groves and remnants of over-grazed coastal sage scrub and chaparral. A railroad and a two-lane road border the canyon. Development of portions of the uplands continues to occur. San Timoteo Creek was surveyed from Cooper's Creek to approximately 15 miles (24 km) downstream at the point the creek becomes channelized. In September 2017, the Palmer Fire destroyed dozens of acres of riparian habitat in San Timoteo Creek and a number of vireos have not returned to the historical territories that were burned in the fire. In 2022, some areas of the creek were unable to be surveyed due to access restrictions and/or safety issues.

The riparian zone can be classified as a *Salix laevigata* Woodland Alliance (Sawyer et al., 2009), with arroyo willow as a co-dominant. However, the creek is also interspersed with Fremont cottonwood, Goodding's black willow, and mulefat. The dominant invasive plant in the riparian zone is tamarisk. Dominant invasives in the adjacent upland zone include Russian thistle, mustard (*Brassica* sp.), and perennial pepperweed.

Mockingbird Canyon (Sampled)

Mockingbird Canyon is located in the city of Riverside in Riverside County. Its arroyo serves as a drainage tributary to the Santa Ana River. The riparian zone is classified as a *Salix gooddingii* Woodland Alliance, with Fremont cottonwood as a co-dominant (Sawyer et al., 2009). However, red willow and arroyo willow are also interspersed within the arroyo. The dominant

invasive plant in the riparian zone is perennial pepperweed. Mustard species are the dominant invasive species in the adjacent upland zone; however, stinknet is becoming more prevalent.

Although the reservoir and basin are protected from development at this time, residential development remains an issue in Mockingbird Canyon. Creation of a new subdivision between Mockingbird Canyon Road and Washington Street has resulted in additional habitat fragmentation. Throughout Mockingbird Canyon, residents extend their properties into the arroyo, which causes damage to the habitat and potential harm to nesting vireos. Much of the adjacent upland habitat is already developed and the arroyo is becoming more fragmented by culverts and bridges. The riparian habitat throughout the entire site is continually threatened by OHVs, trash dumping, and other illegal activities. SAWA manages an 11-acre easement in Mockingbird Canyon east of Roosevelt Street and Markham Street and will continue to work with local stakeholders to enhance and protect the canyon's natural resources.

Santa Ana River (SAR) – Upstream (Monitored/Sampled)

The SAR-Upstream section extends along the Santa Ana River from Riverside Avenue in the City of Riverside downstream to Interstate 15 in Norco. The site is divided into five different sections: Riverside Avenue to Van Buren Boulevard, Lower Hole Creek, Hidden Valley – North, Hidden Valley – South, and Goose Creek (Figure 3). A small portion of the Goose Creek section includes a mitigation area managed by the Inland Empire Resource Conservation District (IERCD). Prior to 2015, these sections of the river were not grouped together as “SAR-Upstream”; all sites were reported separately. In 2016, a change in funding source incorporated Goose Creek into SAR - Upstream. Hidden Valley – South was analyzed as a whole and by two sub-sections (Hidden Valley South – Restoration and Hidden Valley – South Non-Restoration) to isolate a proposed restoration area. In 2019, a previously unsurveyed site, Lower Hole Creek, was added as it is contiguous with the Santa Ana River ecosystem. Also in 2019, the Riverside Avenue to Van Buren Boulevard section was modified to include two proposed restoration areas: Evans Lake Drain (approximately 87 acres of previously unsurveyed land in and near Fairmount Park in Riverside) and Anza/Old Ranch Creeks (321 acres total, approximately 20 acres of which were previously unsurveyed, near the eastern terminus of Rubidoux Avenue in Riverside). The Riverside Avenue to Van Buren Boulevard section was analyzed as a whole and by its three sub-sections: Non-Restoration, Evans Lake Drain, and Anza/Old Ranch Creeks. In 2020, due to safety concerns regarding homeless encampments and COVID-19, Evans Lake Drain and Anza/Old Ranch Creeks were not surveyed. In 2021 and 2022, with COVID-19 restrictions reduced, monitoring resumed at both sites. The Boy Scout Fire burned 32 acres of vegetation in Evans Lake Drain on August 26, 2021. Though monitoring at Evans Lake Drain continued in 2022, vireos did not return to historically occupied territories in the burned area.

There are a variety of vegetation types throughout the SAR-Upstream section of the Santa Ana River. The riparian zone can be classified as a *Salix gooddingii* Woodland Alliance with Fremont cottonwood as a co-dominant (Sawyer et al., 2009). Arundo is the most common invasive plant in the riparian zone. Other invasive plant species include tamarisk, castor bean, perennial pepperweed, tree-of-heaven (*Ailanthus altissima*), golden crownbeard (*Verbesina encelioides*), poison hemlock, white sweetclover (*Melilotus albus*), and various palm species.

Several land managers are engaged in different stages of restoration or mitigation along this portion of the river. Surrounding land use includes industrial, commercial, residential, recreational trails, parks, and golf courses. Approximately 150 homeless encampments were documented within the riparian habitat in 2022. SAWA biologists often observe vegetation clearing, trash dumping, burned habitat, and inappropriate disposal of human waste in this portion of the river.

Norco Bluffs, I-15 to River Rd. (Monitored)

Norco Bluffs is comprised of a 3-mile long riparian zone located along the river between Interstate 15 and River Road in Riverside County. The U.S Army Corps of Engineers (USACE) considers most of this area to be within the Prado Basin (566-feet elevation and below). In 2020, vireos were monitored in select areas within Norco Bluffs which excluded a 101-acre easement belonging to Riverside-Corona Resource Conservation District. In comparison to areas surveyed from 2015-2018, the area monitored exclusively by SAWA from 2019-2022 (Figure 4) is the largest to date. Prior to 2019, the survey area changed from year-to-year; therefore, data cannot be compared across all years. Comparable years of population-level data are as follows: 2015 and 2018, 2016 and 2017, and 2019-2022.

SAWA removed arundo in the winter of 2006 and 2007 from a 15-acre area located immediately south of Eastvale Community Park. After reviewing the mitigation files in 2017, it was determined only 4.6 acres of habitat needed to be mitigated. Small patches of reestablished arundo were removed and subsequently treated with herbicide before nesting season. Additional regular follow-up treatments have continued through 2022.

Riparian vegetation growing beneath and alongside Interstate 15 was removed prior to the 2018 nesting season in preparation for the 15 Express Lanes Project. Active construction occurred at the site throughout the 2019 and 2020 nesting seasons and was completed during the 2021 season.

In 2020, SAWA removed approximately 200 acres of arundo using Proposition 84 funds. The removal area is located one mile upstream of River Road bridge. In 2022, additional follow-up treatments were conducted by SAWA and monitored by a biologist as needed.

Prior to the 2021 nesting season, approximately 100 feet of riparian vegetation was cleared along both sides of the Hamner Avenue bridge as part of an expansion project; active construction occurred throughout the 2021 and 2022 nesting seasons.

In the winter of 2021/2022, the U. S. Army Corps of Engineers began construction on the Lower Norco Bluffs Toe Protection Project. The 75-acre linear project area was cleared of all vegetation and a sound wall was erected along the entirety of the project; active construction occurred throughout the 2022 nesting season.

Norco Bluffs is almost exclusively comprised of riparian vegetation without adjacent upland. Native species of willow, predominantly Goodding's black willow and arroyo willow, dominate much of the landscape. Although many of the large stands of arundo have been eradicated by SAWA, some large patches still remain in areas that SAWA has not been permitted to access. The riparian habitat within the Norco Bluffs survey area can be classified as a *Salix gooddingii* Woodland Alliance with arundo as a sub-dominant (Sawyer et al., 2009). Areas not dominated by mature Goodding's black willow or arundo consist of early successional riparian woodland. These areas are where the river previously changed course and destroyed habitat, which has since regrown, or where substantial native recruitment has occurred after removal of arundo. Riparian vegetation in the more recently disturbed areas is composed of Goodding's black willow, arroyo willow, Pacific willow (*Salix lasiandra*), and narrowleaf willow.

Temescal Canyon (Sampled)

Temescal Canyon is approximately 26 miles (42 km) long and is located along Interstate 15 between Lake Elsinore and Highway 91 where Temescal Creek crosses into Prado Basin. Survey areas within this site include Railroad Canyon, Lake Elsinore, and most of Temescal Wash. The wash extends from Lake Elsinore downstream to two miles (3.2 km) upstream of the intersection of Magnolia Avenue where it becomes channelized and flows into Prado Basin.

SAWA has surveyed for vireos in Temescal Canyon since 2001, when an arundo removal program began along a section of Temescal Creek in El Cerrito, southeast of the city of Corona. Temescal Wash is currently being managed for arundo regrowth and native vegetation has begun to reestablish. Differential survey and monitoring efforts have been undertaken in Temescal Canyon since 2001; some riparian areas of the canyon are unable to be surveyed due to access restrictions.

The habitat within Temescal Canyon is characterized by fragmented patches of dense riparian vegetation. Privately owned sand and gravel mines operate downstream adjacent to Temescal Creek. A commercial fishing lake is located near the middle section of the wash. Areas of complete channelization lacking riparian habitat occur downstream of Lake Elsinore in the most downstream section of the wash. Many sections of the wash are channelized by riprap and

berms, but still allow some meandering of water for quality riparian habitat. The riparian zone in Railroad Canyon and the wash downstream of Lake Elsinore is classified as a *Salix gooddingii* Woodland Alliance (Sawyer et al., 2009). The riparian habitat surrounding Lake Elsinore, however, is dominated by tamarisk. Semi-natural shrubland stands also occur with patches of sparse Goodding's black willow.

Chino Hills (Sampled)

Fragments of riparian habitat in Chino Hills along Highway 71 in San Bernardino County have been surveyed annually since 2003. A total of thirteen suitable areas were monitored in Chino Hills, including but not limited to Butterfield Park, Alterra Park, Vellano Park, a flood basin at Brookwood Lane, and a patch of habitat at Slate Drive. Habitat fragments at Soquel Canyon and the Community Park at English Channel were formerly considered individual assessment sites but were incorporated into the Chino Hills sampling area in 2020. Most of these habitat patches occur on private property in which access is restricted. The riparian habitat in Chino Hills can be classified as a *Salix gooddingii* Woodland Alliance (Sawyer et al., 2009).

Santa Ana Canyon (SAC)

SAC is located downstream of the Prado Dam to Weir Canyon Road, a distance of approximately nine miles (14 km). Due to the differences in habitat throughout the canyon, it is divided into three sites: Upper Canyon, Green River Golf Club, and Featherly Regional Park. The Upper Canyon is located from just below Prado Dam downstream to the beginning of the Green River Golf Club. The Green River Golf Club covers approximately two miles (3.5 km) of the habitat, and the remaining 4.4 miles (7 km) is in the County of Orange's Featherly Regional Park. This location description and site history discuss the entire SAC.

This site has undergone a variety of impacts in the past several years. The USACE Reach 9 bank stabilization project construction in SAC has been ongoing since 2005. In 2014, Phase 3 of the USACE stabilization project began and subsequently impacted the habitat of 10 vireo territories. In 2015, no USACE project work occurred during the nesting season in SAC. In 2016, Phase 5a of the USACE project began adjacent to La Palma Avenue in Yorba Linda, impacting nine vireo territories, though habitat was only partially removed from two territories. Additional disturbances in SAC in 2016 included repeated vegetation removal and grove expansion by the orange grove lessee in Featherly Park and the on-going brine-line project activities in the Upper Canyon and adjacent to the Green River Golf Club. In 2017, activities in Phase 5a continued and Phase 5b began upstream, removing habitat from an additional 10 vireo territories; Phase 4 began on the south side of the river upstream from Canyon RV Park, completely removing habitat

from one vireo territory and partially impacting other territories. In 2018, activities from Phases 5a, 5b, and 4 ran concurrently throughout the nesting season. The footprint of Phase 5b was expanded downstream to Brush Canyon in 2019, removing vegetation from another three and a half territories. In 2019, Phase 5b and Phase 4 construction activities continued throughout the season. Phase 5a concluded and mitigation was installed prior to nesting season. Construction activities in Phase 5b continued throughout the 2022 nesting season and restoration is expected to begin in the fall of 2022. The Burlington Northern Santa Fe (BNSF) railroad bridge construction project commenced in 2018 and continued through 2021. The project located in Green River Golf Club removed vegetation from two territories and partially impacted two additional territories in 2018. The project appeared to be complete as of 2022 with no construction activities and vegetation replacement in progress. The Blue Ridge Fire that began on October 26, 2020, burned habitat in both Green River and Upper Canyon; six total vireo territories were affected. Patches of burned habitat continue to recover. Prior to the nesting season in 2022, vegetation removal and other repairs were done on an ornamental lake on the golf course. Substantial vegetation was removed from the shore. Despite the drastic vegetation loss, the area was occupied by a vireo pair that successfully fledged a nest. Landscape waste from the lake project was piled on the periphery of nearby habitat and became occupied by a second vireo territory that subsequently fledged a nest. In 2022, USACE construction activities occurred in the eastern-most section of the site, by the Prado Dam. As a result, SAWA did not nest-monitor four historically monitored territories; they were instead monitored by a consulting company.

A variety of habitat types occur throughout SAC. Vireos typically inhabit the riparian zone along the river, but also use the adjacent upland habitats for nesting and foraging. The riparian zone is classified as a *Salix gooddingii* Woodland Alliance, with Fremont cottonwood as a co-dominant. The least disturbed adjacent upland is classified as a *Sambucus nigra* Shrubland Alliance (Sawyer et al., 2009). Several areas adjacent to the riparian habitat are in various stages of restoration and cannot be classified at this time. Additionally, some adjacent upland areas are non-native dominant, such as the Green River Golf Club and Chino Hills State Park areas. The dominant invasive plants in the riparian zone are poison hemlock, castor bean, and arundo. Dominant invasives in the adjacent upland zone are Russian thistle, mustard, and tocalote (*Centaurea melitensis*). Other invasive plant species in SAC include tamarisk, tree of heaven, perennial pepperweed, gum tree (*Eucalyptus* sp.), and Peruvian pepper tree (*Schinus molle*).

Upper Canyon (Monitored)

Upper Canyon is located adjacent to Highway 91 within the County of Riverside, from downstream of Prado Dam to the northeast edge of Green River Golf Club. This site is the upstream portion of SAC. In the last decade, Upper Canyon has undergone a number of habitat

disturbances including native vegetation removal, subsequent restoration, additional vegetation removal, and a devastating fire. Construction on a portion of the Santa Ana River trail began during the winter of 2018 and continued into April 2019. Trail construction did not occur during 2020 or the spring/summer of 2021 or 2022 and it is not known when construction will resume. The trail is planned to proceed through Upper Canyon and Green River Golf Club to connect to the existing Santa Ana River Trail located south of the golf course. In 2022, USACE construction activities occurred in the eastern most section of the site, by the Prado Dam. As a result, SAWA did not nest-monitor four historically monitored territories; they were instead monitored by a consulting company.

Green River Golf Club (Monitored)

The Green River Golf Club is located along the Santa Ana River in San Bernardino, Riverside, and Orange Counties between Upper Canyon and Featherly Regional Park. This site is the middle portion of SAC.

Phase 3 of the USACE Reach 9 bank stabilization project started during the fall and winter of 2011 with the removal of several acres of riparian habitat from this site, which included mature willow and cottonwood trees. This area supported 13 vireo territories during the 2011 breeding season. The 2011 project phase was roughly 75% complete at the end of the 2012 nesting season with some replanting underway, but habitat loss and construction activities could have contributed to the 27% decrease in territory numbers between 2011 and 2012. In 2014, construction continued adjacent to occupied habitat upstream of the railroad bridge in the beginning of the nesting season. On May 1, 2014, a vireo nest was found within 100 feet of disruptive construction activities. The USACE and the U.S. Fish and Wildlife Service (USFWS) were notified immediately. Still, work continued toward the nest, and it was abandoned with two eggs. Other vireo nests were found near construction activities and work stopped in this area for the rest of the 2014 season. No additional habitat was removed in 2014.

The BNSF rail bridge construction project, which began in 2018, continued into 2021. Four vireo territories were impacted prior to the avian nesting season in 2018. Riparian habitat for two territories was completely removed and habitat for two other territories was partially removed. In 2021, construction activity and resulting noise disturbance occurred near the remaining habitat, but no vegetation was removed. The areas in which construction activity occurred supported six vireo territories. Nests were found in four of the territories outside of the construction zone, and fledglings were documented from three. On May 11, a small (approximately ½ acre) fire occurred in an occupied patch of habitat near the construction site. The vireos' active nest was destroyed, but enough habitat remained for the birds to stay and

make two more nesting attempts, which were unsuccessful. In 2022, no construction activities took place at this site.

Habitat restoration work, which included mowing, spraying, and hand-pulling of invasive plants, followed the completion of the Reach 9 project phases at this location. Work that began in 2019 on Chino Hills State Park property adjacent to the golf course continued in 2021. During the 2021 nesting season, restoration workers were provided with vireo territory and nest information and asked to avoid those areas. Some restoration also occurred along the Santa Ana River parallel to the 91 freeway. No large-scale removal or disturbance to vegetation or vireos was observed at either site.

A project to replace a golf cart bridge spanning Aliso Creek was completed at the beginning of the 2021 nesting season. Historically, there have been one to two vireo territories located along this section of Aliso Creek. Work on the project, which started in 2020, had been paused in June of 2020 to accommodate vireo fledglings using the area. The project resumed in the fall/winter. Chain link and safety fencing were used to restrict access to the habitat in 2021. At the completion of the project in April, the chain link was removed with no impact to the habitat. The safety fencing remained through the season due to birds nesting beside it. One of the vireo territories that has historically been found near the bridge was occupied again in 2022 and had a successful nest. No construction activities occurred near the bridge in 2022.

On October 26, 2020, the Blue Ridge Fire started near Green River Golf Club and burned riparian and upland habitat in the northern parts of the golf course, near the railroad tracks and border of Chino Hills State Park. Some habitat was damaged, and other parts were destroyed by the fire. No vireos returned to the destroyed sections in 2021, but vireos did occupy some of the less damaged patches. In 2022, recovery was noted in some of the seriously burned patches, and one location that was unoccupied in 2021 hosted a vireo pair in 2022.

Prior to the nesting season in 2022, vegetation removal and other repairs were done on an ornamental lake on the golf course. Substantial vegetation was removed from the shore. Despite the drastic vegetation removal, the area was occupied by a vireo territory that successfully fledged a nest. Landscape waste from the lake project was piled on the periphery of nearby habitat by a second vireo territory. That territory was also occupied and fledged a nest.

Featherly Regional Park (Monitored)

Featherly Regional Park is located along the Santa Ana River, between the west end of the Green River Golf Club and the bridge on Yorba Linda Boulevard and Weir Canyon Road in Orange County. This site is the downstream portion of SAC.

The Santa Ana River Trail and Parkway runs adjacent to the park. Public access is restricted; however, no fencing is in place to deter entry into the riparian habitat. Phase 4 of the

USACE Santa Ana River Mainstem Reach 9 project began in 2014. Riparian habitat containing three vireo territories was removed on both sides of the river, upstream from the Canyon RV Park. This phase has since been completed and the habitat is being restored. In 2016, Phase 5a began on the north side of the river along La Palma Road, downstream of the Riverbend Car Wash. Vegetation removal partially impacted five vireo territories. In 2017, activities in Phase 5a continued and Phase 5b began upstream, removing habitat from an additional 10 vireo territories. Phase 4 construction expanded on the south side of the river upstream of Canyon RV Park, completely removing habitat from one vireo territory and partially impacting other vireo territories. In 2018, activities from Phases 5a, 5b, and 4 ran concurrently throughout the nesting season. The footprint of Phase 5b was expanded upstream to Brush Canyon in 2019 and downstream in 2020, removing vegetation from another three and a half and one and a half territories, respectively. In 2019, Phase 5a was completed and restoration began before the breeding season. Phase 4 was completed, and habitat restoration began in 2020. Construction activities in Phase 5b continued throughout the 2022 nesting season and restoration is expected to begin in the fall of 2022.

Vireo Monitoring

SAWA's vireo management includes habitat restoration, biological monitoring, and cowbird control. The primary purpose of surveys at monitored sites was to locate all vireos and SWFL to determine accurate territory numbers and breeding status, and to enhance breeding output through management. Potential habitats were carefully traversed along the edges and open trails. The vegetation communities in areas of detection, including dominant native and exotic vegetation species, were documented. Location, behavior, and reproductive status of all vireos encountered were noted on each visit. Not all territories were monitored sufficiently to determine pairing success. No playback of vireo vocalizations was used during surveys. GPS coordinates were taken in the approximate center of the territory, if known. Each point denotes a territory (an area occupied and defended by one territorial male), not just a sighting. Great care was taken to identify individual territories and avoid duplication. Territory size range was estimated at monitored sites. Shapefile attributes were associated with each vireo territory location and are as follows: unique ID, notes, survey location, surveyor name, agency, category (monitored/sampled/incidental), breeding status, GPS location, fledged (yes/no/unknown), number fledged, and parasitism (yes/no/unknown). A complete attribute table with detailed metadata is included in the shapefiles submitted to the USACE, CDFW, SBVMWD, and the USFWS. All electronic data is shared with Barbara Kus of the U. S. Geological Survey (USGS), and banded vireos are reported annually to the original bander and the appropriate agencies. Field data were collected using an iPhone with ESRI's ArcGIS FieldMaps and Survey 123 applications. Field

biologists worked under the direction of the Principal Field Investigator and all surveys and nest visitations were performed under, and in compliance with, all terms and conditions of Federal Endangered Species Permit #TE-839480-5.5 and a Memorandum of Understanding with the CDFW.

Surveys were conducted five or six days per week throughout the nesting season (March through July). Occasional visits to determine continued vireo presence occurred through August and September. Biologists watched for nesting behavior from a distance and did not approach nests during the nest-building stage. Subsequent nest visits were conducted from a greater distance with binoculars if possible. Otherwise, a telescopic mirror was used to observe nest contents. Extreme care was used to avoid leaving a trail to or scent near the nest. Nest searching or visitation was avoided if excessive scolding by an adult occurred or if predators were observed nearby (e.g., jays, crows, etc.). Nest visitation was avoided if there was a chance of inducing premature fledging of nestlings, if approaching the nest would result in habitat destruction or trailing, and during extreme climatic factors that could cause disturbance to nesting birds. Nest visitation dates and times were variable depending on a pair's reproductive stage. Nests were visited once every seven to eight days during incubation to check for cowbird eggs. If found, cowbird eggs and nestlings were removed from nests ("manipulated"). If a parasitized nest had fewer than three remaining vireo eggs, a non-viable vireo egg was used to replace the cowbird egg. Beginning in 2019, nests that were predated before it could be determined if they had been parasitized (seven days after incubation began) were excluded from parasitism rate calculations (Pike et al., 1999; Sharp & Kus, 2006).

Survey techniques and data analyses follow Pike et al. (1999). The following monitoring definitions, with some modifications, were taken from Pike et al. (2005):

Survey: any visit to a site(s) for the purpose of collecting data regardless of the duration or distance traveled. The term survey is used synonymously with visit.

Incidental: any other species detection documented while conducting an unrelated activity. Vireo detection in an area not sampled for vireo with less than 3 visits.

Adult: an after hatch year bird; Male: a singing individual; Female: a non-singing individual accompanied by a male.

Breeding pair: only pairs for which nests were located, who were observed nest building or exhibiting other reproductive behavior, or were observed with at least one fledgling.

Well-monitored pair: visited frequently enough to observe and document all successful nesting attempts and accurately quantify number of young fledged from pair. Unsuccessful nests may or may not be found. Pairs that are known not to have fledged young may also be considered well-monitored.

Nesting attempt: any attempt by a pair to build a nest. Includes carrying nest material, even if a nest is not found.

Complete nest: a nest built by a pair and capable of receiving young.

Well-tracked nest: a complete nest observed with vireo egg(s) and/or nestling(s), and if successful, nestling(s) were observed at ≥ 8 days old.

Successful nest: a nest that fledged at least one known young.

Successful pair: a pair that produced at least one successful nest.

Failed nest: a nest that had egg(s) or nestling(s) but did not fledge young.

Presumed failure (nest): a complete nest in which no egg(s) or eggshell(s) were observed; no powder from pin feathers seen in nest; adults seen without fledgling(s).

Presumed successful (nest): a well-tracked nest with powder from pin feathers seen in the nest, or adults observed with fledgling(s).

Presumed predation: the loss of all eggs or nestlings in a nest.

Cowbird parasitism: classified as such only if a cowbird egg(s), eggshell(s), or nestling were found in, or below, the affected well-tracked nest.

Reproductive failure: classified as such when loss due to known reasons other than predation or parasitism (e.g., abandonment, etc.).

Unknown failure: classified as such when the cause of failure of nest could not be determined.

Manipulated nest: cowbird egg(s) or nestling(s) removed from a well-tracked nest.

Known fledged young: a fledgling seen out of the nest; nestlings from well-tracked nests that are presumed fledged.

Juvenile: a fledgling that has been out of the nest over 14 days.

Reproductive success: the average number of fledglings produced by well-monitored pairs.

Migrant Willow Flycatchers (*Empidonax traillii* ssp.) were documented in conjunction with visual and auditory searches for vireos. If a Willow Flycatcher was incidentally observed, the biologist checked the location weekly to determine if the individual(s) remained throughout the season. Willow Flycatchers are deemed migrants if they fail to remain on-site through June. In addition to vireo data, special attention was paid to other sensitive species found on-site, which were reported to the appropriate agencies. A complete list of wildlife species detected at monitored sites is provided with sensitive species noted. GPS points were taken for all listed species and cowbirds detected in vireo habitat.

Brown-headed Cowbird Trapping

In 2022, a total of 51 traps were deployed; forty-three traps were deployed in or near vireo habitat and the remaining eight were placed on dairy farms (Figure 5). The USACE and USFWS funded 24 habitat traps and eight dairy traps. Due to a persistent wasp infestation, one of the USACE/USFWS-funded traps in Prado was relocated mid-season for the safety of field assistants (“Cuckoo Pond” was thus renamed “Shooting Park”). SBVMWD funded ten traps in upper SAR. In San Timoteo, SAWA/IERCD Reach 3B project funded four traps and the San Bernardino County Transportation Authority funded two traps. The North County BRS Project, LLC funded one trap in Yorba Linda and Rivers and Lands Conservancy funded two traps in the Meridian Conservation Area. All traps were opened by March 23 and were closed by July 29.

Traps are designed after Australian crow traps. The trap is a cubic wood frame covered in wire mesh and fitted with cloth to provide shade for the birds. Ideal trap locations are in accessible open areas near riparian habitat or near cowbird feeding areas such as stables and dairies. Most traps are placed in areas inaccessible to the general public to protect the trap from vandalism. Traps were kept free from weeds and vegetation and labeled with signs identifying the purpose of the trap as well as SAWA contact information. Consequences for tampering with the trap, according to the Migratory Bird Treaty Act, were also specified on these signs.

Trapping procedures adhered to the “Santa Ana Watershed Association and Orange County Water District Cowbird Trapping Protocol” (Tenant et al., 2008). Each trap contained a food bowl, one-gallon water dispenser, a large paint tray for use as a bath, and perches. Cowbirds were fed with a basic millet seed mixture. Field assistants were hired and trained by SAWA biologists to perform daily maintenance, safely handle birds, and properly identify and release non-target species. Non-target native species were released as soon as possible to minimize stress. Due to permit conditions, dated September 3, 2020, SAWA is required to dispatch all European Starlings (*Sturnus vulgaris*) and House Sparrows (*Passer domesticus*) caught in the traps. Since starlings require a different type of food and do not survive well in the traps, this permit condition required additional resources in supplies, time, and effort. Due to these extenuating circumstances, some of these non-native species were released to avoid unnecessary distress to the birds.

Field assistants recorded non-target species, number of cowbirds in the trap (males, females, and juveniles), and number of cowbirds removed. Hatch-year birds were considered “juveniles” even as their adult plumage developed. Traps were inspected daily for structural integrity. Assistants were in constant contact with their supervising biologist for quick resolution of any problems.

Traps were baited with male and female cowbirds that were captured over the fall and winter. The typical ratios used were two males to three females for the smaller-sized habitat

traps and three males to five females for larger habitat traps. Large traps placed on dairies were typically baited with five males to nine females. The flight feathers on each cowbird were trimmed so that if a cowbird escaped, it may return to the trap or at least be unlikely to resume reproducing. A lock was placed on each trap to prevent unauthorized access. Removed cowbirds, starlings, and House Sparrows were transferred to a licensed falconer for dispatch or temporarily housed in a holding pen until the falconer could collect the birds. Holding pens contained extra food and water containers and were closed to entry by additional birds. If applicable, banded cowbirds were reported to the U.S. Bird Banding Laboratory, but only banded males were released. At the end of July, birds, food, and water were removed from all traps. The trap entry point was closed, and the door was locked in an open position to prevent unintended captures. SAWA removed traps from sites in or near vireo habitat after they had been closed; dairy traps remain in place year-round.

RESULTS

Vireo Abundance

In 2022, SAWA documented a total of 1,393 vireo territories, including 688 known pairs and 1,005 known fledglings at all monitored, sampled, and incidental sites. This represents a 1% increase in territories from 2021 (n=1,378); however, in 2022, Chino Hills State Park was surveyed for the first time since 2019 and an additional 48 territories were documented. Without accounting for the survey conducted in Chino Hills State Park, a 2% decrease in overall abundance would be shown in 2022 as compared with 2021. OCWD reported 683 territories in Prado Basin in 2022 (preliminary data; Bonnie Johnson, personal communication) for a total of 2,076 vireo territories watershed-wide (Table 1). Watershed-wide (excluding Prado Basin) abundance data over time can be found in Appendix B-1 and by site in Appendix C-1.

In 2022, monitoring efforts at most sites were similar to 2021. At San Jacinto River and SAR-Upstream, Riverside Avenue to Van Buren Boulevard (including Evans Lake Drain and Anza/Old Ranch Creeks) and Lower Hole Creek restoration areas, numerous concerns about homeless encampments continued to hamper observer visits, although limited nest monitoring did occur. The decrease in territory numbers detected at SAR-Riverside Avenue to Van Buren Boulevard in 2020 was a result of access issues and probably did not represent an actual decrease in territories in this area. Therefore, the apparent increase in 2021 was likely due to increased sampling effort instead of an increase in population size at this site. The steady increase documented at this location in the last two years is similar to what we have seen in other locations in the same time period. However, four monitored sites have trended downward since 2020. San Jacinto abundance decreased from 108 in 2020 to 73 in 2022 (32%); San Timoteo

Canyon abundance decreased from 139 in 2020 to 98 in 2022 (29%); Goose Creek, Norco to I-15 decreased from 88 in 2020 to 67 in 2022 (24%); and Hidden Valley - South abundance decreased from 176 in 2020 to 140 in 2022 (20%). Potential reasons for these observed declines are discussed in the Results and Discussion by individual site below. Abundance at most other monitored and sampled sites remained relatively the same (Table 1). A total of 3,077 SAWA biologist hours were spent monitoring and surveying for vireos in 2022.

Chronology of Breeding Activity

Surveys at monitored sites began between March 14 and April 20 and ended between September 13 and September 22. The first vireo was detected on March 14 at Featherly Regional Park. The estimated earliest date for the arrival of 50% of vireo males was on April 5 at San Jacinto and Green River Golf Club. The estimated earliest date for 50% of males paired was April 12 at Goose Creek – Norco to I-15. The first nests found were on April 5 at San Timoteo Canyon, Hidden Valley – South, and Green River Golf Club. The first date a nest fledged was May 4 at Green River Golf Club. The last date a nest fledged was July 17 at Hidden Valley – South. The last date vireos were detected was September 15 at Upper Canyon, Green River Golf Club, and Featherly Regional Park (Table 2).

Reproductive Success

Reproductive success, as measured by productivity of well-monitored pairs, was 2.7 (n=190) watershed-wide in 2022, slightly higher than 2.6 in 2021 (n=189); however, this rate is substantially lower than 3.8 (n=151) in 2019. Nest success was 55% (n=367), a slight increase from 52% (n=336) in 2021 (Appendix B-1). Average clutch size was 3.4 based on 325 complete clutches (Table 3). See Appendix C-1 for individual site data over time. Metrics specific to SBVMWD restoration sites can be found in Table 3B.

Nesting Site Preferences

Nesting site preferences followed those previously documented in Pike et al. (1999). Nests were found mostly in riparian vegetation, near water, along dirt trails or roads, and on edges of riparian habitat. Mulefat (25%), arroyo willow (21%), red willow (9%), and Fremont cottonwood (9%) were the primary plant species used for nest placement by vireos in 2022 (n=408; Table 4). Other abundantly used riparian plant species were Goodding's black willow (7%), desert wild grape (*Vitis girdiana*; 5%), and narrowleaf willow (4%). Twenty-one (5%) nests

were placed in non-native vegetation. Five (1%) nests were placed in deadfall (Table 4). This suggests that vireos will use a variety of vegetation for nesting in otherwise suitable riparian or adjacent habitat. The use of non-traditional riparian vegetation for nesting by vireos supports the need for careful monitoring of all plants during the nesting season. A complete list of plant species utilized by nesting vireos in 2022 can be found in Table 4. Historical nest site preference data across the watershed can be found in Appendix B-2; site-specific nest site preference data can be found in Appendix C-2.

Predation Rates

Nests are assumed predated if all eggs or unfledged young were destroyed or removed. In 2022, the watershed-wide predation rate for well-tracked nests was 35% (n=367), consistent with the rate of 36% (n=336) in 2021 (Appendix B-1). Predation rates varied at each site and can be found in individual site results. At sites with five or more well-tracked nests, predation rates varied between 14% and 60% (Table 3). Over all years, nest loss due to predation is 34% watershed-wide (n=4,407; Appendix B-1).

Nest losses are typically due to unknown predators, but several predator observations were made throughout the season. Vireos were observed scolding or chasing California Scrub-jays (*Aphelocoma californica*) at several sites (San Timoteo Canyon, Hidden Valley – North, Hidden Valley – South, and Green River Golf Club). At Hidden Valley South – Non-Restoration, a pair of vireos were observed intensely scolding a Cooper’s Hawk (*Accipiter cooperii*) near a nest. Since nests are not checked when predators are present, the nest was checked later in the day and determined depredated. Also in Hidden Valley South – Non-Restoration, recently deceased nestlings were found covered in ants, though the ants may not have caused the deaths of the nestlings. A southern alligator lizard (*Elgaria multicarinata*) was observed near a predated nest in the San Jacinto Wildlife Area. In Hidden Valley – North, vireos were observed scolding a San Diego gopher snake (*Pituophis catenifer annectens*). A pair of vireos at Green River Golf Club were observed scolding a California Scrub Jay as it flew out of mulefat carrying a small, white egg. In Upper Canyon, a nest that previously contained vireo nestlings was discovered on the ground with adult vireo feathers scattered among the nest remnants. One female at Hidden Valley South – Non-Restoration was observed with a missing tail after her nest was predated.

Other suspected nest predators not mentioned above include American Crow (*Corvus brachyrhynchos*), Common Raven (*Corvus corax*), long-tailed weasel (*Mustela frenata*), raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), and various snake species. These predator species occur at most sites throughout the watershed (Table 5). Feral pigs (*Sus scrofa*) are another potential predator that occurs in high numbers in San Timoteo Canyon and the upstream portion

of the Santa Ana River. Feral pigs are extremely disruptive to habitat by creating wallows, possibly trampling or knocking over nests, and eating a wide range of vegetation and animals.

Brown-headed Cowbird Parasitism

In 2022, 7% (n=317) of well-tracked nests were parasitized by cowbirds, a decrease from 11% in 2021 (n=278). This was the lowest annual watershed-wide parasitism rate since 2018 (3%, n=267; Appendix B-1). Parasitism was documented within San Jacinto (13%), Hidden Valley – North (29%), and Hidden Valley – South (20%). The decrease in parasitism documented in 2022 continues the trend of recent declines in the watershed-wide parasitism rate as compared with the high rates of 21-28% recorded in the early 2000s (Appendix D), likely due to SAWA's extensive cowbird trapping program.

In 2022, failure of well-tracked nests due to parasitism was 2% (n=367), consistent with rates ranging from 1-4% over the last five years (Appendix B-1). The criterion for judging nest failure of well-tracked nests due to parasitism is the loss or abandonment of vireo eggs in the presence of a cowbird egg or nestling. Nest "manipulation", which is the removal of cowbird eggs and nestlings by SAWA biologists, accounts for the low rate of nest failure due to parasitism, as almost all parasitized vireo nests fail in the absence of nest manipulation (Parker, 1999). Since SAWA began nest monitoring in 2000, 318 nests have been manipulated and 145 of these nests successfully fledged 312 vireos (Appendix B-1).

Repaired Vireo Nests

Eleven nests were repaired in 2022, five (45%) of which were ultimately successful and fledged 11 young. Since SAWA began monitoring vireos in the watershed, 84 nests have been repaired and successfully fledged 136 young (Appendix B-1).

Results and Discussion by Site

San Jacinto (Monitored)

In 2022, 73 territories were detected at San Jacinto, a 20% decrease from 91 territories detected in 2021, and an overall decrease of 32% from the record high of 108 territories detected in 2020 (Table 1). Of the 73 territories in San Jacinto, 11 were documented in the San Jacinto Wildlife Area, 26 were in the riparian habitat between Bridge Street to Sanderson Avenue, eight were in the riparian habitat between Sanderson Avenue and State Street, and 28 were in the section of riparian habitat from State Street to Lake Park Drive. Forty-one males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success.

Fifty-three fledglings were detected across all pairs in 2022. The San Jacinto Wildlife Area section was monitored in 2022, while all other sections were sampled. Ten fledglings were produced by six well-monitored pairs in the San Jacinto Wildlife Area, resulting in an average number of 1.7 fledglings produced per well-monitored pair (Table 3). Estimated territory size ranged from approximately 0.6 to 3.2 acres. A total of 362 biologist hours were spent monitoring vireos at the San Jacinto site in 2022.

Population increases and decreases at San Jacinto have occurred at different rates throughout the subsections. While some overall population variation at this site can be attributed to differences in monitoring effort as well as funding constraints between years, two of the longest-studied subpopulations show an overall decline, particularly in relation to the large population increase observed in 2020. At the San Jacinto Wildlife Area, some riparian vegetation shows signs of drought stress, which could impact availability and quality of suitable nesting habitat for vireos; territories in this subsection have decreased by 56% since 2020. In the State Street to Lake Park Drive subsection, substantial increases in human encampments have created safety hazards that have subsequently hindered the biologist's ability to spend appreciable amounts of time in these areas. These encampments have also severely impacted habitat quality due to alteration of understory vegetation, particularly in the center of the riverbed, which formerly supported a majority of the vireo population at this site. Territory numbers in this section have decreased by 42% since 2020.

Nest monitoring has occurred at San Jacinto at varying intensities since 2004. Twenty-nine nests were found in 2022, twenty-six of which were well-tracked. Apparent nest success was 50% (n=26). Predation (23%) was the most common cause of nest failure. Two (8%) nests failed as a result of reproductive failure and two (8%) failed for unknown reasons. Three nests (13%; n=24) were parasitized by cowbirds, and all (12%; n=26) failed as a result. No nest manipulation occurred because the parasitized nests had failed prior to discovery (Table 3). The 2022 parasitism rate remains a marked decrease from a high of 75% (n=8) in 2016 (Appendix D). Although parasitism by cowbirds still occurs at a rate of 15% (n=232) over the 18 years monitoring has occurred, only 6% (n=260) of nests have failed due to parasitism (Appendix C-1-A).

Goodding's black willow (31%) and mulefat (21%) were most frequently used for nest placement in 2022. Two (7%) nests were found in tamarisk; the remaining nests were placed in various native substrates (Table 4).

With the exception of 2015, Brown-headed Cowbird trapping has occurred in San Jacinto since 2003, and a total of 30,226 cowbirds have been removed during the breeding season over 15,363 trap days, mostly from local dairies (Appendix C-1-A). In 2022, three traps placed adjacent to riparian habitat caught 46 cowbirds over 198 trap days. Three additional traps were placed at local dairies during the breeding season and captured 670 cowbirds over 368 trap days (Table 6). Altogether, the six traps captured 716 cowbirds over 566 trap days during vireo nesting season.

Current threats to the riparian habitat in San Jacinto primarily involve human encroachment, including the use of OHVs in the riverbed and trash dumping. In the San Jacinto River between State Street and Lake Park Drive, homeless encampments are increasing in size and in number, which has resulted in refuse in the habitat, vegetation clearing, and habitat modification in the form of tarps and fences used as encampment walls. In the section from Sanderson Avenue to Bridge Street, illegal disposal of farm animal carcasses has led to an increase in raven presence in the riparian habitat.

San Timoteo Canyon (Monitored)

In 2022, 98 vireo territories were documented in San Timoteo Canyon, down 17% from the 118 documented in 2021 (Table 1); however, some areas of the creek surveyed in 2021 were unable to be surveyed in 2022 due to access restrictions and/or safety issues. The population in the canyon is still below what it was before the Palmer Fire that occurred in September 2017 that destroyed dozens of acres of riparian habitat in San Timoteo Creek; many historical territories in the burn areas have not been documented since. However, the population in San Timoteo has experienced an almost 30-fold increase in 22 years. This increase can be attributed to the removal of invasive species and subsequent restoration of native vegetation, nest monitoring, and cowbird management. In 2022, estimated territory size of the vireo in San Timoteo ranged between 0.4 to 2.3 acres.

Fifty-nine pairs and 118 fledglings were detected in 2022, though not all territories were monitored sufficiently to determine pairing success. Apparent nest success was 61% (n=59), higher than the 49% (n=77) documented in 2021 (Appendix C-1-B). Nesting success is 55% over 22 years of monitoring (n=1,323). Thirty-four well-monitored pairs had a 2.8 reproductive success rate in 2022, slightly higher from 2.7 in 2021. Overall reproductive success based on productivity of well-monitored pairs in the last 22 years is 3.0 (n=700). Nest losses in 2022 were primarily due to predation, accounting for 32% of total nest outcomes. Predation (36%) has been the major cause of nest loss in the last 22 years (n=1,323; Appendix C-1-B).

Arroyo willow (44%), red willow (14%), and desert wild grape (14%) were the most frequently used substrates for nest placement in 2022 (n=63). Six (10%) nests were placed in non-native vegetation in 2022; the remaining nests were built in various native substrates (Table 4). Arroyo willow (24%), mulefat (22%), and red willow (17%) have been the primary plant species used for nest placement in San Timoteo since 2001. Only 29 (2%) nests found from 2001-2022 have been placed in non-native vegetation (n=1,440; Appendix C-2-B).

Brown-headed cowbird trapping has occurred in San Timoteo Canyon since 2001 and a total of 3,002 cowbirds have been removed during this time. No parasitism by cowbirds of well-tracked nests was documented between 2020-2022. In 2019, 12 nests (15%; n=80) were

parasitized by cowbirds and subsequently seven nests (8%; n=90) failed as a result (Appendix C-1-B). However, in 2019 cowbird traps were not placed in the area in which the majority of parasitism occurred. Since 2020, two traps have been deployed in the vicinity of where most parasitism was documented in 2019 and cowbirds were removed from the habitat. The 2019 parasitism rate (15%) remains a marked decrease from a high of 75% (n=4) in 2001 (Appendix D). Although parasitism by cowbirds still occurs at a rate of 10% (n=1,271) over 22 years, only 3% (n=1,323) of nests have failed due to parasitism (Appendix C-1-B). A total of 355 biologist hours were spent monitoring vireos at the San Timoteo site in 2022.

Although the riparian area is protected under existing laws, residential and utility development continues in San Timoteo Canyon. Current threats to the riparian habitat include removal of vegetation by landowners, human encroachment (e.g., all-terrain vehicle activity), fire, and cattle grazing. Feral pigs continue to disturb the habitat throughout the canyon.

Mockingbird Canyon (Sampled)

In 2022, 24 vireo territories, four pairs, and one fledgling were detected in Mockingbird Canyon, a decrease of 35% from 37 territories in 2021, and a decrease of 47% from 45 territories in 2020 (Table 1). Three nests were located in 2022, two of which were well-tracked; both well-tracked nests failed due to predation (Appendix C-1-D). No parasitism was observed at the site in 2022.

In 2003, an intensive cowbird management program was initiated in Mockingbird Canyon. In this same year, 62% of nests (n=13) were parasitized, the highest recorded at this site in all survey years (Appendix D). The parasitism rate decreased sharply after the trapping program began and parasitism has only occurred episodically over subsequent years, resulting in an overall parasitism rate of 10% (n=185; Appendix C-1-D). Since 2003, a total of 2,383 cowbirds have been removed from Mockingbird Canyon (Appendix C-1-D). A total of 76 biologist hours were spent monitoring vireos at the Mockingbird Canyon site in 2022.

There are a multitude of threats to vireo habitat in Mockingbird Canyon. Despite SAWA's efforts within its conservation easement, important habitat was bulldozed and destroyed in adjacent areas to both the west and east in 2016 and 2017. Residential development continues to occur throughout the site, creating noise disturbance and fragmenting riparian habitat in the area. Much of the vegetation that had previously shown signs of heat and drought stress has died. In some areas, including the SAWA easement, large trees have died, resulting in a lack of canopy. In other areas, dead understory vegetation has been scoured, resulting in a lack of preferred vireo nesting habitat. Immediately southeast of the Mockingbird Reservoir, much of the riparian vegetation has died and upland invasive species have become established, resulting in a lack of suitable habitat. In addition to these threats, Mockingbird Canyon has extensive OHV

use, trash dumping, hiking, dog-walking, and equestrian use along the narrow strips of riparian habitat. The area is also highly impacted by invasive species encroachment.

Santa Ana River (SAR)-Upstream

In 2022, 433 vireo territories were documented in the upstream portion of the Santa Ana River (Table 3B). Vireo territories decreased 4% from the 450 territories documented in 2021 (Zembal et al., 2021); this represents a decrease of 11% from the record high of 488 territories detected in 2020 (Zembal et al., 2020). This decrease may be attributed to reduced access to some sections due to safety concerns and degradation of the habitat related to fire, homeless encampments, illegal off-roading, and drought. Overall, vireo abundance has increased throughout the upstream section since monitoring began in 2000 (Appendix D) and may be attributed to increased monitoring efforts, addition of new survey areas in some years, removal of invasive vegetation allowing for native plant regeneration, and cowbird management. In 2022, 253 pairs and 427 fledglings were documented. Of these, 89 pairs were well-monitored and produced 248 fledglings for a reproductive success rate of 2.8 fledglings per pair. Apparent nest success was 52% (n=173), similar to the 49% (n=151) documented in 2021 (Table 3B; Zembal et al., 2021). The overall parasitism rate in SAR-Upstream was 12% (n=151); however, only 2% (n=173) of nests failed due to parasitism after cowbird eggs were removed. The most common cause of nest failure in 2022 was predation (37%; n=173). Other causes of nest failure were unknown causes (8%) and reproductive failure (1%; Table 3B). Ten cowbird traps were placed in this section of the river and a total of 52 cowbirds were removed over 1,182 trap days (Table 3B). A total of 1,282 biologist hours were spent monitoring vireos at the SAR-Upstream site in 2022.

SAR-Riverside Ave. to Van Buren Blvd.

Historically, SAR-Riverside Avenue to Van Buren Boulevard was analyzed as one site. In 2019, SAR-Riverside Avenue to Van Buren Boulevard was divided into three sub-sections (Non-Restoration, Evans Lake Drain, and Anza/Old Ranch Creeks) due to two new restoration projects. However, to keep consistency with prior years, results are reported herein for SAR-Riverside Avenue to Van Buren Boulevard Overall, in addition to the three sub-sections.

SAR-Riverside Ave. to Van Buren Blvd. Overall

In 2022, 161 territories were detected at SAR-Riverside Avenue to Van Buren Boulevard, a 5% increase from 154 territories detected in 2021 (Table 1). Sixty-seven males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Ninety fledglings were detected across all pairs, 32 of which fledged from 11 well-monitored

pairs, resulting in an average of 2.9 fledglings produced per well-monitored pair. Twenty-one nests were found, 16 of which were well-tracked. Apparent nest success was 63%, considerably higher than the rate observed in 2021 (15%, n=13; Appendix D). The main cause of nest failures was predation (25%); the remaining nests (13%) failed for unknown reasons. Parasitism and reproductive failure were not observed in well-tracked nests at this site in 2022 (Table 3B).

Nests were most commonly placed in arroyo willow (43%), followed by red willow (14%), mulefat (10%), and western sycamore (10%). The remaining nests were located in various native substrates (Table 4).

Some previously inaccessible areas were surveyed this year with the assistance of a hired consultant. However, SAWA biologists still avoided some areas with dense concentrations of homeless encampments due to safety concerns.

Over 100 homeless camps, compounds, and related hazards were documented in this stretch of the Santa Ana River in 2022. This is likely an underestimate of the actual number of camps, as there were areas unsafe for biologists to traverse, which prevented camps from being documented in those areas. In addition, each camp hosts an unknown number of individuals, and it is likely that some camps are inhabited by multiple individuals. Some camps are compounds with multiple tents, structures, and vehicles. Observations related to the camps include clearing of understory, damage to and removal of large trees, compaction of dirt, unleashed dogs, free-roaming cats, chicken coops, chain-link and wooden structures, solar panels, generators, large scale latrines, small landfills, and various types of vehicles in the habitat. Along the mainstem, alteration of the levee was observed, with trails and stairs cut into the levee leading to trails and camps in the habitat. Within the habitat near the river at the end of Wilderness Avenue, many camps have been abandoned, with large amounts of trash left behind.

Further disturbance within the river bottom has been created via police activity related to the encampments, including officers on foot, officers driving OHVs through the river bottom, and low flying helicopters broadcasting announcements. While homeless camps have been an issue at this site for several years, the increase in human activity and encroachment could have a detrimental effect on the riparian habitat and vireos.

Brush fires occur regularly in and near the river bottom. From June 25th to June 29th, 2022, the Union Fire burned 110 acres of upland and riparian habitat on the north side of the river between Van Buren Blvd. and the Metropolitan Water District Upper Feeder Bridge off of Wilderness Avenue. At least six territories, one of which had an active nest, were displaced. The Lake Fire, which occurred on May 24 and 25, 2021, burned 115 acres of predominately riparian habitat near the Van Buren Bridge and displaced at least two territories in SAR-Riverside Avenue to Van Buren Boulevard. On August 26, 2021, nearly 30 acres of Evans Lake Drain burned in the Boy Scout Fire. While vireos had completed nesting by this time, the fire burned most of the occupied habitat; in 2022, only one vireo occupied a historical territory in the area. On October

31, 2019, the 46 Fire burned approximately 325 acres of the Santa Ana River bottom near the old Louis Rubidoux Nature Center. Effects of the fire on riparian habitat persist; at least four historic vireo territories in the area remain unoccupied.

SAR-Riverside Ave. to Van Buren Blvd. Non-Restoration (Sampled)

In 2022, 140 vireo territories were documented in the Riverside Avenue to Van Buren Boulevard Non-Restoration section, an 9% increase from 128 territories in 2021 (Table 3B; Zembal et al., 2021). While efforts were made to document all territories and pairs, the dangers in some parts of this site (e.g., homeless encampments, illegal marijuana cultivation, off-leash dogs, and public drug use) limit the areas that can be safely monitored. Fifty-seven pairs were documented, seven of which were well-monitored. Seventy-five fledglings were detected, 19 of which fledged from well-monitored pairs, resulting in an average of 2.7 fledglings produced per well-monitored pair. Fourteen nests were discovered and 10 nests were well-tracked. Apparent nest success was 60%. Predation (30%) was the main cause of nest failure, and the remaining failures (10%) were due to unknown causes. No parasitism or reproductive failures were documented in well-tracked nests at this site in 2022 (Table 3B).

Prior to the start of the 2014, 2016, 2018, and 2021 nesting seasons, Riverside County Flood Control conducted routine mowing of vegetation from Riverside Avenue to Mission Boulevard. While there was a decline in vireo territories detected in the immediate area of mowing those years, the overall survey site did not see a significant decrease in territories, suggesting the vireos shifted to new areas downstream. In the years following mowing, monitoring efforts showed an increase in vireo territories. This suggests as the vireos move into different areas of the site immediately following mowing, the offspring, or possibly the breeding birds themselves, return to those newly inhabited territories, thus expanding the extent of occupied habitat. The exception was 2018, when there was a slight increase (6%) in vireo territories immediately following mowing (Zembal et al., 2021). Research suggests vireos show strong natal-site fidelity, as well as strong site fidelity between breeding seasons (Greaves, 1990; Smith, 2000). The occupancy and distribution observed at this site appears to support these conclusions.

Brown-headed Cowbird trapping at this site has occurred on public land, private business, and residential properties since 2002 and 944 cowbirds have been removed during this time (Appendix C-1-E). In 2022, 31 cowbirds were removed from the study area over 492 trap days (Table 3B).

SAR-Riverside Ave. to Van Buren Blvd. Evans Lake Drain (Sampled)

One territory was detected at Evans Lake Drain in 2022, an 80% decrease from five territories in 2021. The one male detected was paired, but the territory was not well monitored. One fledgling was observed with the male later in the season.

Eighteen cowbirds were captured over 122 trap days in a trap located approximately 0.25 miles away at Fairmount Park (Table 3B). There was no evidence of parasitism this year, however, no nests were well-tracked. In 2021 when the site was last well-monitored, two out of the four well-tracked nests were parasitized (Zembal et al., 2021).

Prior to 2019, only a small portion of Evans Lake Drain had been surveyed by SAWA, so historical population numbers are unavailable. In 2020, the site was not formally surveyed due to concerns associated with the high density of homeless encampments and the COVID-19 outbreak. Early in the 2021 season, most of the camps were removed and it was possible to visit all the vireo territories regularly. On August 26, 2021, after the completion of vireo nesting, the Boy Scout Fire burned most of the area that had been occupied by vireos. Much of the suitable vireo habitat did not recover before the 2022 breeding season, likely the reason for the decline in territories detected.

SAR-Riverside Ave. to Van Buren Blvd. Anza/Old Ranch Creeks (Monitored)

In 2022, 20 territories were detected in Anza/Old Ranch Creeks (Table 3B). Nine males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Fourteen fledglings were detected across all pairs, thirteen of which fledged from four well-monitored pairs, resulting in an average of 3.3 fledglings produced per well-monitored pair (Table 3B). Estimated territory size ranged from 0.5 to 3.3 acres.

Seven nests were found in 2022, six of which were well-tracked. Apparent nest success was 67% (n=6). One (17%) nest failed due to predation and one (17%) failed for unknown reasons. The parasitism rate was 0% (n=6) and no cowbirds were incidentally observed (Table 3B). The two most common nest substrates used in 2022 were arroyo willow (29%; n=7), and red willow (29%). The remaining nests were found in an assortment of native substrates (Table 4; data included in SAR-Riverside Avenue to Van Buren Boulevard numbers).

On July 21, 2022, the Peralta Fire burned 46 acres of vegetation in the area of Anza/Old Ranch Creeks; although there were no known active vireo nests at the time of the fire, it is unknown if vireos will return to the fire-affected area in 2023. Although potential effects have not been quantified, homeless encampments, OHV use, and trash dumping may threaten habitat quality at Anza/Old Ranch Creeks.

SAR- Lower Hole Creek (Monitored)

In 2022, three territories were detected, the same number as was documented in 2021 (Table 1). Three males were determined to be paired, all of which were well-monitored. Five fledglings were detected across the three well-monitored pairs, resulting in an average of 1.7 fledglings produced per well-monitored pair (Table 3). In 2022, estimated territory size ranged from 0.9 to 1.7 acres.

Five nests were found in 2022, all of which were well-tracked. Apparent nest success was 40% (n=5). All nest failures were due to predation (100%). The parasitism rate was 0% (n=5), and no cowbirds were incidentally observed in the habitat. Two (40%) nests were placed in red willow; the three other nests were found in an assortment of native substrates (Table 4). Although potential effects have not been quantified, homeless encampments and trash dumping may threaten habitat quality at Lower Hole Creek.

SAR-Hidden Valley – North (Sampled)

Sixty-two territories were detected in 2022, consistent with the 61 territories detected in 2021. Forty-five males were paired, and 50 fledglings were observed, though no pairs were well-monitored in 2022 (Table 3).

Nest monitoring occurred at Hidden Valley – North for the first time since 2018. Nest monitoring has been conducted at this site in 2010, 2014, and 2016-2018 (Appendix D). Nest success for 7 well-tracked nests in 2022 was 57%, close to the nesting success over all years of 59% (n=59; Appendix C-1-F). One of the 7 nests was lost to predation (14%), none failed due to reproductive failure, and two nests failed due to unknown causes (29%; Table 3). Two (29%) of the seven well-tracked nests were parasitized, both of which were manipulated, and one was successful (Table 3). Though no pairs were well-monitored in 2022, the average number of fledglings produced per well-monitored pair has ranged from 2.0 in 2014 (n=4) to 4.0 in 2017 (n=6; Appendix D). The sample sizes used to calculate these averages are low and may not accurately represent the vireo population at Hidden Valley – North.

On May 24 and 25, 2021, the Lake Fire burned 115 acres along the Santa Ana River, predominately in Hidden Valley – North and in a small section of Riverside Avenue to Van Buren Boulevard that displaced at least nine territories that year (Zembal et al., 2021). Vegetation in the burned area did not recover before the 2022 breeding season and vireo did not return to the burned territories.

Although their environmental effects have not been quantified, homeless encampments and recreational use of the river threaten habitat quality at Hidden Valley – North. Multiple encampments were observed in 2022, many of which likely involved understory vegetation

removal. In addition, unleashed dogs, kept as pets at several encampments, could potentially disturb vireo breeding behavior. Improper disposal of trash and human waste by the sizable homeless population adds pollutants to the environment, which may also have an impact on vireos. The City of Jurupa Valley Park located on Downey Street is a popular location for swimming, barbecuing, picnicking, and occasionally for bands to play music. The parking lot has been closed since 2020, however, large groups still access the river and riparian habitat via the city park trails. These recreational uses of Hidden Valley – North result in additional noise and refuse in the vireo habitat. The City of Jurupa Valley has installed several large dumpsters at the park near the parking area, but large amounts of trash continue to accumulate in the riparian habitat near the riverbank.

SAR-Hidden Valley — South Overall (Monitored)

In 2022, 140 territories were detected at Hidden Valley – South, a 12% decrease from 159 territories detected in 2021 and a 20% decrease from the high of 176 recorded in 2020 (Table 1). Ninety-one males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Forty-five pairs were well-monitored. One hundred eighty fledglings were detected across all pairs in 2022, 134 of which fledged from 45 well-monitored pairs, resulting in an average of 3.0 fledglings produced per well-monitored pair (Table 3). The average number of fledglings produced per well-monitored pair has ranged from 2.1 in 2010 (n=9) to 4.8 in 2017 (n=4; Appendix D). Estimated territory size ranged from approximately 0.24 to 1.73 acres.

Nest monitoring has occurred at Hidden Valley – South every year since 2000 with widely varying numbers of nests monitored. Ninety-eight nests were found in 2022, 94 of which were well-tracked. Apparent nest success was 51% (n=94), slightly lower than 54% in 2021 (n=102; Appendix C-1-H). Predation was the most common cause of nest failure in 2022, accounting for 33 (35%) nest losses. The cause of nine (10%) nest failures was unknown and zero (0%) nests failed due to reproductive failure. Although 16 (20%; n=82) nests were parasitized by cowbirds, only four (4%; n=94) failed due to parasitism (Table 3B). Predation has been the leading cause of failure every year since 2002 (Appendix D).

Sixteen nests were parasitized, 12 of which were manipulated; four nests were abandoned at the time the cowbird egg was first observed, precluding manipulation. Six (50%) of the 12 manipulated nests were successful, fledging 10 vireos. Parasitism was down from a high of 44% (n=9; Appendix D) in 2007, and slightly down from the 2021 rate of 22% (n=83; Appendix C-1-H). Six incidental adult cowbirds were observed at Hidden Valley – South in 2022, though some of these observations could have been the same individuals observed on different days.

Mulefat (28%), arroyo willow (21%), and red willow (18%) were most frequently used for nest placement in 2022. Five nests (5%, n=98) were placed in invasive substrate: one in arundo, two in poison hemlock, and two in tamarisk. The remaining nests were located in various native substrates (Table 4).

Three homeless camps were found during fieldwork at Hidden Valley – South in 2022, with additional camps established on the north side of the river directly across from this site. Portions of Hidden Valley – South are used for recreational swimming. The shore of the Santa Ana River in these areas often has abundant litter and human waste strewn about. The site is also used frequently by equestrians and hikers which could plausibly disturb vireo breeding behavior, but the potential effect recreation has on vireos is not well studied.

SAR-Hidden Valley — South Restoration

In 2022, 30 territories were detected at Hidden Valley – South Restoration, a three percent decrease from 31 territories in both 2021 and 2020 (Table 3B; Zembal et al., 2021). Twenty males were determined to be paired, 13 of which were well-monitored. Forty-six fledglings were detected across all pairs in 2022, 43 of which fledged from 13 well-monitored pairs, resulting in an average of 3.3 fledglings produced per well-monitored pair. Twenty-eight nests were found, 27 of which were well-tracked. Apparent nest success was 48% (n=27). Predation was the most common cause of nest failure in 2022, accounting for seven (26%; n=27) nest losses. Five (19%) nests failed for unknown reasons. The parasitism rate was 36% (n=22; Table 3B), a marked increase over the 2021 rate of 10% (n=20; Zembal et al., 2021). Two nests (7%; n=27) failed as a result of parasitism. Additional information specific to Hidden Valley – South Restoration can be found in Table 3B.

SAR-Hidden Valley — South Non-Restoration

In 2022, 110 territories were detected at Hidden Valley – South Non-Restoration, a 14% decrease from 128 in 2021, and an overall decrease of 24% from the high of 145 observed in 2020 (Table 3B; Zembal et al., 2021). Seventy-one males were determined to be paired, 32 of which were well-monitored. One hundred thirty-four fledglings were detected across all pairs in 2022, 91 of which fledged from the 32 well-monitored pairs, resulting in an average of 2.8 fledglings produced per well-monitored pair (reproductive success). Seventy nests were found, 67 of which were well-tracked. Apparent nest success was 52% (n=67). Predation was the most common cause of nest failure in 2022, accounting for 26 (39%; n=67) nest losses. Four (6%) nests failed for unknown reasons. The parasitism rate was 13% (n=60); however only 3% (n=67) failed due to parasitism. Additional information specific to Hidden Valley – South Non-Restoration can be found in Table 3B.

A portion of Hidden Valley – South Non-Restoration burned during the winter of 2019-2020. Vireos were generally not detected in historically occupied areas within the burn area in both 2020 and 2021, but one vireo established a territory in the burn area in 2022. On July 8, 2022, the Marlatt Fire burned approximately seven acres in a different area of Hidden Valley South Non-Restoration. Vegetation was affected at two vireo territories, but the vireos returned to these territories within one week.

Reasons for continued population decline in Hidden Valley – South Non-Restoration are unclear. Though fires have occurred at this site, the riparian vegetation most heavily used by vireos has not been significantly affected. The area is patrolled by conservation officers and contains far fewer homeless encampments than most other areas of SAR – Upstream. Although recreation occurs by way of equestrian trail use and occasional picnics along the river, vireo habitat and nesting substrates at this site generally face less disturbance compared to other locations that did not demonstrate a similar decline in territory numbers. The increase in parasitism observed since 2020, when rates rose from 9% to 20% (Appendix C-1-H) may be impacting overall reproductive success and recruitment.

SAR-Goose Creek, Norco to I-15 (Monitored)

In 2022, 67 vireo territories were documented in Goose Creek, an 8% decrease from the 73 territories documented in 2021. This is the lowest number of territories detected at the site since 2016 (63 territories; Appendix D) and continues the downward population trend at the site that began in 2019. Forty-seven males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success, and 102 fledglings were documented (Appendix C-1-I). Estimated territory size ranged from approximately 0.63 to 2.5 acres.

Nest success for 51 well-tracked nests in 2022 was 51%, an increase from 44% in 2021 (n=34), but 12% lower than the overall nesting success from 2001 to 2022 of 63% (n=493; Appendix C-1-I). In 2022, 23 of the 51 nests were lost to predation (45%), one of 51 nests failed due to reproductive failure (2%), and one nest failed due to unknown causes (2%; Table 3). None of the 41 well-tracked nests included in the parasitism rate calculation were parasitized, a welcome decrease from the 2021 rate of 21%, which was the highest recorded parasitism rate since 2006 (n=29; Appendix C-1-I). Thirty well-monitored pairs had a reproductive success rate of 2.6 in 2022, lower than the average reproductive success rate between 2001 and 2022 of 3.0 at this site (Appendix C-1-I), but close to the 2022 watershed-wide rate of 2.7 (Appendix B-1). Of the four territorial males that were banded in 2020 as part of a USGS genetic study, only one was re-sighted in 2022, which remained throughout the season and nested in the same (greatly expanded) territory as in 2021 and 2020. The second banded bird that had returned in 2021 (only

observed from April 12-April 26) did not return to the site, nor did the other two banded birds that were not relocated in 2021.

In 2022, nests were primarily placed in arroyo willow (25%), Fremont cottonwood (12%), red willow (12%), and mulefat (10%). Four nests (8%) were placed in non-native substrates; two in arundo, one in tamarisk, and one in poison hemlock (n=52; Table 4). Three of these nests were successful: one of the nests in arundo, which fledged three young; the nest placed in tamarisk, which fledged three young; and the nest placed in poison hemlock, which fledged one young. The successful nest in arundo was composed of both dead and live overhanging arundo, potentially providing more stability than is usually found in nests in this substrate. The isolated nature of the stand allowed the arundo on the edges to fall to the side, creating the opportunity to build a nest underneath, which would not be possible within a large, dense stand. Since 2001, most nests in Goose Creek have been placed in arroyo willow (27%) and mulefat (26%). Less frequently, nests have been placed in Goodding's black willow (11%), Fremont cottonwood (7%), and desert wild grape (6%). Only 3% of all nests have been placed in non-native substrates in this time period (n=561; Appendix C-2-I).

Cowbird trapping has occurred at this site since 2004 and a total of 599 cowbirds have been removed over 3,277 trap days (Appendix C-1-I). In 2022, three cowbirds were removed from one trap, located at the Goose Creek Golf Club, over 123 trap days (Table 3). Parasitism was not documented at this site in 2022, though parasitism was recorded in 2021 (21%) and 2020 (3%). From 2001 to 2022, the parasitism rate is 5% at this site (n=473; Appendix C-1-I).

Low winter precipitation preceding the 2021-22 breeding seasons has resulted in reduced vegetation growth. Desiccated vegetation and the resulting lack of nesting cover may account for the lower reproductive success rate, lower percentage of successful nests, and increased predation documented in both the 2021 and 2022 breeding seasons. Additionally, there is evidence of invasive polyphagous shot hole borer (*Euwallacea* sp.; PSHB) and resultant damage to vegetation.

Additional impacts to vireo habitat at Goose Creek relate primarily to human encroachment. A housing development near the west end of the IERCD Goose Creek mitigation parcels (southwest of the golf course) was finished prior to the 2020 breeding season. This housing development includes a neighborhood park with access to the habitat resulting in increased human and domestic animal use, including a feral cat observed on site during the 2022 breeding season. Construction activity on the I-15 bridge over the Santa Ana River was completed prior to the 2021 season and there was an influx of homeless encampments in this area in 2021 and 2022. Vegetation is recovering in this area from a small fire that occurred prior to the 2020 breeding season, but vireos did not reestablish territories in the burn area in 2021 or 2022. Feral pigs are prevalent on the site and damage the habitat. Evidence of feral pig trapping and hunting was also observed in the area in 2022, including trails created through the understory, game

cameras, a feeding apparatus, and a blind. The site is impacted by human recreational use on an equestrian trail system and in areas where there is easy access to the river on the south side of the site. At this access point there are groups swimming in the river, littering, and small structures being built.

Norco Bluffs, I-15 to River Rd. (Monitored)

In 2022, a total of 137 vireo territories were detected in Norco Bluffs, the highest recorded to date and a 21% increase from the 113 documented in 2021¹. Sixty-two males were known to be paired, though not all territories were monitored sufficiently to determine pairing success; 119 fledged young were documented (Table 1). A total of 34 nests were found, all of which were well-tracked. Nesting success of well-tracked nests was 68% (n=34), a large decrease from 90% (n=30) in 2021, but similar to 2020 when nesting success was 70% (n=43). The reproductive success rate of well-monitored pairs decreased from 3.9 in 2021 to 3.1; however, the 2022 success rate was similar to the 3.2 success rate observed in 2020. Average clutch size was 3.6 in 2022, a slight decrease from 3.8 in 2021, but close to the 2020 rate of 3.7. Of the well-tracked nests, 32% (n=34) were lost due to predation in 2022, the highest percent documented to date. In 2021, the predation rate was 10% (n=30) and in 2020 the rate was 26% (n=43; Appendix C-1-J). Anecdotally, there seemed to be a notable increase in the distribution and frequency of Eastern Fox Squirrel (*Sciurus niger*) sightings within the survey area. Though no direct predation of nests by Eastern Fox Squirrels was observed, the species is a known nest predator. No nests failed due to reproductive failure, parasitism or for unknown reasons. Estimated vireo territory size in Norco Bluffs ranged from approximately 0.4 to 1.5 acres.

From 2013-2018, cowbird trapping at Norco Bluffs was conducted by a contractor retained by USACE. Due to the absence of trapping within the area since 2018, SAWA has placed a trap each season at a site previously used by the contractor. During the 2022 trapping season, no cowbirds were caught over the course of 124 trap days (Table 3). No cowbirds were detected in vireo habitat over the course of the season. Parasitism was not observed in 2022 and has not been documented since regular monitoring began in 2015 (Appendix D). A total of 196 biologist hours were spent monitoring vireos at Norco Bluffs in 2022.

As in past seasons, the primary sources of habitat degradation in 2022 were invasive plants and the continued negative impacts of the PSHB. This beetle drills into trees and brings with it a pathogenic fungus (*Fusarium* sp.) that can infect, and subsequently kill, many different tree species. Fortunately, the large-scale dieback of riparian habitat, as observed in the Tijuana

¹ Prior to 2019 vireos were monitored in select areas within Norco Bluffs and excluded a 250-acre parcel monitored the previous two seasons; vireos within the parcel were surveyed using a different methodology by a USACE consultant. The on-going changes in the survey area preclude the possibility of comparing all data across all years; comparable population level data is as follows: 2015/2018, 2016/2017, and 2019-2022.

River Valley (Boland, 2016) from PSHB infestation has yet to occur; nonetheless, arroyo willows have been significantly impacted by PSHB in Norco Bluffs. Many arroyo willows continue to show signs characteristic of heavy infestation (e.g., heavy staining and branch dieback) or are completely dead. Goodding's black willows infested with the beetle/fungus are declining in health as well, albeit at a slower rate. Over the long term, the loss of cover from these species may have a negative impact on the local vireo population as 38% (n=34) were placed in these two species in 2022 (Table 4). Before the arrival of PSHB, the Norco Bluffs habitat was characterized as healthy in areas where arundo had yet to become dominant. OCWD and SAWA's arundo removal efforts that occurred in Norco Bluffs through the winter of 2019-2020 removed most mature arundo stands. Several removal areas already have recruitment of native species, including willows. In addition to arundo, there is a relatively small, yet highly dense, stand of mature Mexican fan palm (*Washingtonia robusta*) that appears to have a rapid rate of recruitment. The understory within the stand of palms consists primarily of younger palms with little presence of native plant species. Much like arundo, the palms provide relatively low-quality habitat compared to the surrounding areas dominated by native plant species. During the winter of 2019-2020, SAWA treated palms with herbicide within OCWD property; however, numerous palms within USACE property will need to be treated as well. Treating the remaining arundo stands and palms would allow for additional natural recruitment of native riparian plant species and thereby increase functional habitat for vireos and other native species.

Temescal Canyon (Sampled)

One hundred nineteen territorial male vireos were detected in 2022, a 16% increase from 2021 (n=103), but 19% lower than the high count of 147 documented in 2020. Thirty-three pairs and 28 fledglings were detected in 2022; no pairs were well-monitored (Table 1). Prior to 2020, the highest number of observed territories was 2013 (n=131; Appendix D) and included surveying the Dos Lagos Golf Course. SAWA biologists have been prohibited from accessing the Dos Lagos Golf Course for vireo surveys since 2017; this may affect observed territory numbers. Two nests were observed incidentally, though neither were well-tracked (Appendix D).

Five cowbird traps were open during the 2022 breeding season in Temescal Canyon (Table 6). Four traps were located adjacent to riparian habitat and the fifth at a small dairy near Lake Elsinore where the highest parasitism rates typically occur. The five traps caught a total of 179 cowbirds over 634 trap days. Cowbird trapping has occurred during the nesting season in Temescal Canyon since 2001 and a total of 5,211 cowbirds have been removed during this time (Appendix D). Even with on-site cowbird trapping, parasitism has been documented in Temescal in 10 out of the 14 years in which the site was monitored, reaching a peak rate of 42% in 2007

(n=12; Appendix D). Of the two nests observed incidentally in 2022, one was parasitized and contained a cowbird egg. Seventeen cowbirds were detected in or near the habitat in 2022.

In 2022, much of the habitat throughout Temescal Canyon continues to show drought stress, especially downstream of Dos Lagos Golf Course where effluent outflow by City of Corona Wastewater Treatment Plant #3 was suspended in 2013. In 2014, a SAWA biologist familiar with the area reported to CDFW massive vegetation die-off due to lack of water from the historical water treatment outflow. This die-off has been amplified by the ongoing drought conditions and habitat quality has continued to decline since the effluent outflow was halted. In addition to these stressors, the habitat in Temescal Canyon and Lake Elsinore is regularly impacted during the nesting season by off-road vehicle use, illegal vegetation removal, homeless encampments, and understory clearing to deter the establishment of additional homeless encampments around Lake Elsinore. Management recommendations for this area include increased cowbird management, removal of tamarisk, enforcement of illegal vegetation removal during avian nesting season, and reestablishing outflow to the creek near Dos Lagos Golf Course.

Chino Hills (Sampled)

In 2022, Chino Hills was not monitored extensively due to lack of access to all potential vireo locations. Even though fewer site visits were conducted, and survey effort was reduced, 28 territories, five pairs, and three fledglings were documented in 2022, representing a 7% decrease in territories from 2021 (n=30) and a 22% decrease from 2020 (n=36; Appendix D).

Cowbird trapping occurred in Chino Hills between 2008-2019 and a total of 236 cowbirds were removed during this time (Appendix D). No vireos were observed with cowbird fledglings in 2022. Parasitism, development, human activity, cattle grazing, and small fragmented habitat patches are factors that may threaten vireos and reduce productivity throughout the Chino Hills area.

Santa Ana Canyon (SAC)

The following results are compiled from three sites in the Santa Ana Canyon (Upper Canyon, Green River Golf Club, and Featherly Regional Park), collectively known as SAC. One hundred fifty-three vireo territories were detected in SAC in 2022, close to the same as the 154 detected in 2021. One hundred fifty-five fledglings were documented in SAC in 2022, a 0.64% decrease from 156 fledglings observed in 2021 (compiled from Table 1). A total of 1,992 fledglings have been documented in SAC over the last 22 years; of these, 1,022 fledged from 428 well-tracked pairs (compiled from Appendices C-1-K to C-1-M). The reproductive success rate in SAC in 2022 was 2.4, an increase from 2.1 in 2021 and consistent with the average rate of 2.4 from

2001-2022 (compiled from Appendices C-1-K to C-1-M). For comparison, the watershed-wide rate of reproductive success for well-monitored pairs in 2022 was 2.7 (n=190) and was 2.8 (n=2,398) from 2001-2022 (Appendix B-1). Vireo territory size in SAC is estimated to be between 0.37 acres and 2.77 acres.

Nesting success for 75 well-tracked nests in SAC was 55% overall, an increase from 45% in 2021. Twenty-eight (37%) well-tracked nests were lost to predation, two (3%) were lost to reproductive failure, and four (5%) were unsuccessful for unknown reasons (compiled from Appendix C-1-K to C-1-M). Vireo used a variety of plant species (n=18) for nest substrates in 2022. Of the 90 total nests found, the highest number of nests were found in mulefat (46%), followed by Fremont cottonwood (11%), laurel sumac (*Malosma laurina*; 8%), and Goodding's black willow (6%; compiled from Table 4).

SAWA began cowbird trapping in SAC in 2001 when parasitism was documented in five (26%) of 19 nests. Parasitism was again documented in one (5%) of 21 nests in 2009 after five years of no occurrences (Appendix D). SAWA deployed two traps within a mile of that location and no parasitism had been recorded until 2020, when a productive trap was inaccessible due to the BNSF bridge project and five nests were subsequently parasitized in Green River Golf Club. In 2021, four nests were parasitized in Featherly Park. SAWA deployed one trap near the habitat mid-season. No parasitism was detected after the trap was deployed. In 2022, no nests were found to be parasitized. Since 2001, a total of 2,478 cowbirds have been removed from SAC over 15,015 trap days during the vireo breeding season (compiled from Appendices C-1-K to C-1-M).

In 2022, only one phase of the USACE Reach 9 project remained active in Featherly Park. In Green River Golf Club, no activities related to the BNSF bridge project occurred and the sites impacted in 2021 are being revegetated. Vegetation removal occurred at an ornamental lake on the golf course. Since Reach 9 projects are nearly complete, proposed mitigation should expand and enhance vireo habitat in the post-construction years. For example, several vireos have already moved into restored areas in Phase 2b, Phase 3, and Phase 4.

Currently, riparian habitat in SAC is becoming infested with arundo at all three sites. The restoration edges between the golf course and the homes have opened new areas for arundo to infest along the river, while the arundo patches in Upper Canyon continue to spread. In the lower section (Featherly Regional Park), the arundo had been treated with Imazapyr in 2013, which damaged many of the surrounding native trees. Though much of the arundo at this location is dead, the biomass remains, hampering native regeneration at this site. Additionally, multiple native trees were killed from Imazapyr over-spray. Castor bean has infiltrated the habitat at this site from the edges of the restoration areas as well.

PSHB is known to have infested trees in the Canyon RV Park within Featherly Regional Park and several trees in the riparian zone appear to have been infested (unconfirmed). There is no significant native tree die-off caused by the invasive PSHB observed in SAC at this time. In the

past, SAWA deployed PSHB traps in this area to assist in a monitoring program coordinated with the University of California, Riverside (UCR). The County of Orange has implemented the Santa Ana River Canyon Habitat Management Plan and SAWA biologists sit on two subcommittees overseeing implementation of the plan, though no meetings have occurred in many years. With the USACE riverbank stabilization (Reach 9) and BNSF bridge projects nearly done, the Santa Ana River Trail project was set to resume in 2021.

Upper Canyon (Monitored)

In 2022, 39 territories were detected at Upper Canyon, a 9% decrease from 43 territories detected in 2021 (Table 1). Twenty-three males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Nine pairs were well-monitored. Thirty-two fledglings were detected across all pairs in 2022, 23 of which fledged from nine well-monitored pairs, resulting in an average of 2.6 fledglings produced per well-monitored pair (reproductive success; Table 3). Estimated territory size of the vireos in Upper Canyon ranged from 0.41 to 1.92 acres in 2022.

Twenty-two nests were found in 2022, 15 of which were well-tracked. In 2022, apparent nest success was 53% (n=15), an increase from 47% success in 2021, but still a decrease from a high of 74% in 2019. Predation was the most common cause of nest failure accounting for five (33%) nests in 2022. One (7%) nest failed due to reproductive failure. Overall success of well-tracked nests from 2001 to 2022 is 64% (n=159), with a reproductive success rate of 2.7. A total of 551 fledglings have been documented over the last 22 years (Appendix C-1-K).

No nests were parasitized in 2022. Parasitism has only been documented in two of the 22 years of monitoring in Upper Canyon and has not been documented since 2003 when 18% (n=17) of well-tracked nests were parasitized (Appendix D). Cowbird trapping has occurred in Upper Canyon since 2001 when the first vireo was detected on-site. To date, 852 cowbirds have been removed from this area (Appendix C-1-K). No cowbirds were detected in the habitat in 2022.

Mulefat (64%), and poison oak (18%) were most frequently used for nest placement in 2022. Other hosts included Southern California black walnut (5%), laurel sumac (5%), and Fremont cottonwood (5%, n=22). Historically, mulefat (41%) has been the most common substrate used for nest placement at this site, followed by blue elderberry (*Sambucus mexicana*; 16%), Fremont cottonwood (7%), and Goodding's black willow (7%, n=215; Appendix C-2-K). A total of 111 biologist hours were spent monitoring vireos at Upper Canyon in 2022.

No construction activities occurred within Upper Canyon in 2022. Unfortunately, this site continues to be affected by other human-related impacts including illegal fishing, trash dumping, and illegal trail creation, in addition to large areas of invasive species (e.g., arundo, tamarisk) infestation.

Green River Golf Club (Monitored)

In 2022, 48 territories were documented at Green River Golf Club, one more than in 2021. This is a decrease of 21% from the 61 territorial males detected in 2020 (Table 1). Part of this decrease may be attributed to the October 2020 Blue Ridge Fire, which burned vireo habitat in the northern parts of the golf course near the railroad tracks and border of Chino Hills State Park. The habitat has still not fully recovered. The vireo population at Green River Golf Club has increased since monitoring began in 2001, when only 10 vireos were detected (Appendix D).

In 2022, 36 males were known to be paired, though not all territories were monitored sufficiently to determine pairing success. Twenty-three pairs were well-monitored. Seventy-one fledglings were detected across all pairs; 56 of which fledged from 23 well-monitored pairs, resulting in an average of 2.4 fledglings produced per well-monitored pair (reproductive success), a slight increase from 2.3 in 2021 (n=19). In comparison, the lowest reproductive rate observed was 0.6 in 2018, and the highest was 4.4 in 2017 (Appendix D). The overall reproductive success rate from 2001-2022 of well-monitored pairs is 2.4. A total of 740 fledglings have been documented over the last 22 years (Appendix C-1-L).

In 2022, estimated territory size of the vireos at Green River Golf Club ranged between 0.37 and 1.36 acres. In 2020, five territorial males and a paired female were banded as part of a USGS genetic study. None of these individuals were resighted in 2022.

Thirty-seven nests were discovered in 2022, 31 of which were well-tracked. Nesting success was 61%, an increase over the 48% (n=33) success rate of nests in 2021. Nine (29%) well-tracked nests failed due to predation, two (6%) failed for unknown reasons, and one (3%) nest failed due to reproductive failure. Overall nest success from 2001 to 2022 is 57% (n=282; Appendix C-1-L). Nests were most frequently placed in mulefat (38%), Goodding's black willow (11%), laurel sumac (11%), and Fremont cottonwood (11%; Table 4).

Cowbird trapping has occurred at the golf club since 2001, and a total of 1,084 cowbirds have been removed from this area (Appendix C-1-L). When SAWA began monitoring this site in 2001, the parasitism rate was 44% (n=9; Appendix D). Between 2002 and 2019, no parasitism was observed. Cowbird trapping did not occur in 2020 due to access limitation from the BNSF construction, and five (17%; n=29) well-tracked nests were parasitized. All five parasitized nests were manipulated; however, only two of these nests were successful (Appendix C-1-L). Two cowbird traps were deployed at the site in 2021, and a total of six cowbirds were removed. In 2022, eight cowbirds were removed, and no nests were found to be parasitized. A total of 173 biologist hours were spent monitoring vireos at Green River Golf Club in 2022.

Management at the Green River Golf Club has continued its cooperative relationship with SAWA and is supportive of SAWA's efforts to control cowbirds, manage vireos and other sensitive species, and enhance habitat.

Featherly Regional Park (Monitored)

In 2022, 66 territorial males were detected in Featherly Regional Park, a 3% increase from 2021 (n=64). Forty-three territories were known to be paired, though not all territories were monitored sufficiently to determine pairing success. Fifteen pairs were well monitored. Fifty-two fledglings were detected across all pairs, 31 of which fledged from 15 well-monitored pairs for a reproductive success rate of 2.1. A total of 701 fledglings have been observed over the last 22 years at this site (Appendix C-1-M). The overall reproductive success rate of well-monitored pairs over 22 years of monitoring is 2.1 (Appendix C-1-M), compared to the watershed wide rate of 2.8 (Appendix B-1). These numbers continue to emphasize the vireo population recovery at this site over the last 22 years given that no vireos were detected in 2001, the first year of monitoring. The population's first major increase at this site came in 2004 when it quadrupled from six in 2003 to 24 the following year (Appendix D). However, reproductive success has greatly fluctuated at this site from a high of 5.6 in 2019 to a low of 0.0 in 2012 (Appendix C-1-O; Appendix D).

In 2022, estimated territory size of the vireos in Featherly Regional Park ranged between 0.71 to 2.77 acres. Of the four territorial males that were banded in 2020 as part of a USGS genetic study, only one was re-sighted in 2022. One of the territories with a banded male in 2020 was occupied by an unbanded male in 2021, one other territory was unoccupied in 2021, and another in 2022.

Nesting success for 29 well-tracked nests in 2022 was 48%, slightly above the overall nesting success of 45% (n=300) from 2002 to 2022. Fourteen (48%; n=29) well-tracked nests were lost to predation (Appendix C-1-M). Parasitism had not been documented at this site since 2009 when 9% (n=11) of nests were parasitized (Appendix D). In 2021, four (21%) of 19 well-tracked nests were found to be parasitized; however, no nests failed due to parasitism after cowbird eggs were removed. No parasitism was documented in 2022. No well-tracked nests failed due to reproductive failure, and one (3%) failed for unknown causes (n=29).

Of the 31 nests found in 2022, thirteen (42%) were placed in mulefat and five (16%) in Fremont cottonwood; the remaining nests were placed in other native substrates. No nests were placed in non-native vegetation. Nests were placed in 11 different plant species, five of which are not considered riparian plants (Table 4).

Cowbird trapping has occurred in Featherly Regional Park since 2002 when the first vireos were detected on-site, and 542 cowbirds have been removed during this time. Parasitism has been documented in four out of the 22 years monitored, reaching its highest rate (67%) in 2002 (Appendix D). For the first time since 2009, parasitism (21%) was detected in Featherly Regional Park in 2021 (Appendix C-1-M). An additional trap was added near the area where parasitism occurred, but no cowbirds were caught at this trap and the affected vireos' subsequent nests were not parasitized. In 2022, that trap was redeployed, but was vandalized after only 36 trap

days and was removed. A total of 316 biologist hours were spent monitoring vireos at Featherly Regional Park in 2022.

The California Scrub-jay, a well-known avian nest-predator, occurs in large numbers throughout Featherly Regional Park. One such predation was observed when a scrub-jay pair took three seven-day old nestlings from one nest in 2015. Another nest invader found in large numbers throughout the site is the Argentine ant. In 2020, one nest was found containing three nestlings covered in Argentine ants while the adults were frantically trying to defend the nestlings. Other indications of ant predation in prior years include: in 2015, a nest found with ants entering a pip hole in the eggs on hatch day (a later visit found the eggs to be completely empty with only the same small hole in each egg); in 2016, ants were observed eating two Black-headed Grosbeak (*Pheucticus melanocephalus*) nestlings and one egg; in 2017 and 2018, ants were observed preying on vireo nestlings and hatch-day eggs; in 2021, ants were found to have consumed all but a few nestling bone fragments; in 2022, nestlings were consumed by ants at about 4-5 days and unhatched eggs were consumed by ants in a different nest that had recently fledged two young.

Until the abundant winter rains in 2016 and 2017, the habitat at Featherly Regional Park had become extremely drought-stressed, with the exception of the area immediately adjacent to the riverbanks. The dramatic increase in breeding success in 2017 and 2019 at this site was likely due to the increased precipitation and resulted in higher recruitment in 2018 and 2020. Unfortunately, 2021 brought another extreme drought year with low reproductive success at this site. Continued drought conditions in 2022 did not appear to affect reproductive success, perhaps aided by a few small precipitation events throughout the season. PSHB has been detected within the park, though no large die-off has been observed. Other ongoing disturbances at this site include habitat destruction during nesting season by the orange grove lessee, illegal fishing, and sporadic homeless camps. Invasive plants continue to be a problem at this site. Arundo began re-sprouting two weeks after the Freeway Complex Fire in 2008 and has since spread sporadically throughout the site. In an effort to take advantage of the arundo biomass removed by the fire, Orange County Public Works management was able to spray herbicide on the rapid arundo regrowth before the following nesting season, which helped control a large amount of regrowth. Unfortunately, many patches have reestablished since that time and a large amount of dead arundo biomass remains, hampering native plant regeneration. Additionally, the subsequent use of Imazapyr on arundo was found to have damaged over 200 nearby native trees in 2013. More damage was observed in 2020. The USACE Reach 9 project, Phase 5B, was still active in Featherly Park during the nesting season in 2022. However, this project should be completed by next season and proposed mitigation should expand and enhance vireo habitat in the post-construction years. Vireos have already begun inhabiting the Phase 4 and 5a restoration areas. The 8% decrease of territorial males at this site from 2016 (n=64) to 2017 (n=59) was likely due

to habitat loss during construction; however, territories increased until 2020 (n=79), then subsequently decreased in 2021 (n=64) and have now returned to the 2018 level of 66 territories in 2022 (Appendix D).

Sampled Sites

Thirty-seven sites were sampled in 2022 and 554 vireo territories were documented. Vireos were not detected at three of the 37 sampled sites (Table 1). Fourteen (41%) out of a subset of 34 sites classified as “sampled sites” both in 2021 and 2022 reported an increase in detected vireo territories, while seven (21%) of those sites reported a decrease in detected vireo territories. Thirteen (38%) of the sampled sites reported the same number of territories in 2021 and 2022; of those, three sites had zero territories. Chino Hills State Park (CHSP) was not surveyed in 2020 or 2021 due to COVID-19 restrictions. Sample surveys resumed at CHSP in 2022 and 48 territories were detected, a 30% increase from 37 detected territories in 2019. SAWA biologists spent a total of 397 hours surveying vireos at all sampled sites in the watershed in 2022.

Incidental Sites

In 2022, seven additional vireo territories were documented at three sites in which no formal surveys were conducted. Three of the males were determined to be paired and a total of five fledglings were incidentally detected (Table 1). Location names and GPS coordinates of incidental vireo detections can be found in Appendix A.

SIGHTINGS OF INTEREST – INCIDENTAL SPECIES OBSERVATIONS

All incidental species sightings were documented at monitored sites and only sensitive species were documented at sampled and incidental sites during vireo monitoring. One hundred sixty-four avian, 21 mammal, 17 herpetofauna, and four fish species were observed at monitored, sampled, and incidental sites, including one Wood Stork (*Mycteria americana*) detected at Norco Bluffs this year. Sensitive species were documented by site and a combined total of 43 sensitive species were detected (Table 5). Sensitive species are defined as those listed as endangered, threatened, or a species of concern by resource agencies as well as those covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Observations are verified detections and are considered presence at each location; this should not be considered a complete species list for each site. For example, California Gnatcatchers (*Poliophtila californica*) were detected at sixteen sites adjacent to vireo habitat; however, other California Gnatcatchers likely occur in adjacent areas of other sites where biologists do not frequent, thus many may go

undetected. Similarly, some species are difficult to detect, such as the long-tailed weasel, and may occur in locations other than those reported here. Sensitive species sightings are reported annually to the appropriate resource agencies.

Southwestern Willow Flycatcher

Southwestern Willow Flycatchers have been documented sporadically in Prado Basin since 1996 and a total of 37 nests have been discovered on site from 1996-2013 (Pike, 2021). No Southwestern Willow Flycatchers were detected in the Prado Basin in 2022 (Cameron Macbeth, personal communication, November 15, 2022). In past years, the highest number of detections in the Prado Basin occurred in 2003, with nine individuals present (Pike, 2021).

In 2022, SAWA biologists detected twelve individual migrant Willow Flycatchers within the watershed. Willow Flycatchers are deemed migrants if they fail to remain on-site through June; none of the twelve migrants were found to remain through June. One adult was detected at Featherly Park on May 12. On May 18, a singing male was found at the San Jacinto River; a second individual was found at SAR – Riverside Avenue to Van Buren Boulevard on the same date. Two individuals were detected in fire-damaged riparian habitat at Green River Golf Club on May 19. On May 23, two males were observed countersinging in San Timoteo Canyon. One individual was detected at Lake Perris on May 25. On June 1, an individual was detected at Hidden Valley – South; two additional individuals were detected at SAR - Riverside Avenue to Van Buren Boulevard on the same date. The last willow flycatcher observation occurred at Sycamore Canyon on June 4.

Migrant Willow Flycatchers have been observed periodically throughout the rest of the watershed over the years; however, SAWA has not documented any breeding attempts at monitored or sampled sites. All migrant Willow Flycatcher sightings are reported to USGS Riparian Birds Working Group and to the California Natural Diversity Database.

BROWN-HEADED COWBIRD TRAPPING RESULTS

Brown-headed Cowbird Trapping, March-July 2022

Fifty-one cowbird traps were deployed during the 2022 vireo season and 1,469 cowbirds were removed from all sites over 5,671 trap days. Of the 51 traps, eight were located at local dairies. The sex and ages of the cowbirds removed were 895 adult males, 379 adult females, and 195 juveniles. SAWA biologists and field assistants spent 3,541 hours servicing traps during the vireo season, including installation and removal of traps from the field (Table 6).

Cowbird captures decreased by 61% (n=3,755) from 2021, though number of trap days also decreased by 9% (n=6,217). Sixty percent fewer males (n=2,210), 73% fewer females (n=1,395), and 30% more juveniles (n=150) were trapped during the 2022 breeding season compared to 2021. In 2022, the overall capture rate was 0.26 cowbirds per trap day (Table 6), a decrease from 0.60 in 2021 (Zemba et al., 2021). Since cowbird management began in 2001, close to 53,000 cowbirds have been removed from the watershed by SAWA during the breeding season (Appendix B-3).

Non-target Captures in Cowbird Traps, March-July 2022

Twenty-five non-target native species and three non-nuisance exotic species were captured in 51 traps in 2022. There were 1,812 non-target trapping occurrences (1,801 native and 11 non-nuisance exotic); exotic nuisance species are excluded from these totals. It should be noted that many of these trapping occurrences are likely the same individuals returning to the same traps. In order of most frequently captured, the most common species were California Towhee (*Melospiza crissalis*), Red-winged Blackbird (*Agelaius phoeniceus*), and House Finch (*Haemorhous mexicanus*). The percent of trapping occurrences that resulted in mortality was 2.04% in 2022 (Table 7). Numbers of the two nuisance exotic species (European Starlings and House Sparrows) released and removed are also listed in Table 7.

Fall/Winter 2021-2022 Brown-headed Cowbird Trapping and Non-target Captures

Eight cowbird traps were deployed at dairies during the non-breeding season (fall/winter) of 2021-2022. Two dairies in the Prado Basin each had two traps, three dairies near the San Jacinto River each had one trap, and one dairy in Lake Elsinore had one trap. A total of 5,046 cowbirds were removed (1,613 adult males, 2,427 adult females, and 1,006 juveniles) over 977 trap days (Table 8). SAWA biologists and field assistants spent 1,264 hours servicing traps during the fall/winter of 2021-2022, including installation and removal of traps from the field. In the fall/winter of 2020-2021, 6,698 cowbirds were removed from six dairy traps over 729 trap days (Zemba et al. 2021). In 2021-2022, the capture rate was 5.16 cowbirds per trap day, a decrease from 9.19 in 2020-2021 (Table 8; Zemba et al., 2021). Over 100,000 cowbirds have been removed from the watershed by SAWA during the fall/winter since cowbird management began (Appendix B-3).

Seven non-target native species, consisting of 111 individual trapping occurrences, were captured in the eight dairy traps in 2021-2022. The most common species captured was the Red-winged Blackbird (n=77). Two Red-winged Blackbirds and one House Finch died in traps in 2021-

22, resulting in a mortality rate of 2.7 percent. No mortality occurred for other non-target species. Numbers of European Starlings and House Sparrows removed and released from cowbird traps are reported in Table 9.

DISCUSSION

With the exception of a few years, vireo abundance has increased annually in the Santa Ana Watershed since monitoring outside of Prado Basin began in 2000. In 2022 2,076 vireo territories were documented watershed-wide (includes preliminary data from Prado Basin), a 5% increase from 2021 (n=1,974; Figure 6). The significant population increase over 22 seasons of monitoring at four sites is illustrated in Figure 7. The 1,393 vireos detected by SAWA biologists outside of Prado Basin in 2022 represent a 1% increase in territories from 2021 (n=1,378); however, in 2022, Chino Hills State Park was surveyed for the first time since 2019 and an additional 48 territories were documented. Without accounting for the survey conducted in Chino Hills State Park, a 2% decrease in overall abundance would be shown in 2022 as compared with 2021 (n=1,574; Table 1). Survey efforts were otherwise similar at most sites with the exception of Mockingbird Canyon and Meridian, which were only sampled this year.

Nesting success watershed-wide was 55% (n=367) in 2022, slightly lower than the overall nesting success of 57% (n=4,407) in the last 22 years. The overall reproductive success rate (average number of fledglings produced by well-monitored pairs) was 2.7 (n=190), just under the 22-year average of 2.8 (n=2,398) and lower than the unusually high rate of 3.8 (n=151) in 2019 (Appendix B-1). Southern California again received much lower than average precipitation during the winter of 2021-2022, which may have resulted in reduced prey availability for nesting vireos and potentially contributed to lower reproductive success than observed in 2019, which had higher than average precipitation (National Oceanic and Atmospheric Administration, 2021; National Oceanic and Atmospheric Administration, 2022). Predation remains the primary cause of nest failure, with an overall 35% (n=367) of nests lost due to predation in 2022, slightly higher than the 34% (n=4,407) watershed-wide spanning all years of monitoring (Appendix B-1). Site-specific predation rates ranged from 14% at Hidden Valley - North to 60% at Lower Hole Creek (Appendix C-1). Another potential factor for the lower than average overall reproductive success rate was the high parasitism rate found at three sites in Upper SAR and San Jacinto. The overall parasitism rate was 7% in 2022, though two sites along the Santa Ana River ranged from 20-29%. However, nest loss from cowbird parasitism was only 2% (22-year average of 3%; Appendix B-1), largely due to SAWA's management procedure of removing cowbird eggs when found. Regardless, the high rate of parasitism in this section of the Santa Ana River is concerning. Biologists cannot find every nest and there are likely un-located parasitized nests that could be fledging cowbirds instead of vireo. We continue to reevaluate the trapping program and other

factors that may be contributing to the large population of cowbirds at this site. The watershed-wide (excluding Prado) parasitism rate has ranged from 3% to 11% in the last five years and these relatively low rates at most sites can likely be attributed to SAWA's cowbird trapping program and nest monitoring. Kus and Whitfield (2005) showed that cowbird trapping reduces parasitism of vireo nests, thus enhancing productivity of nesting pairs and in turn increasing the population level. Figure 8 shows the increase in vireo territories in relation to the rate of cowbird parasitism in the Santa Ana Watershed from 2001-2022. A comparison of watershed-wide nesting success, predation, and parasitism rates from 2003-2022 are shown in Figure 9. Nest losses due to reproductive failure and other unknown factors in 2022 were 2% and 6%, respectively. Examples of nest loss due to reproductive failure are failure of the vegetation to support the nest and non-parasitized egg abandonment (Appendix B-1; Appendix D).

The two primary causes of vireo decline in the past, parasitism by the Brown-headed Cowbird and the loss of riparian habitat, are being successfully managed at most sites by SAWA through cowbird trapping and habitat restoration. SAWA biologists have removed over 153,000 cowbirds from the watershed in the last 21 years (Figure 10). SAWA has also removed nearly 6,100 acres of invasive arundo from the watershed, allowing for almost as many acres of riparian recovery.

Finally, the lack of documented nesting Willow Flycatchers in the watershed in 2022 is not surprising given the dwindling numbers over the last decade. No breeding activity from this subspecies has been documented in the watershed below Seven Oaks Dam since 2014. Southwestern Willow Flycatcher territories have been reported in riparian habitat located in the higher elevations of the watershed (around and above Seven Oaks Dam) in the past and should be surveyed to ascertain the status of this imperiled subspecies in the mountains.

MANAGEMENT RECOMMENDATIONS

Parasitism by Brown-headed Cowbirds continues to occur episodically throughout the watershed and was particularly pervasive at some locations in 2022 (13% - 29%; Table 3). Vireo monitoring and cowbird trapping should continue along with the removal of non-native vegetation. Hidden Valley Wildlife Area was hit particularly hard by parasitism again in 2022, therefore, we recommend land managers coordinate with SAWA to increase trapping efficiency. The removal of arundo and other invasive vegetation, in conjunction with cowbird management, has had a positive influence on vireo territory numbers in the watershed since 2000. With the removal of nearly 6,100 acres of arundo and other invasive plants to date, SAWA continues to have extraordinary success with riparian habitat restoration along the Santa Ana River and its tributaries. Since invasive plants like arundo cannot typically be eradicated within a five-year

mitigation term, we recommend that long-term maintenance of invasive plant regrowth become a mitigation opportunity much like cowbird trapping.

In recent years, large homeless encampments have become increasingly prevalent throughout the Santa Ana River. These encampments could have a strongly negative effect on habitat and water quality and cause increasing safety issues for biological monitors. In addition to restoration, as well as maintenance and procurement of new lands, there should be increased protection of lands for wildlife values. Increased enforcement of current laws that restrict illegal activities in sensitive riparian areas is needed. Local landscapes are scarred with OHV tracks and these activities are damaging riparian habitat in areas such as Mockingbird Canyon, San Timoteo Canyon, the San Jacinto River, and the Santa Ana River. Additionally, laws meant to prevent other human disturbances such as streambed alteration, illegal fishing, and camping need increased enforcement. Enforcement of these laws can protect riparian habitat from degradation. There is also increasing awareness of the need to control feral pigs throughout the watershed. Some multi-organizational planning attempts to control this destructive species have been publicized; however, a management plan has yet to be implemented.

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FIGURES AND TABLES

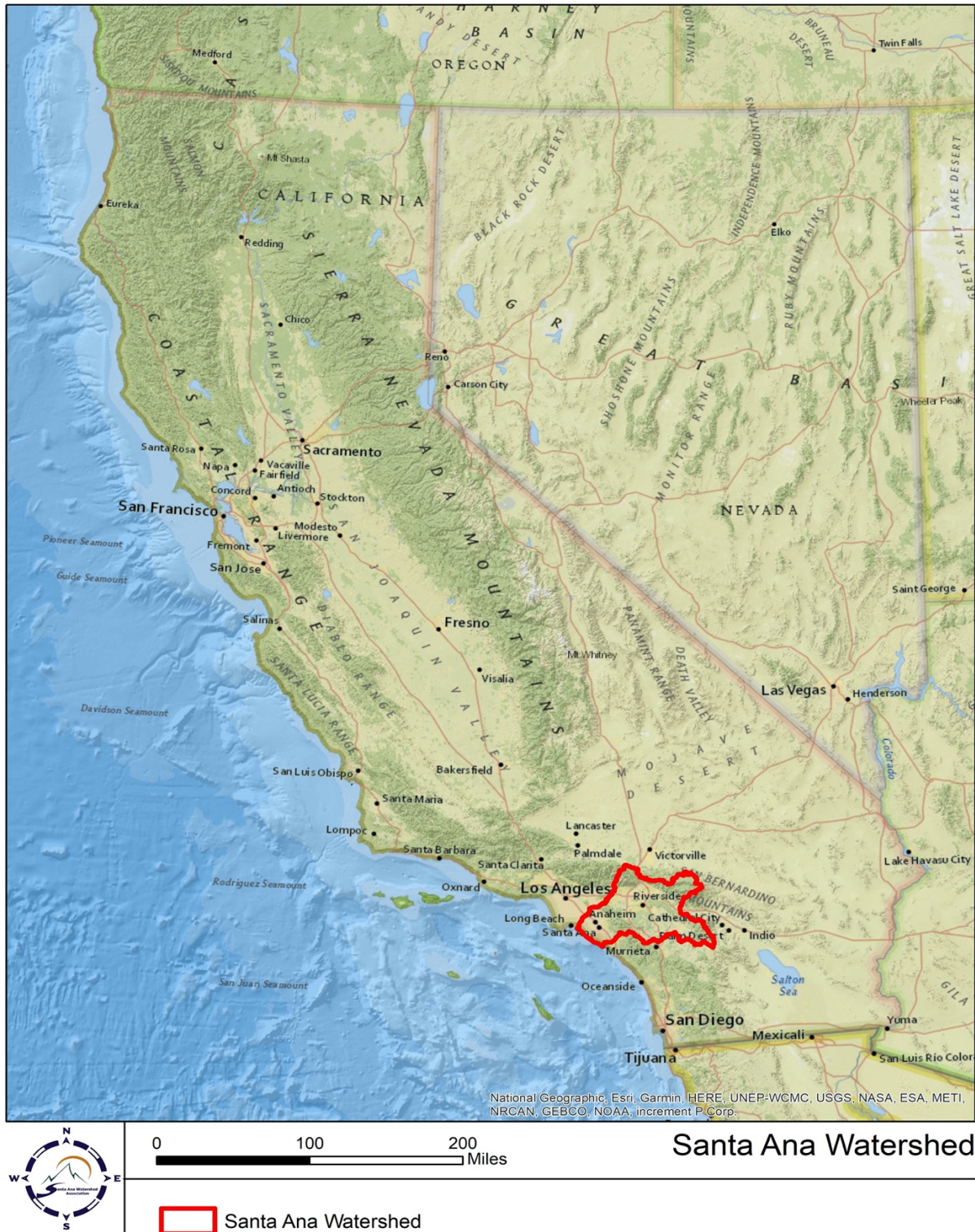


Figure 1. Location of the Santa Ana Watershed. The watershed, delineated in red, covers nearly 3,000 square miles in southern California and includes parts of San Bernardino, Riverside, Orange, and Los Angeles counties.

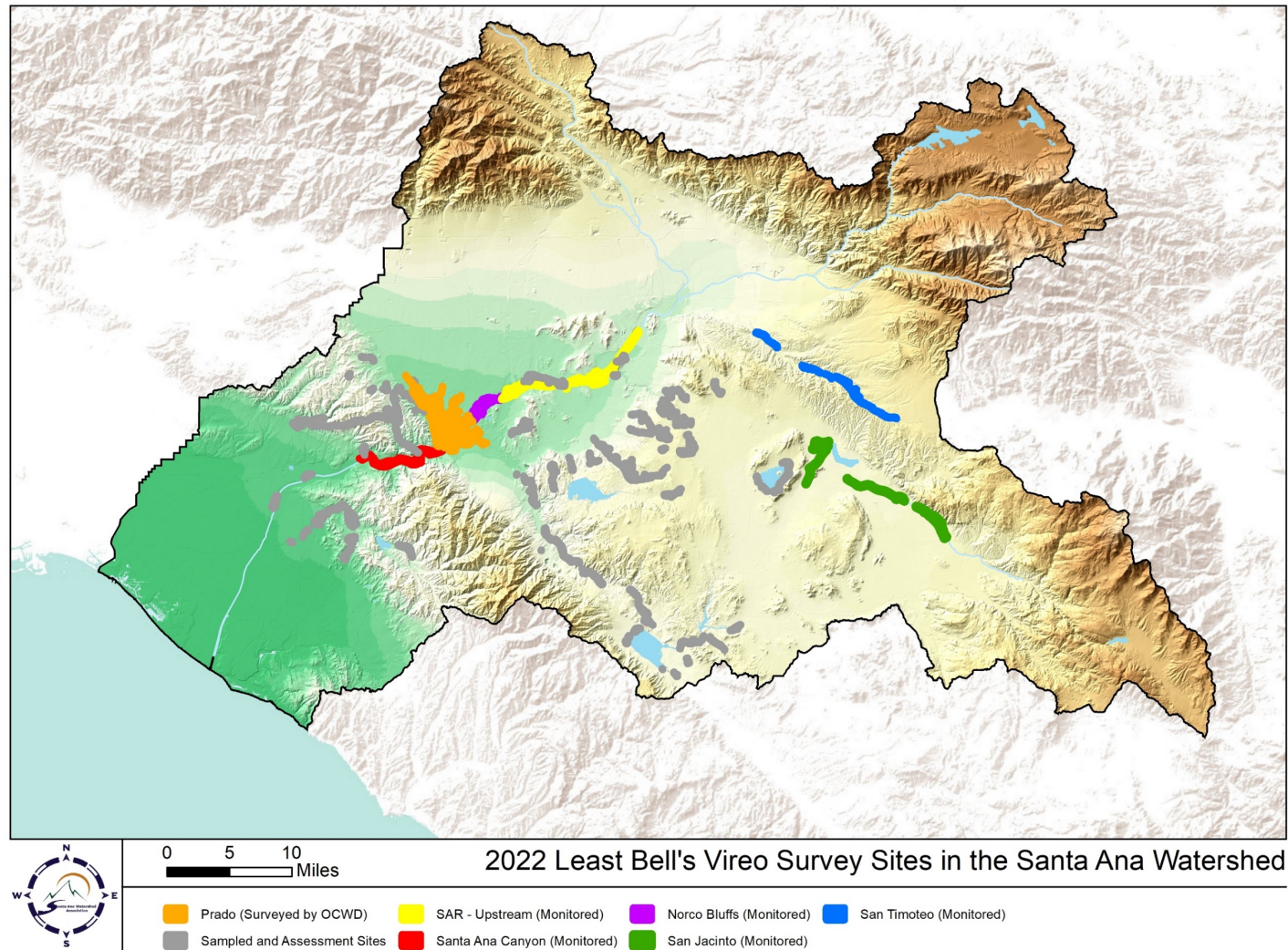


Figure 2. Least Bell's Vireo Survey Sites in the Santa Ana Watershed, 2022. Monitored sites are shown in various colors, while sampled/assessment sites are shown in gray. Refer to Table 1 for a list of sampled/assessment sites and Appendix A for a corresponding list of site coordinates. Monitored sites had well-monitored vireo territories, with eight or more visits and nest monitoring. Sampled/assessment sites were visited three or more times during the breeding season, and no or minimal nest monitoring occurred.

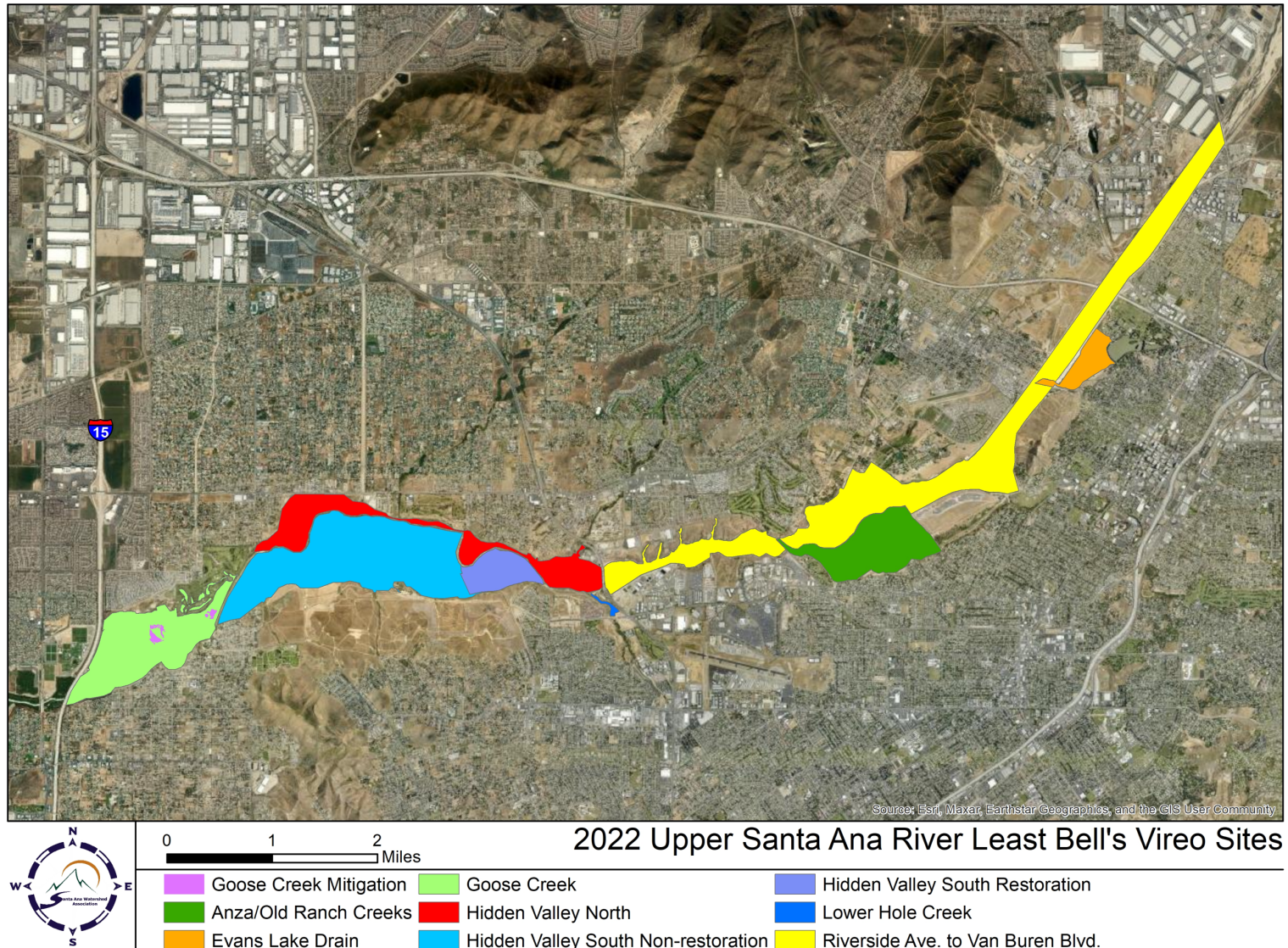


Figure 3. Upper Santa Ana River Least Bell's Vireo Sites, 2022. Hidden Valley – North was a sampled site in 2022 (three or more visits with no or minimal nest monitoring). All other sites were monitored (territories well-monitored with eight or more visits and regular nest monitoring).

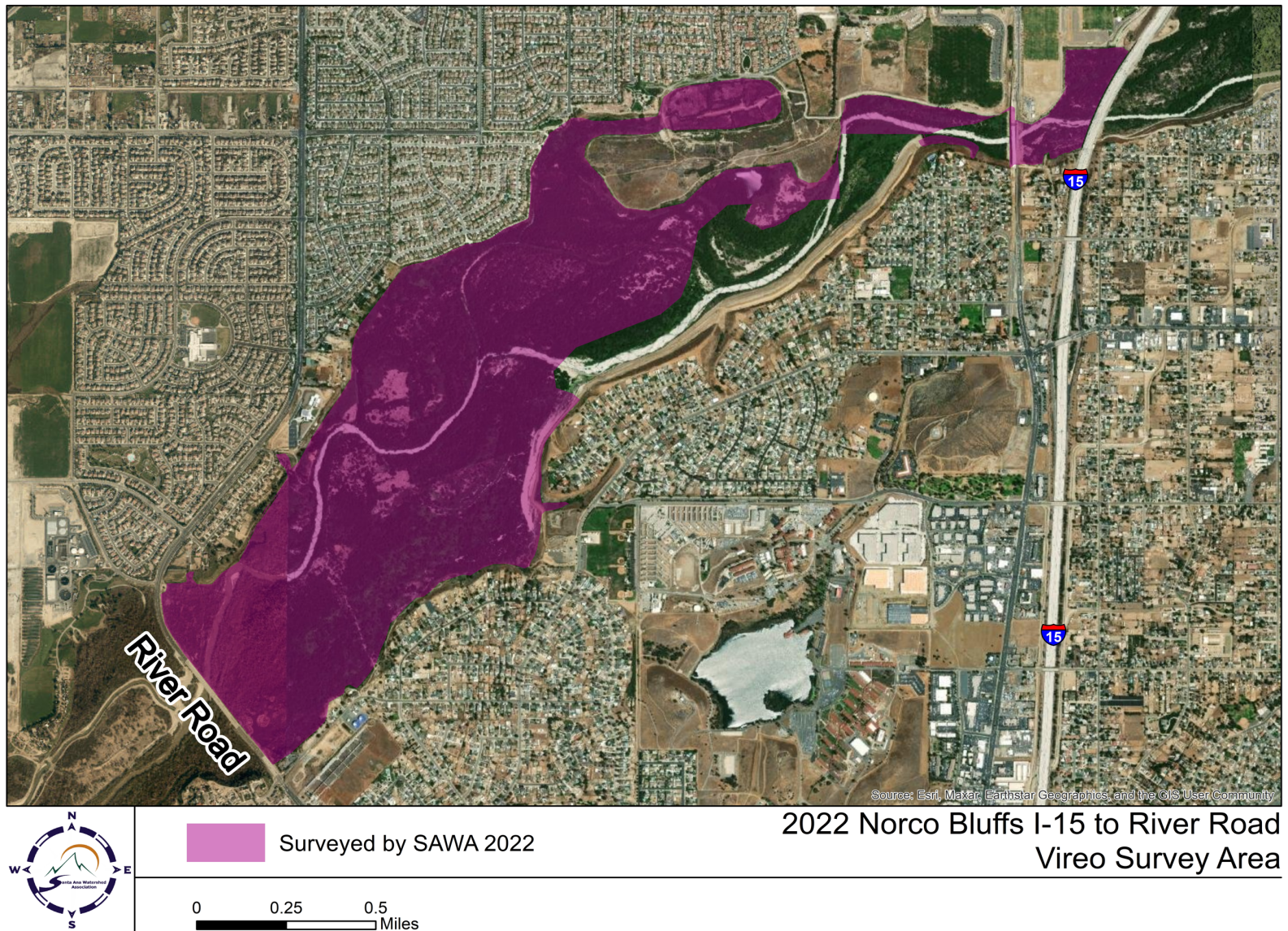


Figure 4. Norco Bluffs Least Bell's Vireo Survey Area, 2022. Norco Bluffs has been a monitored site since 2015 (territories well-monitored, with eight or more visits and regular nest monitoring). Area outside of the shaded polygon was not monitored due to denial of access.

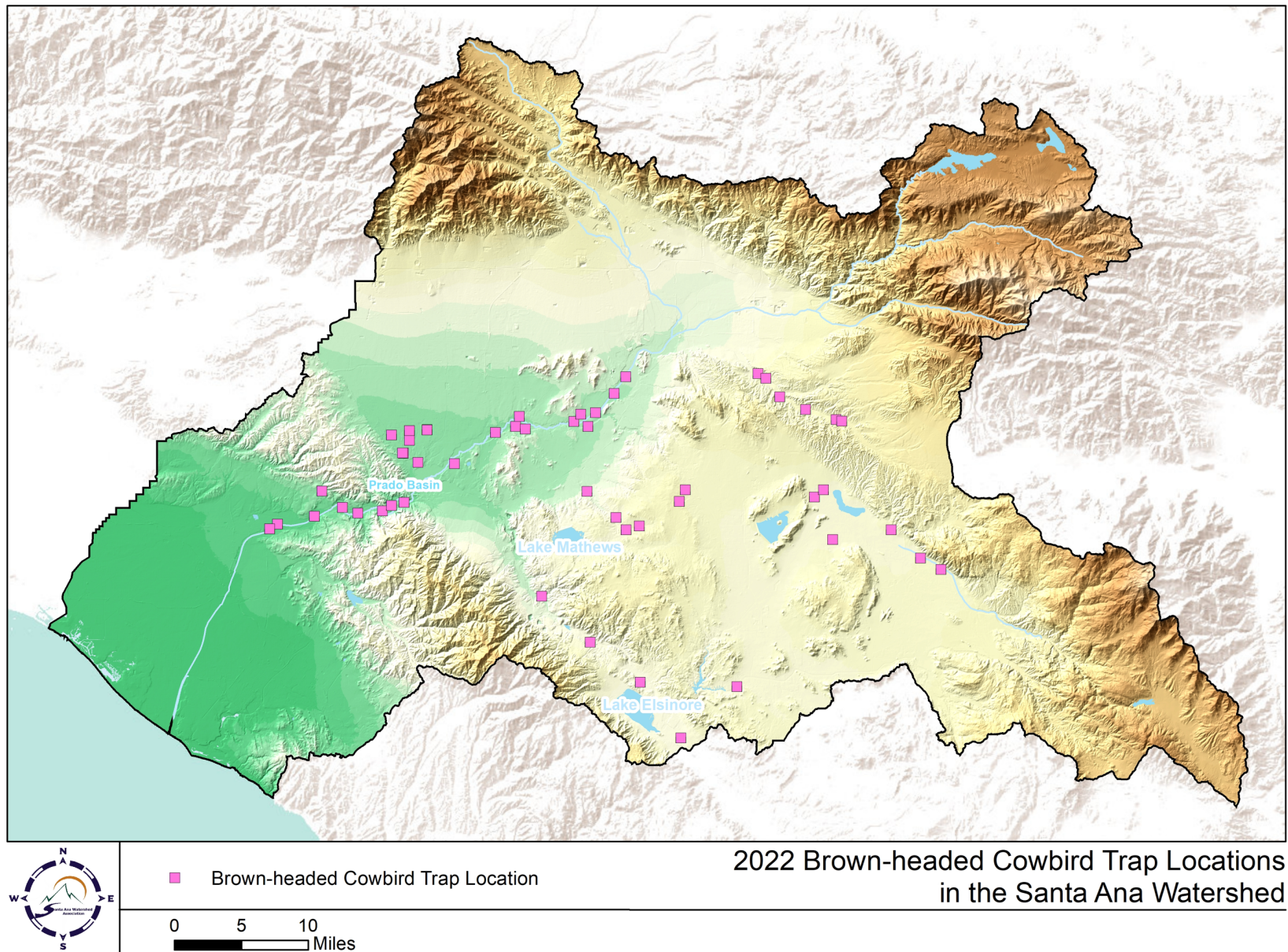


Figure 5. Brown-headed Cowbird Trap Locations in the Santa Ana Watershed, 2022. Fifty brown-headed cowbird traps were deployed and maintained in the Santa Ana Watershed during the 2022 vireo nesting season (March – July).

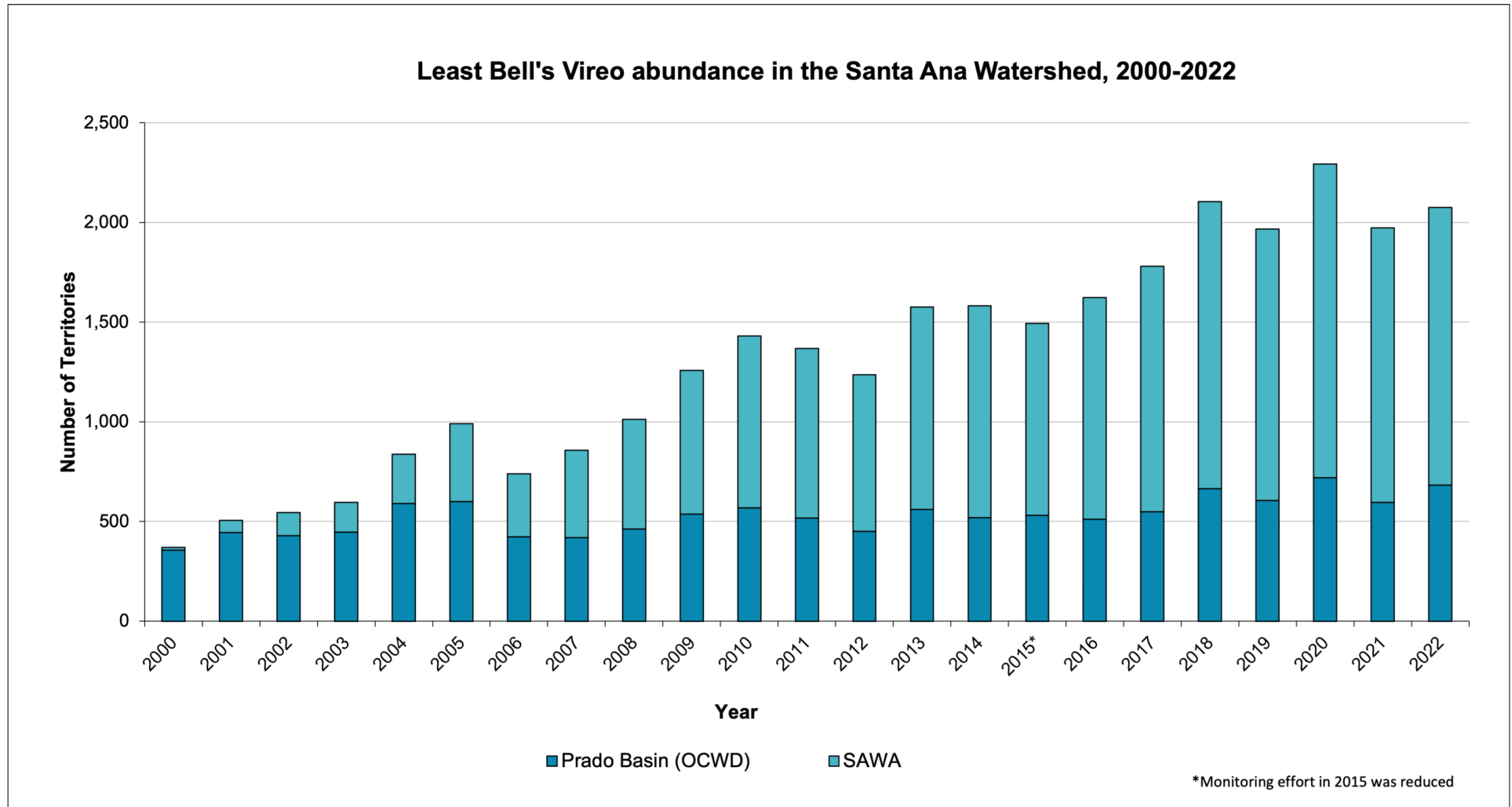


Figure 6. Least Bell's Vireo Abundance in the Santa Ana Watershed, Including Prado Basin, 2000-2022. Vireo population monitoring outside of Prado Basin began in 2000. Vireo abundance in the Santa Ana Watershed has increased dramatically in the past two decades.

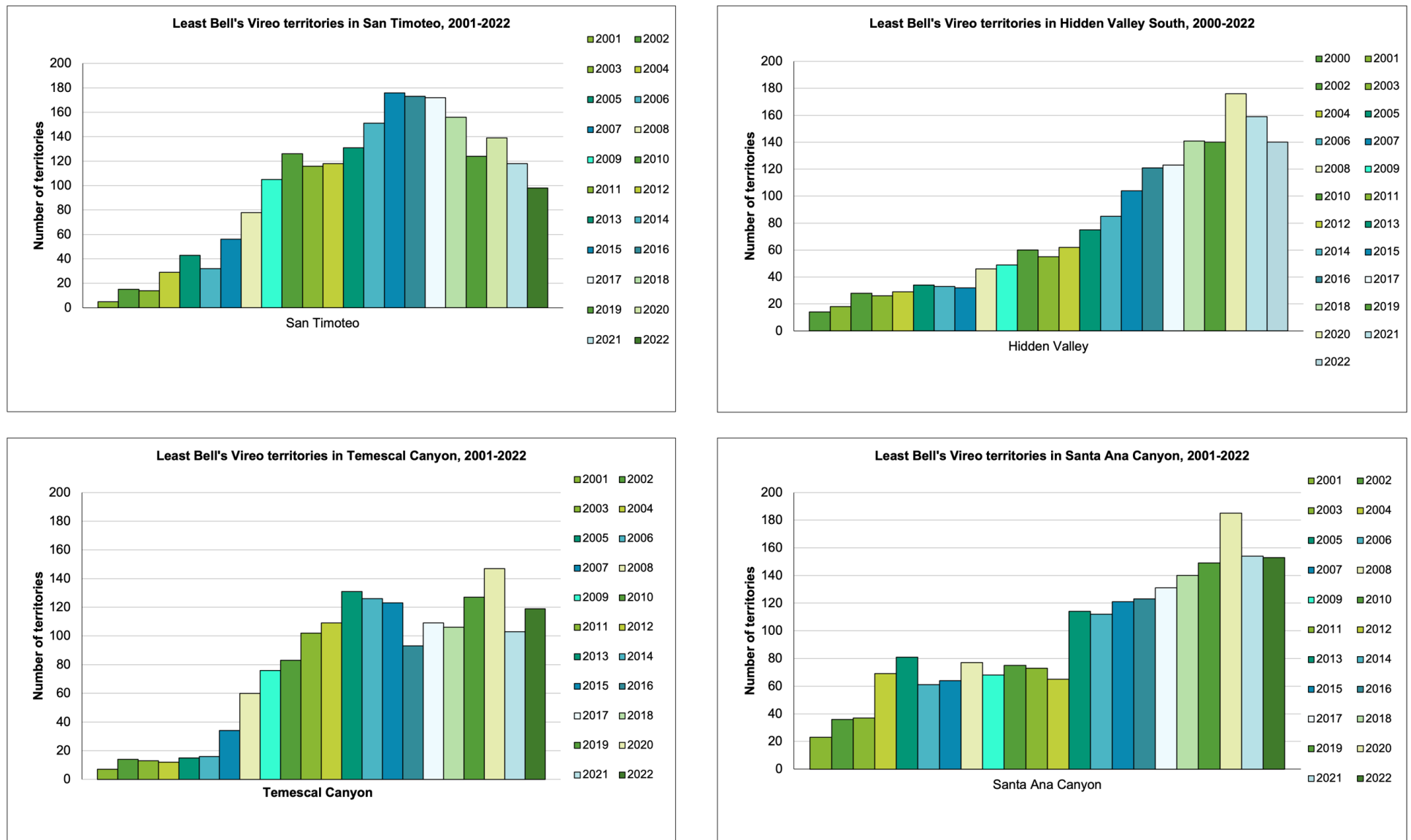


Figure 7. Least Bell's Vireo Territories at Four Sites in the Santa Ana Watershed, 2000-2022. Number of vireo territories at four sites that were comparatively monitored in the watershed. Data shows how vireo abundance has increased substantially over 22 seasons.

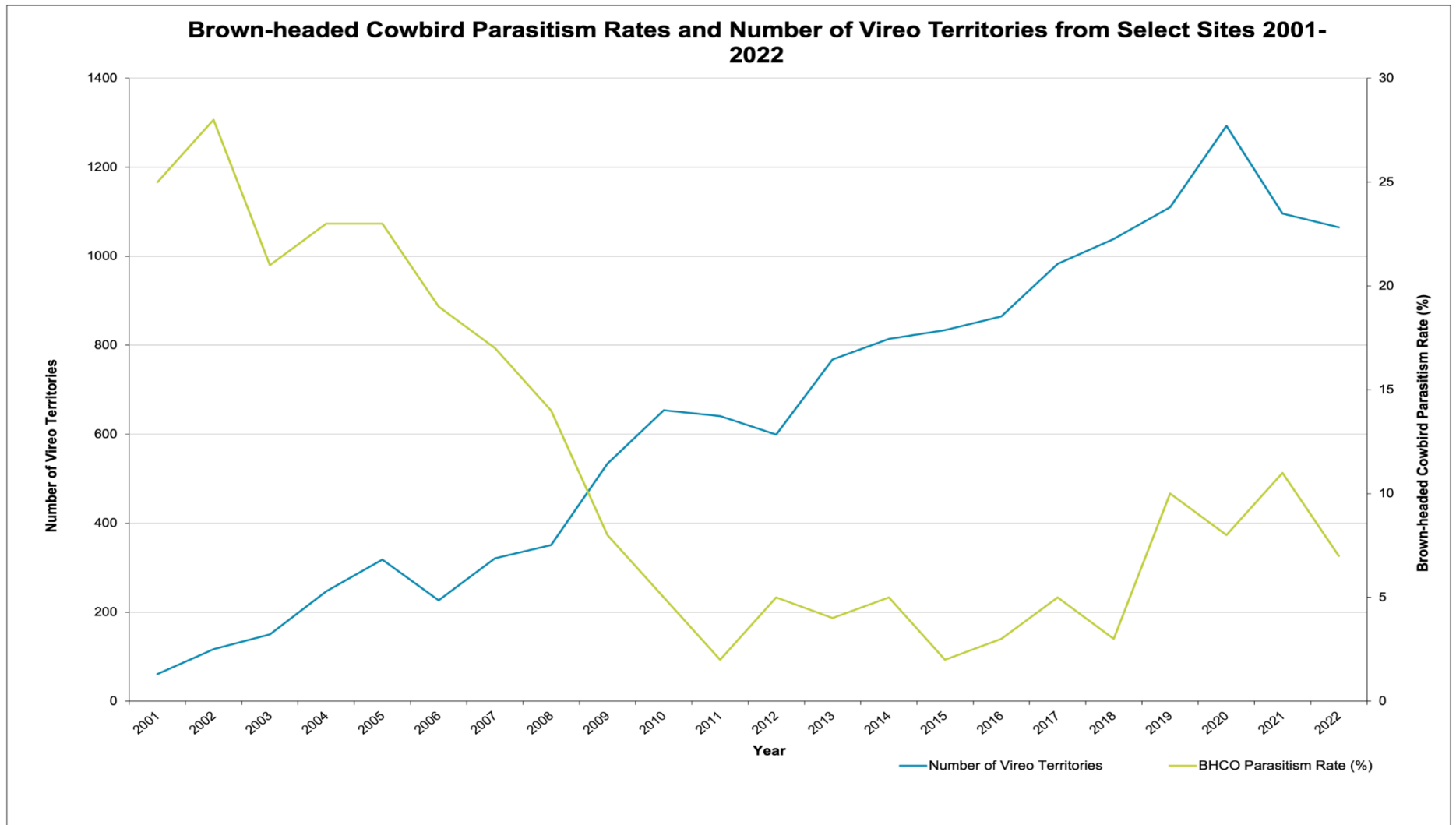


Figure 8. Vireo Territories vs. Parasitism Rates in the Santa Ana Watershed, 2001-2022. This graph shows the inverse relationship between vireo abundance and parasitism rates. Vireo territories have generally increased in number since 2001, while Brown-headed Cowbird parasitism rates have decreased due to intensive cowbird management. Parasitism data are only collected for well-tracked nests. Beginning in 2019, nests that were predated before it could be determined if they had been parasitized (seven days after the start of incubation) were excluded from parasitism rate calculations, slightly increasing the rates. Source data: "Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed" tables, 2001-2022. In 2022, Chino Hills, Mockingbird Canyon, and Temescal Canyon data were omitted from the table but are included in this figure for consistency with prior years.

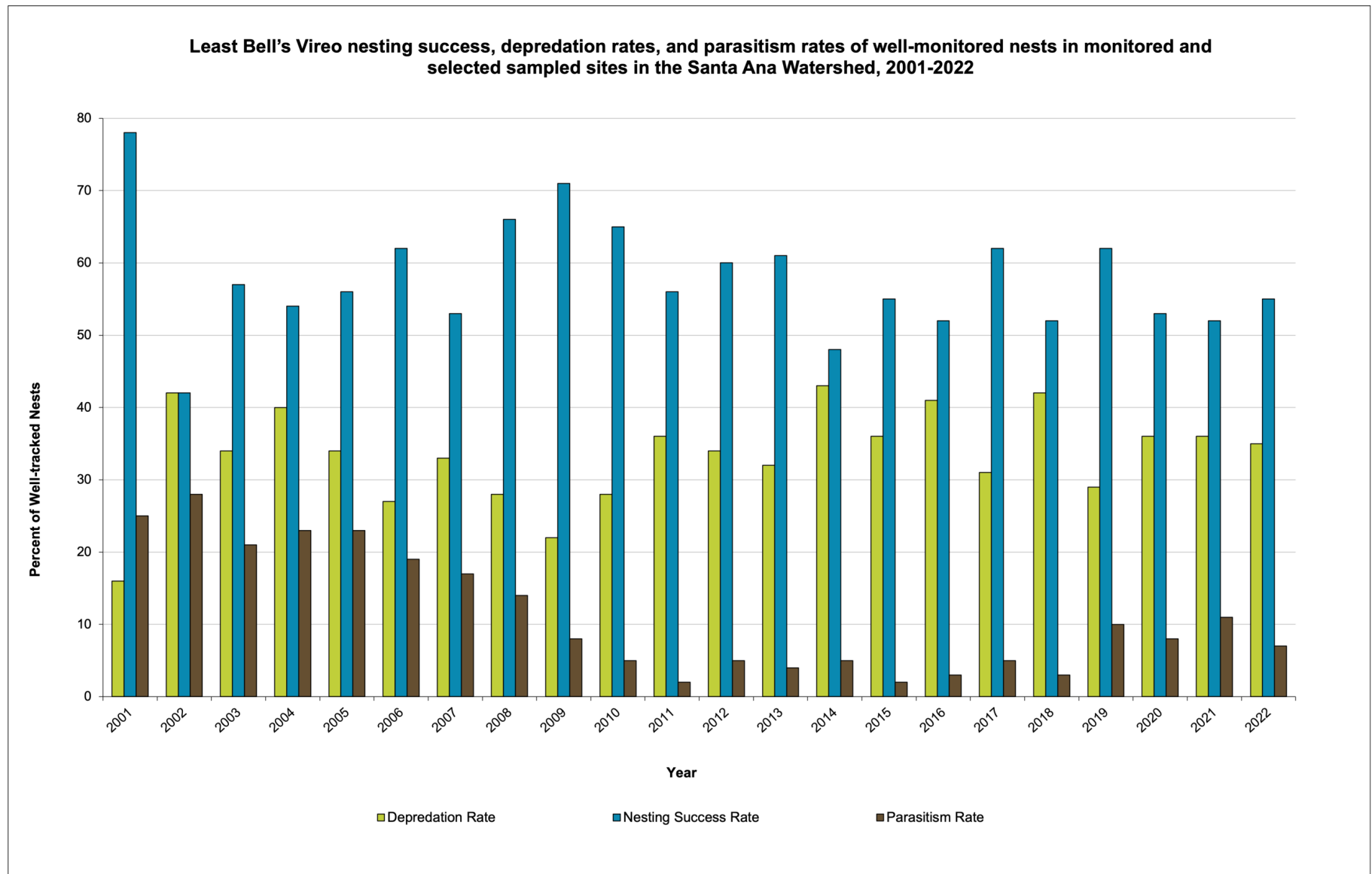


Figure 9. Least Bell's Vireo Nesting Success, Depredation Rates, and Parasitism Rates in the Santa Ana Watershed, 2001-2022. Nest failure due to parasitism remains low due to SAWA's cowbird management program, which includes trapping and removing cowbird eggs from vireo nests when found. Beginning in 2019, nests that were predated before it could be determined if they had been parasitized (seven days after start of incubation) were excluded from parasitism rate calculations, slightly increasing the rates.

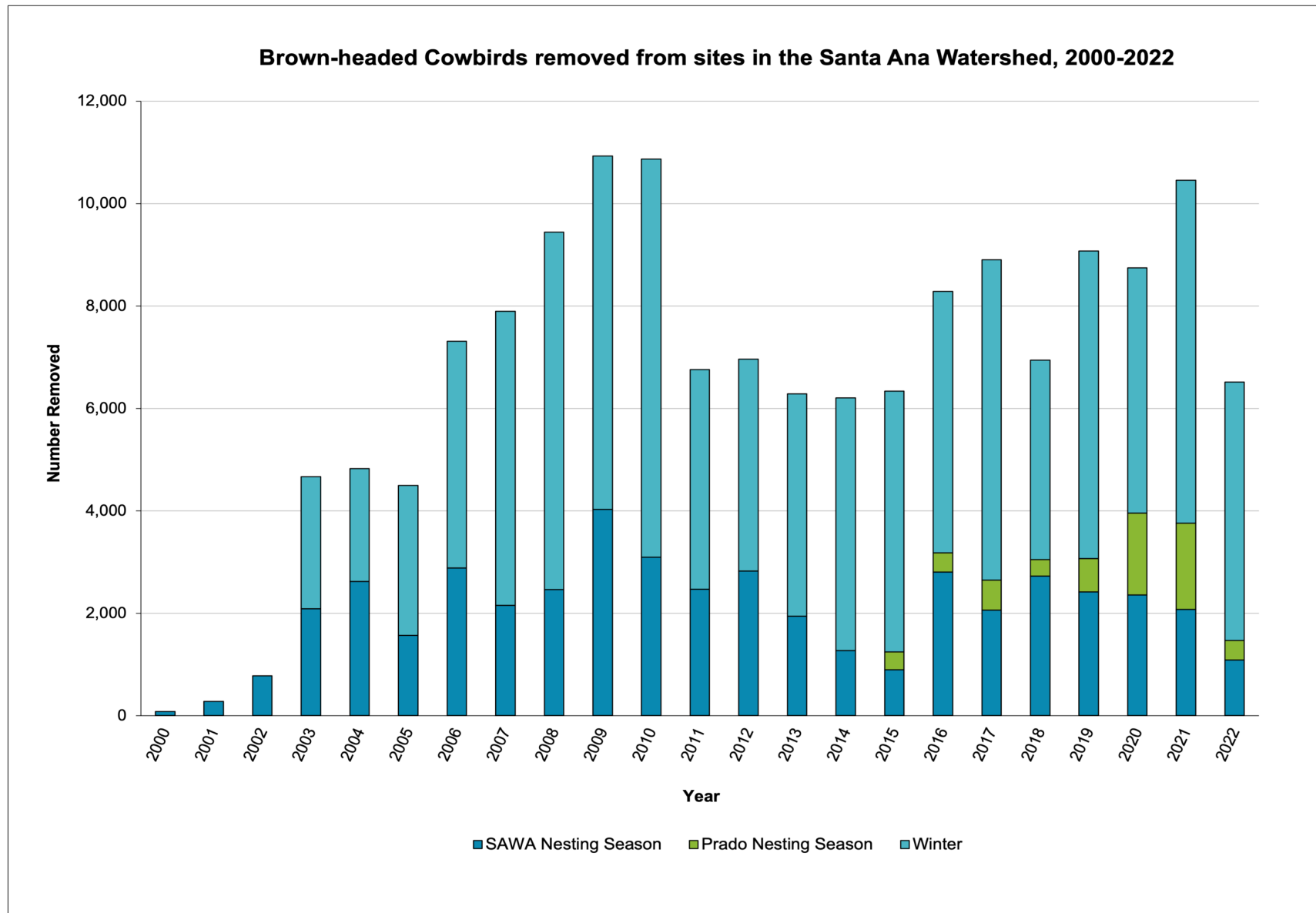


Figure 10. Brown-headed Cowbirds Removed from Sites in the Santa Ana Watershed, 2000-2022. SAWA biologists have trapped and removed over 153,000 cowbirds from the watershed in the last 22 years. “Winter” for each year refers to the period outside of vireo nesting season that ended in March of that year, i.e., “Winter 2022” refers to the trapping season that ran from August 2021 through March 2022.

Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2018-2022. Numbers of territories, pairs, and fledglings detected.

Site Name	2018	2019	2020	2021	2022
Monitored Locations					
San Timoteo Canyon	156 / 104 / 161	124 / 92 / 170	139 / 105 / 207	118 / 83 / 149	98 / 59 / 118
San Jacinto	74 / 34 / 60	63 / 44 / 117	108 / 83 / 145	See Sampled Locations	73 / 41 / 53
Santa Ana River (SAR) - Upstream					
Riverside Ave. to Van Buren Blvd.	164 / 96 / 95	166 / 72 / 82	128 / 54 / 55	154 / 78 / 58	161 / 67 / 90
Lower Hole Creek	n/s	3 / 1 / 0	2 / 1 / 1	3 / 3 / 3	3 / 3 / 5
Hidden Valley, north side of river	62 / 38 / 65	See Sampled Locations	See Sampled Locations	See Sampled Locations	See Sampled Locations
Hidden Valley, south side of river	141 / 60 / 88	140 / 79 / 209	176 / 102 / 187	159 / 118 / 200	140 / 91 / 180
Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)	91 / 56 / 86	90 / 58 / 110	88 / 58 / 114	73 / 47 / 73	67 / 47 / 102
Meridian Conservation Area (former March SKR Preserve)	See Sampled Locations	See Sampled Locations	14 / 9 / 24	See Sampled Locations	See Sampled Locations
Mockingbird Canyon	See Sampled Locations	43 / 19 / 24	45 / 17 / 26	See Sampled Locations	See Sampled Locations
Norco Bluffs (I-15 to River Rd., non-mitigation) ¹	36 / 17 / 39	101 / 50 / 139	133 / 65 / 159	113 / 48 / 125	137 / 62 / 119
Santa Ana Canyon (SAC)					
Upper Canyon	32 / 25 / 23	35 / 24 / 58	45 / 30 / 52	43 / 34 / 50	39 / 23 / 32
Green River Golf Club	42 / 38 / 20	45 / 34 / 96	61 / 42 / 63	47 / 35 / 63	48 / 36 / 71
Featherly Regional Park	66 / 25 / 25	69 / 33 / 76	79 / 48 / 66	64 / 34 / 43	66 / 43 / 52
Sampled Locations					
Santa Ana River & Tributaries:					
Alessandro Arroyo/Prenda Arroyo	20 / 5 / 3	18 / 2 / 0	26 / 7 / 8	22 / 4 / 3	23 / 4 / 3
Box Springs	3 / 0 / 0	1 / 0 / 0	7 / 5 / 3	4 / 0 / 0	4 / 0 / 0
Burris Basin	0 / 0 / 0	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Canyon Crest	n/s	n/s	n/s	0 / 0 / 0	n/s
Carbon Canyon Regional Park	26 / 9 / 5	n/s	See Incidentals	30 / 9 / 4	31 / 10 / 9
Chino Creek Wetlands Park	See Incidentals	n/s	n/s	5 / 1 / 0	4 / 3 / 3
Chino Hills	26 / 9 / 3	29 / 17 / 19	36 / 10 / 10	30 / 9 / 5	28 / 5 / 3
Chino Hills State Park (CHSP)	32 / 9 / 0	37 / 17 / 13	n/s	n/s	48 / 30 / 22
City Creek (Highland)	1 / 0 / 0	2 / 0 / 0	n/s	n/s	n/s
Conrock Basin FHQ	1 / 0 / 0	0 / 0 / 0	1 / 1 / 0	1 / 0 / 0	2 / 0 / 0
Fresno Canyon	0 / 0 / 0	0 / 0 / 0	n/s	n/s	n/s
Goldenstar	2 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s	n/s

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2018-2022. Numbers of territories, pairs, and fledglings detected.

Site Name	2018	2019	2020	2021	2022
Sampled Locations					
Santa Ana River & Tributaries:					
Harrison Reservoir (aka McAllister Creek)	5 / 4 / 1	7 / 1 / 1	7 / 3 / 5	6 / 1 / 0	7 / 1 / 0
Hidden Valley Golf Club	9 / 1 / 1	8 / 2 / 1	12 / 3 / 3	16 / 10 / 9	16 / 3 / 3
Hidden Valley, north side of river	See Monitored Locations	78 / 37 / 41	94 / 61 / 74	61 / 38 / 39	62 / 45 / 50
Huckleberry Basin	n/s	n/s	n/s	n/s	1 / 1 / 0
La Sierra	2 / 1 / 1	4 / 0 / 0	5 / 2 / 0	4 / 3 / 2	4 / 1 / 1
Mead Valley (Cajalco/Aqueduct)	9 / 4 / 0	7 / 3 / 1	9 / 5 / 1	6 / 1 / 1	6 / 3 / 0
Meridian Conservation Area (former March SKR Preserve)	20 / 2 / 2	14 / 2 / 2	See Monitored Locations	13 / 8 / 4	14 / 5 / 7
Mockingbird Canyon	43 / 15 / 10	See Monitored Locations	See Monitored Locations	37 / 16 / 8	24 / 4 / 1
Plunge Creek	5 / 0 / 0	2 / 0 / 0	2 / 0 / 0	n/s	n/s
Poorman Reservoir	6 / 2 / 0	6 / 1 / 0	6 / 4 / 3	7 / 4 / 2	6 / 2 / 2
Pyrite Channel	n/s	n/s	n/s	1 / 0 / 0	n/s
Quail Run	3 / 1 / 2	2 / 1 / 1	1 / 1 / 1	0 / 0 / 0	3 / 0 / 0
Ryan Bonaminio Park	See Incidental Locations	See Incidental Locations	See Incidental Locations	See Incidental Locations	1 / 1 / 2
Sycamore Canyon	20 / 8 / 5	22 / 5 / 3	43 / 28 / 19	35 / 12 / 8	28 / 19 / 18
Talbert Park (Orange County)	6 / 0 / 0	3 / 0 / 0	n/s	2 / 0 / 0	n/s
Temescal Canyon	106 / 48 / 16	127 / 56 / 48	147 / 30 / 20	103 / 35 / 24	119 / 33 / 28
Tin Mine Rd. (Temescal)	n/s	4 / 0 / 0	10 / 1 / 1	8 / 3 / 3	8 / 4 / 3
Van Buren Blvd. (Bountiful)	0 / 0 / 0	2 / 0 / 0	0 / 0 / 0	1 / 0 / 0	1 / 0 / 0
Wardlow Wash	2 / 1 / 0	0 / 0 / 0	n/s	n/s	n/s
Woodcrest	1 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s	n/s
Wyle Labs	3 / 1 / 1	3 / 3 / 3	13 / 4 / 2	10 / 3 / 4	10 / 6 / 6
Yorba Linda (Starlight Dr.)	5 / 0 / 0	9 / 1 / 1	15 / 4 / 4	11 / 0 / 0	7 / 3 / 1
Yorba Linda Lakebed Park	n/s	n/s	n/s	0 / 0 / 0	n/s
San Jacinto River Sub-watershed:					
San Jacinto	See Monitored Locations	See Monitored Locations	See Monitored Locations	91 / 52 / 24	See Monitored Locations
Cottonwood Canyon	2 / 1 / 1	1 / 0 / 0	n/s	2 / 2 / 3	3 / 2 / 1
Kabian Park	7 / 5 / 2	2 / 2 / 1	n/s	n/s	n/s
Lake Perris	8 / 3 / 0	6 / 2 / 1	8 / 6 / 1	5 / 2 / 2	3 / 0 / 0
Menifee (Salt Creek)	10 / 5 / 2	11 / 7 / 11	18 / 12 / 13	14 / 4 / 2	14 / 10 / 3

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2018-2022. Numbers of territories, pairs, and fledglings detected.

Site Name	2018	2019	2020	2021	2022
Sampled Locations					
Santiago Creek Sub-watershed:					
Irvine Trust Management Area	n/s	1 / 0 / 0	2 / 0 / 0	1 / 0 / 0	1 / 0 / 0
Peters Canyon	23 / 7 / 1	22 / 8 / 9	24 / 9 / 6	22 / 8 / 6	25 / 6 / 2
Santiago Basin	3 / 0 / 0	5 / 0 / 0	5 / 0 / 0	2 / 0 / 0	2 / 0 / 0
Santiago Canyon (Irvine Park)	18 / 5 / 2	20 / 10 / 8	28 / 13 / 17	29 / 10 / 8	30 / 8 / 8
Santiago Creek (above Irvine Lake)	12 / 2 / 1	5 / 0 / 0	12 / 2 / 1	10 / 2 / 1	11 / 2 / 1
Santiago Creek (Cambridge Road)	1 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Santiago Creek (Chapman Ave.)	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Santiago Creek (Lower Channel)	n/s	n/s	n/s	0 / 0 / 0	n/s
Santiago Oaks Regional Park (to Cannon Rd.)	1 / 0 / 0	2 / 0 / 0	n/s	2 / 0 / 0	3 / 1 / 0
Smith Basin	3 / 0 / 0	4 / 1 / 0	3 / 2 / 0	4 / 0 / 0	5 / 1 / 1
Incidental Sightings					
Ambriz Park (Orange)	n/s	n/s	n/s	2 / 0 / 0	n/s
Carbon Canyon Regional Park	See Sampled Locations	n/s	14 / 0 / 0	See Sampled Locations	See Sampled Locations
Chino Creek Wetlands Park	4 / 1 / 1	n/s	n/s	See Sampled Locations	See Sampled Locations
Cielo Vista	n/s	1 / 0 / 0	1 / 0 / 0	2 / 1 / 1	n/d
Hwy 71	1 / 0 / 0	n/s	n/s	n/s	n/s
Irvine Lake	1 / 0 / 0	1 / 0 / 0	n/s	n/s	5 / 3 / 5
Moreno Valley (near Pigeon Pass Rd.)	n/s	1 / 0 / 0	n/s	n/s	n/s
Murrieta Creek	n/s	n/s	n/s	n/s	1 / 0 / 0
Raceway Ford	1 / 0 / 0	n/d	n/d	n/d	n/s
Riverside (near Goldenstar)	n/s	1 / 0 / 0	n/s	n/s	n/s
Riverside (Van Buren & Jurupa)	n/s	1 / 0 / 0	1 / 0 / 0	n/s	1 / 0 / 0
Riverside (Near Alessandro Arroyo)	n/s	n/s	n/s	1 / 1 / 1	n/s
RLC Alessandro Arroyo - 1.52 ac	See Alessandro Arroyo/Prenda Arroyo	2 / 1 / 1	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo
Rock Vista Park	n/s	n/s	2 / 0 / 0	n/s	n/s

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2018-2022. Numbers of territories, pairs, and fledglings detected.

Site Name	2018	2019	2020	2021	2022
Incidental Sightings					
Ryan Bonaminio Park	n/s	n/s	n/s	1 / 0 / 0	See Sampled Locations
Santa Ana River - San Bernardino County Flood Control	30 / 3 / 5	8 / 0 / 0	2 / 0 / 0	1 / 0 / 0	n/s
Wolfskill	2 / 1 / 1	3 / 1 / 1	1 / 1 / 1	2 / 1 / 1	n/s
SUBTOTAL	1,347 / 646 / 728	1,361 / 686 / 1,247	1,574 / 828 / 1,292	1,378 / 720 / 929	1,393 / 688 / 1,005
Reported by other agencies					
SAR - Norco Bluffs USACE Mitigation Areas ²	76 / n/a / n/a	See Norco Bluffs	See Norco Bluffs	See Norco Bluffs	See Norco Bluffs
Santa Ana River - San Bernardino County ³	17 / 0 / 0	Not Reported	Not Reported	Not Reported	Not Reported
TOTAL FOR SANTA ANA WATERSHED EXCLUDING PRADO BASIN					
	1,440 / 646 / 728	1,361 / 686 / 1,247	1,574 / 828 / 1,292	1,378 / 720 / 929	1,393 / 688 / 1,005
PRADO BASIN ⁴	665 / n/a / n/a	606 / n/a / n/a	719 / 373 / 577	596 / 281 / 417	683 / 326 / 546
TOTAL FOR SANTA ANA WATERSHED	2,105 / 646 / 728	1,967 / 686 / 1,247	2,293 / 1,201 / 1,869	1,974 / 1,001 / 1,346	2,076 / 1,014 / 1,551
Outside Watershed					
French Valley, Benton Channel ⁵	1 / 0 / 0	n/s	n/s	n/s	n/s
French Valley, Warm Springs ⁵	1 / 0 / 0	n/s	n/s	n/s	n/s
Temecula, Santa Gertrudis ⁵	6 / 1 / 0	n/s	n/s	n/s	n/s
Wildomar, Helash Mitigation ⁵	4 / 0 / 0	n/s	n/s	n/s	n/s

a. Entries correspond to numbers of territorial males/pairs/'known fledged young' for designated time period and locale.

b. "n/a" indicates that no data were available.

c. "n/s" indicates that no surveys were conducted.

d. "n/d" indicates the site was visited during the breeding season, but no vireos were detected. Site was not visited enough to declare absence.

¹ USACE mitigation areas of varying size not surveyed by SAWA in 2018. Survey numbers for these areas can be found in this table under SAR-Norco Bluffs USACE Mitigation Areas reported by other

² Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2018."

³ Reported by San Bernardino County Flood Control biologist Theresa Sims.

⁴ Preliminary data. Bonnie Johnson personal communication.

⁵ Outside Santa Ana Watershed, not included in totals.

Table 2. Least Bell's Vireo survey dates and breeding chronology, monitored and select sampled sites, 2022.

	San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream					Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)		
			Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Lower Hole Creek	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)		Upper Canyon	Green River Golf Club	Featherly Reg. Park
Survey Start Date ¹	14-Mar	17-Mar	15-Mar	17-Mar	20-Apr	14-Mar	14-Mar	16-Mar	21-Mar	21-Mar	14-Mar
Survey End Date	15-Sep	14-Sep	15-Sep	14-Sep	15-Sep	13-Sep	22-Sep	15-Sep	15-Sep	15-Sep	21-Sep
Date First Detected	16-Mar	23-Mar	23-Mar	24-Mar	20-Apr	18-Mar	22-Mar	16-Mar	21-Mar	21-Mar	14-Mar
50% Arrival Observed	5-Apr	8-Apr	5-May	n/a	n/a	8-Apr	8-Apr	12-Apr	7-Apr	5-Apr	6-Apr
50% Pairs Observed	6-May	20-Apr	6-May	n/a	n/a	22-Apr	12-Apr	27-Apr	22-Apr	26-Apr	20-Apr
First Nest Found	11-Apr	5-Apr	21-Apr	n/a	20-Apr	5-Apr	12-Apr	11-Apr	7-Apr	5-Apr	11-Apr
Last Nest Found	16-Jun	24-Jun	9-Jun	n/a	1-Jun	8-Jul	27-Jun	21-Jun	7-Jul	15-Jul	24-Jun
First Nest Fledge	18-May	9-May	14-May	n/a	3-Jun	12-May	9-May	11-May	5-May	4-May	10-May
Last Nest Fledge	2-Jul	10-Jul	10-Jul	n/a	14-Jun	17-Jul	10-Jul	5-Jul	15-Jul	6-Jul	12-Jul
Date Last Detected ²	31-Aug	31-Aug	13-Sep	8-Sep	26-Jul	13-Sep	14-Sep	20-Jul	15-Sep	15-Sep	15-Sep

¹ First date of full survey specifically for Least Bell's Vireo

² Some sites were not visited sufficiently to determine the approximate date of departure. For example, Norco Bluffs and Lower Hole Creek were not visited between the date last detected and survey end date, although vireos were likely still on-site during that time.

Table 3. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2022.

	Parameter	San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream					Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)			Combined
				Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Lower Hole Creek	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)		Upper Canyon	Green River Golf Club	Featherly Reg. Park	
A.	Number of territorial males	73	98	161	62	3	140	67	137	39	48	66	894
B.	Number of known pairs	41	59	67	45	3	91	47	62	23	36	43	517
C.	Number of known breeding (nesting) pairs	36	51	52	36	3	76	45	55	22	35	32	443
D.	Number of breeding pairs that were well-monitored throughout the season	6	34	11	0	3	45	30	14	9	23	15	190
E.	Number of known fledged young observed	53	118	90	50	5	180	102	119	32	71	52	872
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	10	96	32	n/a	5	134	77	43	23	56	31	507
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.5	2.3	1.7	1.4	1.7	2.4	2.3	2.2	1.5	1.9	1.6	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	1.7	2.8	2.9	n/a	1.7	3.0	2.6	3.1	2.6	2.4	2.1	2.7
I.	Number of nests that were discovered	29	63	21	16	5	98	52	34	22	37	31	408
J.	Number of well-tracked nests	26	59	16	7	5	94	51	34	15	31	29	367
K.	Number of successful well-tracked nests	50% 13 / 26	61% 36 / 59	63% 10 / 16	57% 4 / 7	40% 2 / 5	51% 48 / 94	51% 26 / 51	68% 23 / 34	53% 8 / 15	61% 19 / 31	48% 14 / 29	55% 203 / 367
L.	Rate of cowbird parasitism (well-tracked nests) ²	13% 3 / 24	0% 0 / 46	0% 0 / 16	29% 2 / 7	0% 0 / 5	20% 16 / 82	0% 0 / 41	0% 0 / 31	0% 0 / 13	0% 0 / 27	0% 0 / 25	7% 21 / 317
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	8% 2 / 26	2% 1 / 59	0% 0 / 16	0% 0 / 7	0% 0 / 5	0% 0 / 94	2% 1 / 51	0% 0 / 34	7% 1 / 15	3% 1 / 31	0% 0 / 29	2% 6 / 367
	B. Number of well-tracked nests that failed as a result of parasitism	12% 3 / 26	0% 0 / 59	0% 0 / 16	0% 0 / 7	0% 0 / 5	4% 4 / 94	0% 0 / 51	0% 0 / 34	0% 0 / 15	0% 0 / 31	0% 0 / 29	2% 7 / 367

Table 3 continued. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2022.

	Parameter	San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream					Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)			Combined
				Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Lower Hole Creek	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCO)		Upper Canyon	Green River Golf Club	Featherly Reg. Park	
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	23% 6 / 26	32% 19 / 59	25% 4 / 16	14% 1 / 7	60% 3 / 5	35% 33 / 94	45% 23 / 51	32% 11 / 34	33% 5 / 15	29% 9 / 31	48% 14 / 29	35% 128 / 367
M.	D. Number of well-tracked nests that failed for unknown reasons	8% 2 / 26	5% 3 / 59	13% 2 / 16	29% 2 / 7	0% 0 / 5	10% 9 / 94	2% 1 / 51	0% 0 / 34	7% 1 / 15	6% 2 / 31	3% 1 / 29	6% 23 / 367
	Average clutch size	3.2	3.4	3.4	3.5	3.4	3.5	3.4	3.6	3.3	3.3	3.3	3.4
N.	Number of eggs/Number of clutches	73 / 23	179 / 52	51 / 15	21 / 6	17 / 5	253 / 73	162 / 47	114 / 32	49 / 15	101 / 31	86 / 26	1,106 / 325
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	0	0	2	0	16	0	0	0	0	0	22
P.	Number of 'manipulated' parasitized nests ³	0	n/a	n/a	2	n/a	12	n/a	n/a	n/a	n/a	n/a	14
Q.	Number of successful 'manipulated' nests ³	n/a	n/a	n/a	50% 1 / 2	n/a	50% 6 / 12	n/a	n/a	n/a	n/a	n/a	50% 7 / 14
R.	Number of vireo fledged from 'manipulated' nests ³	n/a	n/a	n/a	4	n/a	15	n/a	n/a	n/a	n/a	n/a	19
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0	0	0	0
T.	Number of repaired nests	1	2	0	1	0	3	1	0	0	3	0	11
U.	% of successful repaired nests	0% 0 / 1	50% 1 / 2	n/a	100% 1 / 1	n/a	33% 1 / 3	0% 0 / 1	n/a	n/a	67% 2 / 3	n/a	45% 5 / 11
V.	Number of vireo fledged from repaired nests	n/a	1	n/a	3	n/a	1	n/a	n/a	n/a	6	n/a	11
W.	Number of cowbirds removed from study area ⁴	716	59	51	-6	n/a	4	3	0	3	8	10	848
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) ³	566	676	736	79	n/a	244	123	124	119	229	269	3,165
Y.	Average number of cowbirds trapped per day (W/X)	1.27	0.09	0.07	-0.08	n/a	0.02	0.02	0.00	0.03	0.03	0.05	0.27

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

²Fifty of the 336 "well-tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these 50 nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

³Only well-tracked nests are counted for these parameters

⁴All traps are not accounted for in this total. See Table 6.

Table 3B. Least Bell's Vireo breeding biology data detailed for surveys funded by the San Bernardino Valley Municipal Water District at monitored (restoration) and sampled (non-restoration) sites in upper Santa Ana River, 2022.

	Parameter	Evans Lake Drain Restoration	Anza/Old Ranch Creeks Restoration	SAR - Riverside to Van Buren Non-Restoration	SAR - Riverside to Van Buren - Overall	Hidden Valley North	Lower Hole Creek Restoration	Hidden Valley South - Restoration	Hidden Valley South - Non - Restoration	Hidden Valley South - Overall	Goose Creek ⁴	SAR Upstream - Overall
A.	Number of territorial males	1	20	140	161	62	3	30	110	140	67	433
B.	Number of known pairs	1	9	57	67	45	3	20	71	91	47	253
C.	Number of known breeding (nesting) pairs	1	6	45	52	36	3	17	59	76	45	212
D.	Number of breeding pairs that were well-monitored throughout the breeding season	0	4	7	11	0	3	13	32	45	30	89
E.	Number of known fledged young observed	1	14	75	90	50	5	46	134	180	102	427
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	n/a	13	19	32	n/a	5	43	91	134	77	248
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.0	2.3	1.7	1.7	1.4	1.7	2.7	2.3	2.4	2.3	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	n/a	3.3	2.7	2.9	n/a	1.7	3.3	2.8	3.0	2.6	2.8
I.	Number of nests that were discovered	0	7	14	21	16	5	28	70	98	52	192
J.	Number of well-tracked nests	n/a	6	10	16	7	5	27	67	94	51	173
K.	Number of successful well-tracked nests	n/a	67% 4 / 6	60% 6 / 10	63% 10 / 16	57% 4 / 7	40% 2 / 5	48% 13 / 27	52% 35 / 67	51% 48 / 94	51% 26 / 51	52% 90 / 173
L.	Rate of cowbird parasitism (well-tracked nests) ²	n/a	0% 0 / 6	0% 0 / 10	0% 0 / 16	29% 2 / 7	0% 0 / 5	36% 8 / 22	13% 8 / 60	20% 16 / 82	0% 0 / 41	12% 18 / 151
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	n/a	0% 0 / 6	0% 0 / 10	0% 0 / 16	0% 0 / 7	0% 0 / 5	0% 0 / 27	0% 0 / 67	0% 0 / 94	2% 1 / 51	1% 1 / 173
	B. Number of well-tracked nests that failed as a result of parasitism	n/a	0% 0 / 6	0% 0 / 10	0% 0 / 16	0% 0 / 7	0% 0 / 5	7% 2 / 27	3% 2 / 67	4% 4 / 94	0% 0 / 51	2% 4 / 173

Table 3B continued. Least Bell's Vireo breeding biology data detailed for surveys funded by the San Bernardino Valley Municipal Water District at monitored (restoration) and sampled (non-restoration) sites in upper Santa Ana River, 2022.

	Parameter	Evans Lake Drain Restoration	Anza/Old Ranch Creeks Restoration	SAR - Riverside to Van Buren Non-Restoration	SAR - Riverside to Van Buren - Overall	Hidden Valley North	Lower Hole Creek Restoration	Hidden Valley South - Restoration	Hidden Valley South - Non - Restoration	Hidden Valley South - Overall	Goose Creek ⁴	SAR Upstream - Overall
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	n/a	17% 1 / 6	30% 3 / 10	25% 4 / 16	14% 1 / 7	60% 3 / 5	26% 7 / 27	39% 26 / 67	35% 33 / 94	45% 23 / 51	37% 64 / 173
M.	D. Number of well-tracked nests that failed for unknown reasons	n/a	17% 1 / 6	10% 1 / 10	13% 2 / 16	29% 2 / 7	0% 0 / 5	19% 5 / 27	6% 4 / 67	10% 9 / 94	2% 1 / 51	8% 14 / 173
	Average clutch size	n/a	3.4	3.4	3.4	3.5	3.4	3.7	3.4	3.5	3.4	3.5
N.	Number of eggs/Number of clutches	n/a	17 / 5	34 / 10	51 / 15	21 / 6	17 / 5	56 / 15	197 / 58	253 / 73	162 / 47	504 / 146
O.	Number of cowbird eggs or nestlings found in or near vireo nests	0	0	0	0	2	0	8	8	16	0	18
P.	Number of 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	2	n/a	6	6	12	n/a	14
Q.	Number of successful 'manipulated' nests	n/a	n/a	n/a	n/a	50% 1 / 2	n/a	50% 3 / 6	50% 3 / 6	50% 6 / 12	n/a	50% 7 / 14
R.	Number of vireo fledged from 'manipulated' nests	n/a	n/a	n/a	n/a	4	n/a	11	4	15	n/a	19
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0	0	0
T.	Number of repaired nests	0	0	0	0	1	0	0	3	3	1	5
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	100% 1 / 1	n/a	n/a	33% 1 / 3	33% 1 / 3	0% 0 / 1	40% 2 / 5
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	3	n/a	n/a	1	1	n/a	4
W.	Number of cowbirds removed from study area ³	18	2	31	51	-6	n/a	n/a	4	4	3	52
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) ³	122	122	492	736	79	n/a	n/a	244	244	123	1,182
Y.	Average number of cowbirds trapped per day (W/X)	0.15	0.02	0.06	0.07	-0.08	n/a	n/a	0.02	0.02	0.02	0.04

¹Productivity numbers may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

²Some of the "well-tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

³All traps are not accounted for in this total. See Table 6.

⁴This site includes mitigation areas funded by IERCD

Table 4: Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2022.

Host Plant Species (listed alphabetically by scientific name)	San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream					Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
			Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Lower Hole Creek	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)		Upper Canyon	Green River Golf Club	Featherly Reg. Park		
California Sagebrush (<i>Artemisia californica</i>)							1					1	<1%
Giant Reed ^{le} (<i>Arundo donax</i>)				1		1	2					4	1%
Coyote Brush (<i>Baccharis pilularis</i>)	4						1				1	6	1%
Mulefat (<i>Baccharis salicifolia</i>)	6	4	2	7	1	27	5	9	14	14	13	102	25%
Poison Hemlock ^{le} (<i>Conium maculatum</i>)						2	1					3	1%
Thick-leaved Yerba Santa (<i>Eriodictyon crassifolium</i>)											2	2	<1%
Shamel Ash ^e (<i>Fraxinus udei</i>)				1								1	<1%
Arizona Ash (<i>Fraxinus velutina</i>)						1						1	<1%
Ash sp. (<i>Fraxinus</i> sp.)						1						1	<1%
Coast Goldenbush (<i>Isocoma menziesii</i>)											1	1	<1%
Southern California Black Walnut ^r (<i>Juglans californica</i>)									1			1	<1%
Perennial Pepperweed ^{le} (<i>Lepidium latifolium</i>)		1										1	<1%
Laurel Sumac (<i>Malosma laurina</i>)									1	4	2	7	2%
White Mulberry ^e (<i>Morus alba</i>)		1										1	<1%
Western Sycamore (<i>Platanus racemosa</i>)			2		1						2	5	1%
Arrowweed (<i>Pluchea sericea</i>)							2					2	<1%
Black Cottonwood (<i>Populus balsamifera</i> ssp.										1		1	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	3	5	1			10	6	1	1	4	5	36	9%
Callery Pear ^e (<i>Pyrus calleryana</i>)		3										3	1%
Coast Live Oak (<i>Quercus agrifolia</i>)						1				1		2	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)			1									1	<1%
California Blackberry (<i>Rubus ursinus</i>)						1	2	2		1		6	1%

Table 4 continued: Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2022.

Host Plant Species (listed alphabetically by scientific name)	San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream					Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
			Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Lower Hole Creek	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)		Upper Canyon	Green River Golf Club	Featherly Reg. Park		
Narrowleaf Willow (<i>Salix exigua</i>)	5		1			2	2	5				15	4%
Goodding's Black Willow (<i>Salix gooddingii</i>)	9			1		8	1	5		4	1	29	7%
Red Willow (<i>Salix laevigata</i>)		9	3		2	18	6					38	9%
Arroyo Willow (<i>Salix lasiolepis</i>)		28	9	3		21	13	8		3	1	86	21%
Blue Elderberry (<i>Sambucus mexicana</i>)		1				1	4			3	1	10	2%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)		1								2		3	1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	2					2	1					5	1%
Poison Oak (<i>Toxicodendron diversilobum</i>)									4			4	1%
Desert Wild Grape (<i>Vitis girdiana</i>)		9	1			2	4	4			2	22	5%
Deadfall		1		2	1		1					5	1%
Unknown/No Data			1	1					1			3	1%
Total	29	63	21	16	5	98	52	34	22	37	31	408	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

Table 5. Observations of all species by location, 2022.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Goose Sp.	<i>Anser sp.</i>			X			
Greater White-fronted Goose	<i>Anser albifrons</i>	X					
Canada Goose	<i>Branta canadensis</i>	X		X	X	X	
Domestic Muscovy Duck ^l	<i>Cairina moschata</i>			X			
Wood Duck	<i>Aix sponsa</i>	X				X	
Cinnamon Teal	<i>Spatula cyanoptera</i>	X	X				
Northern Shoveler	<i>Spatula clypeata</i>	X		X			
Gadwall	<i>Mareca strepera</i>	X				X	
American Wigeon	<i>Mareca americana</i>	X					
Mallard	<i>Anas platyrhynchos</i>	X	X	X	X	X	
Northern Pintail	<i>Anas acuta</i>	X					
Green-winged Teal	<i>Anas crecca</i>	X					
Ring-necked Duck	<i>Aythya collaris</i>	X					
Bufflehead	<i>Bucephala albeola</i>	X				X	
Hooded Merganser	<i>Lophodytes cucullatus</i>	X					
Ruddy Duck	<i>Oxyura jamaicensis</i>	X	X				
California Quail	<i>Callipepla californica</i>	X	X	X		X	
Pied-billed Grebe	<i>Podilymbus podiceps</i>	X	X		X		
Western Grebe	<i>Aechmophorus occidentalis</i>	X					
Rock Pigeon ⁱ	<i>Columba livia</i>		X	X			
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	X				X	
Eurasian Collared-Dove ⁱ	<i>Streptopelia decaocto</i>	X	X	X		X	
Common Ground-Dove	<i>Columbina passerina</i>			X	X		
Mourning Dove	<i>Zenaida macroura</i>	X	X	X	X	X	
Greater Roadrunner	<i>Geococcyx californianus</i>	X	X	X	X	X	
Vaux's Swift	<i>Chaetura vauxi</i>			X			
White-throated Swift	<i>Aeronautes saxatalis</i>			X	X	X	
Black-chinned Hummingbird	<i>Archilochus alexandri</i>		X	X	X		
Anna's Hummingbird	<i>Calypte anna</i>	X	X	X	X	X	
Costa's Hummingbird	<i>Calypte costae</i>		X	X		X	
Rufous Hummingbird	<i>Selasphorus rufus</i>			X		X	
Allen's Hummingbird	<i>Selasphorus sasin</i>	X		X		X	
Common Gallinule	<i>Gallinula galeata</i>				X		
American Coot	<i>Fulica americana</i>	X	X	X	X	X	
Black-necked Stilt	<i>Himantopus mexicanus</i>	X					
American Avocet	<i>Recurvirostra americana</i>	X					
Killdeer	<i>Charadrius vociferus</i>	X	X	X	X	X	
Long-billed Curlew	<i>Numenius americanus</i>	X					
Least Sandpiper	<i>Calidris minutilla</i>	X		X			
Wilson's Snipe	<i>Gallinago delicata</i>			X			
Spotted Sandpiper	<i>Actitis macularius</i>			X		X	
Greater Yellowlegs	<i>Tringa melanoleuca</i>	X		X		X	
Ring-billed Gull	<i>Larus delawarensis</i>			X			
Gull sp.	<i>Larus sp.</i>	X					
Wood Stork ^f	<i>Mycteria americana</i>				X		
Double-crested Cormorant ^f	<i>Phalacrocorax auritus</i>		X			X	X
American White Pelican	<i>Pelecanus erythrorhynchos</i>	X	X			X	

Table 5 continued. Observations of all species by location, 2022.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Great Blue Heron ^f	<i>Ardea herodias</i>	X		X	X	X	X
Great Egret	<i>Ardea alba</i>	X	X	X	X	X	
Snowy Egret	<i>Egretta thula</i>	X			X	X	
Cattle Egret	<i>Bubulcus ibis</i>	X					
Green Heron	<i>Butorides virescens</i>	X		X	X	X	
Black-crowned Night-Heron ^f	<i>Nycticorax nycticorax</i>	X		X			X
White-faced Ibis ^f	<i>Plegadis chihi</i>	X					
Turkey Vulture ^f	<i>Cathartes aura</i>	X	X	X		X	X
Osprey ^f	<i>Pandion haliaetus</i>	X	X			X	
White-tailed Kite ^f	<i>Elanus leucurus</i>	X		X			
Northern Harrier ^f	<i>Circus hudsonius</i>	X		X			
Sharp-shinned Hawk ^f	<i>Accipiter striatus</i>			X			
Cooper's Hawk ^f	<i>Accipiter cooperii</i>	X	X	X	X	X	X
Bald Eagle ^f	<i>Haliaeetus leucocephalus</i>	X					X
Red-shouldered Hawk	<i>Buteo lineatus</i>	X	X	X	X	X	
Swainson's Hawk ^f	<i>Buteo swainsoni</i>	X	X	X			
Red-tailed Hawk	<i>Buteo jamaicensis</i>	X	X	X	X	X	
Ferruginous Hawk ^f	<i>Buteo regalis</i>	X					
Barn Owl	<i>Tyto alba</i>	X	X	X		X	
Great Horned Owl	<i>Bubo virginianus</i>	X		X		X	
Acorn Woodpecker	<i>Melanerpes formicivorus</i>		X	X		X	
Downy Woodpecker ^f	<i>Dryobates pubescens</i>		X	X	X	X	X
Nuttall's Woodpecker	<i>Dryobates nuttallii</i>	X	X	X	X	X	
Northern Flicker	<i>Colaptes auratus</i>	X	X	X	X	X	
American Kestrel	<i>Falco sparverius</i>	X	X	X		X	
Merlin ^f	<i>Falco columbarius</i>	X					
Peregrine Falcon ^f	<i>Falco peregrinus</i>					X	
Prairie Falcon ^f	<i>Falco mexicanus</i>	X					
Budgerigar ⁱ	<i>Melopsittacus undulatus</i>			X			
Red-lored Parrot ⁱ	<i>Amazona autumnalis</i>					X	
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	X	X	X	X	X	
Cassin's Kingbird	<i>Tyrannus vociferans</i>	X	X	X	X	X	
Western Kingbird	<i>Tyrannus verticalis</i>	X	X	X	X	X	
Western Wood-Pewee	<i>Contopus sordidulus</i>	X	X	X		X	
Willow Flycatcher ^f	<i>Empidonax traillii</i>	X	X	X		X	X
Hammond's Flycatcher	<i>Empidonax hammondi</i>			X			
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	X	X	X	X	X	
Black Phoebe	<i>Sayornis nigricans</i>	X	X	X	X	X	
Say's Phoebe	<i>Sayornis saya</i>	X	X	X	X	X	
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	X				X	
Loggerhead Shrike ^f	<i>Lanius ludovicianus</i>	X					
Hutton's Vireo	<i>Vireo huttoni</i>		X	X	X	X	
Cassin's Vireo	<i>Vireo cassinii</i>			X			
Warbling Vireo	<i>Vireo gilvus</i>	X		X		X	
California Scrub-Jay	<i>Aphelocoma californica</i>		X	X	X	X	
American Crow	<i>Corvus brachyrhynchos</i>	X	X	X	X	X	
Common Raven	<i>Corvus corax</i>	X	X	X	X	X	

Table 5 continued. Observations of all species by location, 2022.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
California Horned Lark ^r	<i>Eremophila alpestris actia</i>	X		X		X	X
Tree Swallow ^r	<i>Tachycineta bicolor</i>	X		X	X	X	
Violet-green Swallow	<i>Tachycineta thalassina</i>	X				X	
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	X	X	X		X	
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	X		X	X	X	
Barn Swallow	<i>Hirundo rustica</i>	X		X	X		
Bushtit	<i>Psaltiriparus minimus</i>	X	X	X	X	X	
White-breasted Nuthatch	<i>Sitta carolinensis</i>	X					
Rock Wren	<i>Salpinctes obsoletus</i>					X	
Canyon Wren	<i>Catherpes mexicanus</i>	X					
House Wren	<i>Troglodytes aedon</i>	X	X	X	X	X	
Marsh Wren	<i>Cistothorus palustris</i>	X	X		X		
Bewick's Wren	<i>Thryomanes bewickii</i>	X	X	X	X	X	
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	X		X		X	
California Gnatcatcher ^r	<i>Polioptila californica</i>	X				X	X
Ruby-crowned Kinglet	<i>Regulus calendula</i>	X	X	X		X	
Wrentit	<i>Chamaea fasciata</i>		X	X	X	X	
Western Bluebird	<i>Sialia mexicana</i>	X	X	X		X	
Swainson's Thrush	<i>Catharus ustulatus</i>			X	X	X	
Hermit Thrush	<i>Catharus guttatus</i>			X	X	X	
American Robin	<i>Turdus migratorius</i>		X	X	X	X	
California Thrasher	<i>Toxostoma redivivum</i>		X	X	X	X	
Northern Mockingbird	<i>Mimus polyglottos</i>	X		X		X	
European Starling ^j	<i>Sturnus vulgaris</i>	X	X	X		X	
Cedar Waxwing	<i>Bombycilla cedrorum</i>	X		X		X	
Phainopepla	<i>Phainopepla nitens</i>	X	X	X		X	
Pin-tailed Whydah ⁱ	<i>Vidua macroura</i>			X			
House Sparrow ^j	<i>Passer domesticus</i>	X	X	X		X	
American Pipit	<i>Anthus rubescens</i>	X				X	
House Finch	<i>Haemorhous mexicanus</i>	X	X	X	X	X	
Lesser Goldfinch	<i>Spinus psaltria</i>	X	X	X	X	X	
Lawrence's Goldfinch	<i>Spinus lawrencei</i>	X	X	X		X	
American Goldfinch	<i>Spinus tristis</i>	X	X	X	X	X	
Grasshopper Sparrow ^r	<i>Ammodramus savannarum</i>						X
Lark Sparrow	<i>Chondestes grammacus</i>	X	X			X	
Dark-eyed Junco	<i>Junco hyemalis</i>	X				X	
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	X	X	X	X	X	
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>			X			
Bell's Sparrow ^r	<i>Artemisiospiza belli</i>						X
Vesper Sparrow	<i>Poocetes gramineus</i>	X					
Savannah Sparrow	<i>Passerculus sandwichensis</i>	X					
Song Sparrow	<i>Melospiza melodia</i>	X	X	X	X	X	
Lincoln's Sparrow ^r	<i>Melospiza lincolni</i>	X		X			
California Towhee	<i>Melospiza crissalis</i>	X	X	X	X	X	
Southern California Rufous-crowned Sparrow ^r	<i>Aimophila ruficeps canescens</i>			X		X	X
Spotted Towhee	<i>Pipilo maculatus</i>	X	X	X	X	X	
Yellow-breasted Chat ^r	<i>Icteria virens</i>	X	X	X	X	X	X

Table 5 continued. Observations of all species by location, 2022.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Yellow-headed Blackbird ^f	<i>Xanthocephalus xanthocephalus</i>	X	X				X
Western Meadowlark	<i>Sturnella neglecta</i>	X					
Hooded Oriole	<i>Icterus cucullatus</i>	X	X	X	X	X	
Bullock's Oriole	<i>Icterus bullockii</i>	X	X		X	X	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	X	X	X		X	
Tricolored Blackbird ^f	<i>Agelaius tricolor</i>	X					X
Bronzed Cowbird	<i>Molothrus aeneus</i>			X			
Brown-headed Cowbird ⁱ	<i>Molothrus ater</i>	X	X	X	X	X	
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	X					
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	X	X	X			
Orange-crowned Warbler	<i>Leiothlypis celata</i>	X	X	X	X	X	
Nashville Warbler ^f	<i>Leiothlypis ruficapilla</i>			X	X		
MacGillivray's Warbler ^f	<i>Geothlypis tolmiei</i>	X					
Common Yellowthroat	<i>Geothlypis trichas</i>	X	X	X	X	X	
Yellow Warbler ^f	<i>Setophaga petechia</i>	X	X	X	X	X	X
Yellow-rumped Warbler	<i>Setophaga coronata</i>	X	X	X	X	X	
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>			X	X	X	
Wilson's Warbler ^f	<i>Cardellina pusilla</i>	X	X	X		X	X
Western Tanager	<i>Piranga ludoviciana</i>			X		X	
Northern Cardinal ⁱ	<i>Cardinalis cardinalis</i>					X	
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>		X	X	X	X	
Blue Grosbeak	<i>Passerina caerulea</i>	X	X	X		X	
Lazuli Bunting	<i>Passerina amoena</i>	X				X	
Mammals (tracks/other evidence used)							
Virginia Opossum ⁱ	<i>Didelphis virginiana</i>	X	X				
San Diego Black-tailed Jackrabbit ^f	<i>Lepus californicus bennettii</i>	X					X
Desert Cottontail	<i>Sylvilagus audubonii</i>	X	X	X		X	
Broad-footed Mole	<i>Scapanus latimanus</i>			X			
Feral Dog ⁱ	<i>Canis familiaris</i>	X		X			
Coyote ^f	<i>Canis latrans</i>	X	X	X	X	X	X
Gray Fox	<i>Urocyon cinereoargenteus</i>			X			
Feral Cat ⁱ	<i>Felis catus</i>			X		X	
Bobcat ^f	<i>Lynx rufus</i>	X		X		X	
Striped Skunk	<i>Mephitis mephitis</i>	X		X			
Long-tailed Weasel ^f	<i>Mustela frenata</i>	X				X	
Raccoon	<i>Procyon lotor</i>	X	X	X			
Mule Deer	<i>Odocoileus hemionus</i>		X	X		X	
Feral Pig ⁱ	<i>Sus scrofa</i>		X	X	X		
California Vole	<i>Microtus californicus</i>			X			
Woodrat sp. (nest)	<i>Neotoma sp.</i>		X			X	
Botta's Pocket Gopher	<i>Thomomys bottae</i>	X					
House Mouse	<i>Mus musculus</i>	X					
California Ground Squirrel	<i>Otospermophilus beecheyi</i>	X	X	X	X	X	
Western Gray Squirrel	<i>Sciurus griseus</i>		X				
Eastern Fox Squirrel ⁱ	<i>Sciurus niger</i>			X	X	X	

Table 5 continued. Observations of all species by location, 2022.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Herpetofauna							
Western Toad	<i>Anaxyrus boreas</i>			X	X	X	
American Bullfrog ⁱ	<i>Lithobates catesbeianus</i>	X		X	X	X	
Baja California Treefrog	<i>Pseudacris hypochondriaca</i>	X	X	X	X	X	
Belding's Orange-throated Whiptail ^r	<i>Aspidoscelis hyperythra beldingi</i>	X	X				X
San Diegan Tiger Whiptail ^r	<i>Aspidoscelis tigris stejnegeri</i>	X	X			X	X
Zebra-tailed Lizard	<i>Callisaurus draconoides</i>			X			
Southern Alligator Lizard	<i>Elgaria multicarinata</i>	X	X	X		X	
Blainville's Horned Lizard ^r	<i>Phrynosoma blainvillii</i>	X		X			
Western Fence Lizard	<i>Sceloporus occidentalis</i>	X	X	X	X	X	
Granite Spiny Lizard ^r	<i>Sceloporus orcutti</i>	X					X
Side-blotched Lizard	<i>Uta stansburiana</i>	X	X	X	X	X	
Red Racer/Coachwhip	<i>Coluber flagellum piceus</i>	X	X	X		X	
Southern Pacific Rattlesnake	<i>Crotalus oreganus helleri</i>	X	X			X	
Red Diamond Rattlesnake ^r	<i>Crotalus ruber</i>					X	X
California Kingsnake	<i>Lampropeltis californiae</i>	X		X		X	
Texas Spiny Softshell ⁱ	<i>Apalone spinifera emoryi</i>				X	X	
Red-eared Slider ⁱ	<i>Trachemys scripta elegans</i>			X	X	X	
Fish							
Mosquitofish ⁱ	<i>Gambusia affinis</i>	X		X			
Common Carp ⁱ	<i>Cyprinus carpio</i>			X		X	
Largemouth Bass ⁱ	<i>Micropterus salmoides</i>			X			
Green Sunfish ⁱ	<i>Lepomis cyanellus</i>			X			

¹ - Includes detections of sensitive species at sampled and incidental locations. Observations have been reported to CNDDB.

ⁱ = invasive or non-native

^r = endangered, threatened, or sensitive: are those that are listed as endangered, threatened, or species of concern by the resource agencies and those that are covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP).

Note: This list is not intended as a complete species list for these sites. This is a list of species observed in the riparian zone and adjacent habitat, caught in cowbird traps, or otherwise observed during the vireo monitoring from March 11, 2022 to September 17, 2022.

Table 6. Brown-headed Cowbird trapping results, March-July 2022 (grouped by funding source).

Site Name	Trap/Location	2022 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
San Jacinto	Alta	3/14-7/22	70	1	-1	2	0	0.01	0.01
	SJWA A1	3/14-6/7	62	11	6	5	0	0.18	0.18
	SJWA E1	3/14-6/8	66	34	18	16	0	0.52	0.52
Subtotal			198	46	23	23	0	0.23	0.23
Mockingbird Canyon	Dak	3/21-7/27	104	1	1	0	0	0.01	0.01
	Hougen	3/21-7/27	108	6	4	2	0	0.06	0.06
	Markham	3/21-7/27	102	1	3	-2	0	0.01	0.01
	Reservoir	3/21-7/28	108	26	12	11	3	0.21	0.24
Subtotal			422	34	20	11	3	0.07	0.08
Prado/Chino Hills	Bluff	3/21-7/27	124	0	0	0	0	0.00	0.00
	Cuckoo Pond	3/22-6/6	70	1	0	1	0	0.01	0.01
	Dog Park	3/21-7/28	125	0	0	0	0	0.00	0.00
	IEUA	3/23-7/27	119	17	7	6	4	0.11	0.14
	Prado Regional Park	3/23-7/28	122	5	2	3	0	0.04	0.04
	Shooting Park	6/17-7/28	39	0	0	0	0	0.00	0.00
Subtotal			599	23	9	10	4	0.03	0.04
Temescal	Baker	3/22-7/29	124	9	3	5	1	0.06	0.07
	New Sump	3/22-7/28	125	11	8	1	2	0.07	0.09
	Rockery	3/22-7/28	126	5	3	2	0	0.04	0.04
	Salt Creek	3/22-7/26	124	7	5	2	0	0.06	0.06
Subtotal			499	32	19	10	3	0.06	0.06
San Jacinto, Prado and Lake Elsinore Dairies	Dyt	3/14-7/29	129	44	24	3	17	0.21	0.34
	Scott Bros	3/14-7/29	109	394	292	59	43	3.22	3.61
	Tuls 1	3/14-7/29	130	232	142	61	29	1.56	1.78
	Dejongs	3/14-7/29	135	147	85	54	8	1.03	1.09
	Euclid 1	3/14-7/28	121	39	27	8	4	0.29	0.32
	Euclid 2	3/15-7/28	120	73	48	14	11	0.52	0.61
	Weststeyn 1	3/15-7/28	121	113	53	37	23	0.74	0.93
	Weststeyn 2	3/15-7/28	121	132	68	42	22	0.91	1.09
Subtotal			986	1,174	739	278	157	1.03	1.19
Santa Ana Canyon	Chino Hills State Park	3/21-7/27	119	3	0	3	0	0.03	0.03
	Green River Golf Maintenance	3/21-7/27	120	15	10	5	0	0.13	0.13
	Green River Golf West	3/21-7/20	109	-7	-2	-5	0	-0.06	-0.06
	RV Park	3/21-7/26	117	12	5	7	0	0.10	0.10
	Savi Ranch	3/23-5/2	34	-5	-2	-3	0	-0.15	-0.15
	Yorba Park	3/22-7/26	118	3	0	3	0	0.03	0.03
Subtotal			617	21	11	10	0	0.03	0.03

Table 6 continued. Brown-headed Cowbird trapping results, March-July 2022 (grouped by funding source).

Site Name	Trap/Location	2022 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
Anaheim	Conrock	3/22-7/25	105	17	10	2	5	0.11	0.16
	Huckleberry	3/22-7/25	111	6	4	2	0	0.05	0.05
Subtotal			216	23	14	4	5	0.08	0.11
TOTAL (USFWS/USACE/SARM)			3,537	1,353	835	346	172	0.33	0.38
SBVMWD									
Santa Ana River (upstream)	Anza	3/22-7/26	122	2	0	0	2	0.00	0.02
	Bain	3/21-7/27	79	-6	-1	-5	0	-0.08	-0.08
	Crestmore	3/21-7/26	122	0	0	0	0	0.00	0.00
	Fairmount Park	3/22-7/26	122	18	8	9	1	0.14	0.15
	Goose Creek 2	3/21-7/27	123	3	2	1	0	0.02	0.02
	Hidden Valley South	3/22-7/28	123	0	0	0	0	0.00	0.00
	Hidden Valley South-Habitat	3/22-7/28	121	4	2	2	0	0.03	0.03
	Regional Lift Station	3/21-7/27	124	25	10	10	5	0.16	0.20
	Riverside Ave.	3/22-7/26	122	4	2	2	0	0.03	0.03
	Sunnyslope Lift Station	3/21-7/27	124	2	1	0	1	0.01	0.02
	Subtotal		1,182	52	24	19	9	0.04	0.04
NORTH COUNTY BRS PROJECT, LLC									
Santa Ana Canyon	Cielo Vista	3/21-7/11	67	2	0	1	1	0.01	0.03
Subtotal			67	2	0	1	1	0.01	0.03
IERCD/SAWA									
San Timoteo	Fisherman's Retreat	3/14-7/25	115	11	10	0	1	0.09	0.10
	Harned	3/16-7/25	113	2	1	0	1	0.01	0.02
	Headlee	3/14-7/29	119	30	13	9	8	0.18	0.25
	Younglove 1	3/23-7/26	108	14	7	5	2	0.11	0.13
SBCTA									
San Timoteo	Bees 1	3/22-7/27	111	2	1	0	1	0.01	0.02
	Bees 2	3/22-7/26	110	0	0	0	0	0.00	0.00
Subtotal			676	59	32	14	13	0.07	0.09
Rivers and Lands Conservancy									
Meridian C.A.	Meridian 1	3/22-7/26	102	2	2	0	0	0.02	0.02
	Meridian South	3/21-7/26	107	1	2	-1	0	0.01	0.01
Subtotal			209	3	4	-1	0	0.01	0.01
GRAND TOTAL			5,671	1,469	895	379	195	0.22	0.26
*TOTAL BHCO FIELD HOURS		3,541							

*hours also include installation and removal of traps from field

Table 7. Non-target avian captures in Brown-headed Cowbird traps, March-July 2022.

2022 Non-target Species*		USFWS/USACE/SARM Project														SBVMWD		IERCD/SBCTA		Rivers and Lands Conservancy		NORTH COUNTY BRS PROJECT,		2022 Total	
		San Jacinto		Mockingbird Canyon		Prado		Temescal		San Jacinto, Prado, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		Santa Ana River (upstream)		San Timoteo		Meridian C.A.		Cielo Vista			
Common Name	Scientific Name	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died
Common Ground Dove	<i>Columbina passerina</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Mourning Dove	<i>Zenaida macroura</i>	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0
Western Kingbird	<i>Tyrannus verticalis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Black Phoebe	<i>Sayornis nigricans</i>	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Loggerhead Shrike	<i>Lanius ludovicianus</i>	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	2
House Wren	<i>Tragodytes aedon</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0
Bewick's Wren	<i>Thryomanes bewickii</i>	0	0	0	0	2	0	3	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	7	1
California Thrasher	<i>Toxostoma redivivum</i>	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
Northern Mockingbird	<i>Mimus polyglottos</i>	3	0	6	2	0	0	15	4	0	0	2	0	5	0	4	0	0	0	3	0	1	0	39	6
House Finch	<i>Haemorhous mexicanus</i>	0	0	58	3	29	1	1	0	9	0	7	0	15	0	54	1	0	0	10	1	2	0	185	6
Lark Sparrow	<i>Chondestes grammacus</i>	29	1	0	0	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	34	1
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0
Vesper Sparrow	<i>Poocetes gramineus</i>	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
Song Sparrow	<i>Melospiza melodia</i>	0	0	0	0	27	0	6	1	0	0	1	0	2	0	0	0	13	0	1	0	0	0	50	1
California Towhee	<i>Melozone crissalis</i>	74	3	35	1	238	0	34	2	0	0	227	1	4	0	162	2	200	4	136	1	9	0	1,119	14
Spotted Towhee	<i>Pipilo maculatus</i>	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	1	0	0	0	0	0	0	0	48	0	0	0	0	0	0	0	1	0	0	0	0	0	50	0
Hooded Oriole	<i>Icterus cucullatus</i>	0	0	1	0	0	0	0	0	1	0	4	2	1	1	1	0	2	0	0	0	3	0	13	3
Bullock's Oriole	<i>Icterus bullockii</i>	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	4	1
Unknown Blackbird	<i>Icteridae</i>	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	60	1	0	0	0	0	0	0	33	0	2	0	135	0	4	0	3	0	0	0	0	0	237	1
Tricolored Blackbird	<i>Agelaius tricolor</i>	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	4	0
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	5	0
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	3	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	2	0	0	0	0	0	8	0
Exotic Non-targets																									
Bronzed Cowbird	<i>Molothrus aeneus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	8	0
Budgerigar	<i>Melopsittacus undulatus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Zebra Finch	<i>Taeniopygia</i> sp.	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
TOTAL		186	7	103	6	299	1	76	9	102	0	245	3	169	1	239	4	227	4	151	2	15	0	1,812	37
Number of Trap Days		198		422		599		499		986		617		216		1,182		676		209		67		5,671	
Number of Birds/Trap Day		0.94		0.24		0.50		0.15		0.10		0.40		0.78		0.20		0.34		0.72		0.22		0.32	
Mortality %			3.76%		5.83%		0.33%		11.84%		0.00%		1.22%		0.59%		1.67%		1.76%		1.32%		0.00%		2.04%

*Number of dead non-targets included in number caught

**Trap days from total trap days for each route in table 6

Table 7 continued. Non-target avian captures in Brown-headed Cowbird traps, March-July 2022.

Exotic Nuisance Species Captures in Brown-headed Cowbird Traps, March-July 2022

2022 Exotic Nuisance Species**		USFWS/USACE/SARM Project														SBVMWD		IERCD/SBCTA		Rivers and Lands Conservancy		NORTH COUNTY BRS PROJECT, LLC		2022 Total	
		San Jacinto		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		Santa Ana River (upstream)		San Timoteo		Meridian C.A.		Cielo Vista			
		released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed		
Common Name	Scientific Name	1	0	0	0	0	0	1	2	1808	32	7	0	41	3	24	2	1	0	0	0	0	0	1,883	39
European Starling	<i>Sturnus vulgaris</i>																								
House Sparrow	<i>Passer domesticus</i>	1	0	1	0	15	7	0	0	26	145	0	0	9	104	126	54	10	11	0	0	0	0	188	321
TOTAL		2	0	1	0	15	7	1	2	1834	177	7	0	50	107	150	56	11	11	0	0	0	0	2,071	360

Table 8. Brown-headed Cowbird trapping results, winter 2021-2022.

Site Name	Trap/Location	Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
Lake Elsinore	Dejongs	8/2/21-11/17/21	107	728	213	285	230	4.65	6.80
Subtotal			107	728	213	285	230	4.65	6.80
Prado	Euclid 1	8/2/21-3/11/22	124	751	256	444	51	5.65	6.06
	Euclid 2	8/2/21-3/11/22	124	919	296	549	74	6.81	7.41
	Weststeyn 1	8/2/21-3/11/22	124	672	197	399	76	4.81	5.42
	Weststeyn 2	8/2/21-3/11/22	123	638	182	390	66	4.65	5.19
Subtotal			495	2,980	931	1,782	267	5.48	6.02
San Jacinto	Dyt	8/2/21-3/11/22	126	269	54	91	124	1.15	2.13
	Scott Bros	8/2/21-3/11/22	123	583	332	161	90	4.01	4.74
	Tuls 1	8/2/21-3/11/22	126	486	83	108	295	1.52	3.86
Subtotal			375	1,338	469	360	509	2.21	3.57
GRAND TOTAL			977	5,046	1,613	2,427	1,006	4.14	5.16

Table 9. Non-target avian captures in Brown-headed Cowbird traps, winter 2021-2022.

2021-2022 Winter Non-target Species*		Prado		San Jacinto		Lake Elsinore		Total	
Common Name	Scientific Name	caught	died	caught	died	caught	died	caught	died
House Finch	<i>Haemorhous mexicanus</i>	0	0	4	1	1	0	5	1
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	0	0	1	0	0	0	1	0
Song Sparrow	<i>Melospiza melodia</i>	0	0	0	0	1	0	1	0
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	0	0	0	0	5	0	5	0
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	2	0	20	0	55	2	77	2
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	0	0	0	0	1	0	1	0
Unknown		21	0	0	0	0	0	21	0
TOTAL		23	0	25	1	63	2	111	3
Trap Days**		495		375		107		977	
Number of Birds/Trap Day		0.05		0.07		0.59		0.11	
Mortality%			0.00%		4.00%		3.17%		2.70%

*Number of dead non-targets included in number caught

**Trap days from total trap days for each route in table 8

Exotic nuisance species captures in Brown-headed Cowbird traps, winter 2021-2022.

2021-2022 Winter Exotic Nuisance Species***		Prado		San Jacinto		Lake Elsinore		Total	
Common Name	Scientific Name	released	removed	released	removed	released	removed	released	removed
House Sparrow	<i>Passer domesticus</i>	9	0	0	92	0	0	9	92
European Starling	<i>Sturnus vulgaris</i>	70	0	27	20	0	103	97	123
TOTAL		79	0	27	112	0	103	106	215

***Non-natives removed under CDFW authorization to control Brown-headed Cowbirds

APPENDIX A – SURVEY SITES, STARTING AND ENDING COORDINATES

[All coordinates – WGS 1984 (Zone 11S) except where noted otherwise]

Monitored Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>San Jacinto:</u>		
-San Jacinto River	506079, 3738423	493412, 3746014
-San Jacinto Wildlife Area	488055, 3745444	490979, 3750919
<u>San Timoteo Canyon:</u>		
-Riverside County	487618, 3760678	499652, 3753988
-San Bernardino County	481628, 3764975	484320, 3763100
<u>Santa Ana River (SAR):</u>		
-Riverside Ave. to Van Buren Blvd.	466416, 3765008	456998, 3758228
-Evans Lake Drain	464761, 3761889	464031, 3761150
-Anza/Old Ranch Creeks	462172, 3758697	459646, 3758831
-Hidden Valley, north side of river	456941, 3758360	451647, 3758651
Hidden Valley, south side of river	456067, 3758152	451089, 3757558
-Hidden Valley South - Restoration	456067, 3758152	454817, 3758428
-Hidden Valley South - Control	454835, 3758920	451089, 3757558
-Lower Hole Creek	457147, 3757662	456737, 3758025
Hidden Valley to River Rd ¹		
-SAR-Goose Creek, Norco to I-15	451560, 3758574	448772, 3756316
-Goose Creek Mitigation, Norco	451083, 3757763	450045, 3757296
-Norco Bluffs (I-15 to River Rd, non-mitigation)	448907, 3756725	444876, 3753717
<u>Santa Ana Canyon (SAC):</u>		
-Upper Canyon	441121, 3749692	438609, 3749795
-Green River Golf Club	438609, 3749795	436613, 3748409
-Featherly Park	436604, 3748585	430808, 3748480

Sampled Locations and Incidental Sighting Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>Santa Ana River & Tributaries:</u>		
Alessandro Arroyo/Prenda Arroyo	465500, 3754365	470391, 3751168
	465354, 3752493	468066, 3751913
Box Springs	471086, 3757494	472592, 3756430
Burris Basin	419850, 3743943	419377, 3742243
Cajon Wash ²	456784, 3796197	457285, 3791752
Canyon Crest ²	468329, 3757116	468644, 3756933
Carbon Canyon (Chino Hills Pkwy) ²	431500, 3760294	431143, 3759777
Carbon Canyon Regional Park	422957, 3752929	425648, 3754031
Castlevue Park ²	467826, 3755173	468565, 3754997
Chino Creek Wetlands Park	437600, 3758292	437225, 3758829
Chino Hills	438794, 3754812	429061, 3759386
Chino Hills State Park (Bane Cyn)	435061, 3757365	435376, 3753499

Sampled Locations and Incidental Sighting Locations (cont.)

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
Chino Hills State Park (Lower Aliso Cyn)	435288, 3753302	438033, 3749528
Chino Hills State Park (Telegraph Cyn)	434818, 3753694	424101, 3753165
Chino Hills State Park (Upper Aliso Cyn)	435111, 3753336	433834, 3755029
Cielo Vista ³	429825, 3750579	429883, 3750566
City Creek (Highland) ²	482136, 3775290	482454, 3777612
Conrock Basin (FHQ)	423314, 3746089	423465, 3746370
Fresno Canyon ²	440631, 3748012	440954, 3749370
Goldenstar ²	465359, 3751458	466469, 3750869
Harrison Reservoir (aka McAllister Creek)	460113, 3749435	460002, 3747712
Hidden Valley Golf Club	451611, 3752495	452390, 3753455
Highway 71 ²	439575, 3753329	439937, 3752095
Huckleberry Basin	423610, 3746460	424285, 3746705
La Sierra	457473, 3748848	457824, 3747117
Little Sand Basin ²	478157, 3779714	478805, 3780527
Mead Valley (Cajalco/aqueduct)	471930, 3744796	469980, 3743887
Meridian CA (former March SKR Preserve)	471730, 3749646	473403, 3750887
Mockingbird Canyon	461624, 3750450	469580, 3747044
Moreno Valley ²	475810, 3758624	474960, 3759974
Norco Hills Park Mitigation ²	449570, 3751384	449818, 3751233
Plunge Creek ²	486953, 3774720	486987, 3775572
Poorman Reservoir	476434, 3758610	477243, 3757320
Pyrite Channel ²	455758, 3761346	455222, 3760761
Quail Run	469907, 3757374	471038, 3757541
Riverside (Van Buren at Jurupa) ³	457145, 3757620	457172, 3757560
Ryan Bonaminio Park	463782, 3759521	463195, 3759424
San Bernardino Flood Control ³	468779, 3767632	471561, 3769060
Sun Canyon Park ²	454614, 3749211	454788, 3749119
Sycamore Canyon	470209, 3757079	473184, 3753080
Talbert Park (Orange County) ²	411679, 3722998	411932, 3723803
Tequesquite Arroyo ²	467671, 3756303	468003, 3757103
Tin Mine Road	455337, 3747953	455530, 3744748
Van Buren Blvd. (Bountiful)	469382, 3749787	469934, 3750036
Van Buren (Porter Road) ²	467009, 3749689	466421, 3750042
Wardlow Wash ²	442819, 3748289	441873, 3749262
Woodcrest ²	464548, 3751638	464847, 3751471
Wyle Labs (at El Paso only)	450013, 3751824	451585, 3752523
Yorba Linda (San Antonio Rd) ²	429199, 3750653	429494, 3751473
Yorba Linda (Starlight Dr.)	431058, 3749142	431153, 3750250
Yorba Linda Lakebed Park ²	424692, 3749150	425273, 3748223
San Jacinto River Sub-watershed:		
Cottonwood Canyon	475769, 3725678	477572, 3723954
Kabian Park ²	478467, 3734032	475650, 3730501
Lake Perris	483092, 3744484	485461, 3748329
Menifee (Salt Creek)	478298, 3726507	479627, 3727241
Temescal Canyon	450725, 3746717	471425, 3720558
Wolfskill ²	498156, 3747889	497980, 3747499

Sampled Locations and Incidental Sighting Locations (cont.)

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
Santiago Creek Sub-watershed:		
Irvine Lake ³	433920, 3736688	432680, 3738096
Irvine Trust Management Area	429808, 3738428	429834, 3738307
Limestone Canyon ²	434012, 3736548	434897, 3735784
Murrieta Creek ³	486516, 3705027	486516, 3705027
Peter's Canyon	429752, 3738563	428604, 3735584
Santiago Basin	424716, 3740614	425842, 3741365
Santiago Canyon (Irvine Park)	430063, 3740268	428977, 3741769
Santiago Canyon (lower channel) ²	419351, 3737174	417489, 3736996
Santiago Creek (above Irvine Lake)	437249, 3735984	435467, 3737584
Santiago Creek (Cambridge Road)	421800, 3737876	421425, 3737985
Santiago Creek (Chapman Ave.)	423094, 3738524	423849, 3739651
Santiago Oaks Regional Park (to Cannon Rd) ⁴	426419, 3741900	428961, 3742024
Silverado Canyon ²	437692, 3734768	438878, 3734047
Smith Basin ⁴	425362, 3741441	426377, 3741912

¹ In 2015, Hidden Valley to River Rd was divided into separate sites due to funding constraints. These sites are SAR-Goose Creek, Norco to I-15, which also includes Goose Creek Mitigation (funded by IERCD), and Norco Bluffs (I-15 to River Rd, non-mitigation), which as of 2016 includes an additional 250 acres that was not surveyed by SAWA in 2015.

² Denotes sites that were not surveyed this year.

³ Incidental observations of LBVI at this site.

⁴ Beginning in 2018, Santiago Creek (to Cannon, including Smith Basin) was broken out to make Smith Basin a separate site and Santiago Oaks Regional Park was expanded to include the area up to Cannon Road.

⁵ In 2017, Rancho La Sierra West was added to SAR – Upstream, Hidden Valley south side of the river.

APPENDIX B: WATERSHED-WIDE ANNUAL RESULTS, 2000-2022

Appendix B-1. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2000-2022 (sites vary by year).

	Parameter	2000-2017	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	1,039	1,110	1,293	1,096	894	n/a
B.	Number of known pairs	5,161	565	615	714	630	517	8,202
C.	Number of known breeding (nesting) pairs	4,355	418	528	590	510	443	6,844
D.	Number of breeding pairs that were well-monitored throughout the season	1,473	148	151	247	189	190	2,398
E.	Number of known fledged young observed	8,239	691	1,189	1,202	864	872	13,057
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	4,120	363	581	692	494	507	6,757
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.9	1.7	2.3	2.0	1.7	2.0	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.8	2.5	3.8	2.8	2.6	2.7	2.8
I.	Number of nests that were discovered	3,140	333	420	520	412	408	5,233
J.	Number of well-tracked nests	2,618	267	364	455	336	367	4,407
K.	Number of successful well-tracked nests	59% 1,546 / 2,618	52% 140 / 267	62% 225 / 364	53% 241 / 455	52% 174 / 336	55% 203 / 367	57% 2,529 / 4,407
L.	Rate of cowbird parasitism (well-tracked nests) ¹	10% 261 / 2,618	3% 9 / 267	10% 32 / 316	8% 32 / 384	11% 30 / 278	7% 21 / 317	9% 385 / 4,180
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 120 / 2,618	4% 10 / 267	6% 22 / 364	4% 17 / 455	7% 22 / 336	2% 6 / 367	4% 197 / 4,407
	B. Number of well-tracked nests that failed as a result of parasitism	3% 83 / 2,618	1% 2 / 267	4% 13 / 364	2% 8 / 455	2% 7 / 336	2% 7 / 367	3% 120 / 4,407
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 858 / 2,618	42% 113 / 267	29% 104 / 364	36% 165 / 455	36% 120 / 336	35% 128 / 367	34% 1,488 / 4,407
	D. Number of well-tracked nests that failed for unknown reasons	<1% 11 / 2,618	1% 2 / 267	0% 0 / 364	5% 24 / 455	4% 13 / 336	6% 23 / 367	2% 73 / 4,407
N.	Average clutch size	n/a	3.4	3.7	3.6	3.5	3.4	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	330	12	33	35	39	22	471
P.	Number of 'manipulated' parasitized nests ²	213	9	26	30	26	14	318
Q.	Number of successful 'manipulated' nests ²	45% 96 / 213	44% 4 / 9	46% 12 / 26	33% 10 / 30	62% 16 / 26	50% 7 / 14	46% 145 / 318
R.	Number of vireo fledged from 'manipulated' nests ²	207	9	26	21	35	19	317
S.	Number of cowbird young fledged by vireo observed	17	0	1	0	0	0	18
T.	Number of repaired nests	37	4	6	16	10	11	84
U.	% of successful repaired nests	70% 26 / 37	50% 2 / 4	67% 4 / 6	63% 10 / 16	40% 4 / 10	45% 5 / 11	61% 51 / 84
V.	Number of vireo fledged from repaired nests	74	6	9	27	9	11	136
W.	Number of cowbirds removed from study area ³	36,623	2,637	2,345	2,292	1,987	848	46,732
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) ³	85,902	3,096	3,119	3,581	4,619	3,165	103,482
Y.	Average number of cowbirds trapped per day (W/X)	0.43	0.85	0.75	0.64	0.43	0.27	0.45

¹ Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized (Pike et al., 1999; Sharp & Kus, 2006).

² Only well-tracked nests are counted for these parameters

³ All traps are not accounted for in this total. See Table 6.

Appendix B-2. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2022.

Host Plant Species (listed alphabetically by scientific name)	2001-2017	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Bank Catclaw ^e (<i>Acacia redolens</i>)	1						1	<1%
Boxelder (<i>Acer negundo</i>)	2						2	<1%
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)	1	1	1				3	<1%
White Alder (<i>Alnus rhombifolia</i>)	2						2	<1%
Western False Indigo (<i>Amorpha fruticosa</i>)	1		1				2	<1%
Fiddleneck sp. (<i>Amsinckia</i> sp.)	1						1	<1%
Wild Celery ^e (<i>Apium graveolens</i>)	1						1	<1%
California Sagebrush (<i>Artemisia californica</i>)	1	1			1	1	4	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	24		2	2	2		30	1%
Giant Reed ^{ie} (<i>Arundo donax</i>)	1	1	1	1	4	4	12	<1%
Fourwing Saltbush (<i>Atriplex canescens</i>)	2		2	1			5	<1%
Big Saltbush (<i>Atriplex lentiformes</i>)					2		2	<1%
Coyote Brush (<i>Baccharis pilularis</i>)	13	4	13	5	6	6	47	1%
Mulefat (<i>Baccharis salicifolia</i>)	856	93	62	106	89	102	1,308	25%
Dead Mulefat (<i>Baccharis salicifolia</i>)	8						8	<1%
Willow Baccharis (<i>Baccharis salicina</i>)	3						3	<1%
Desertbroom Baccharis (<i>Baccharis sarothroides</i>)	1						1	<1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	12		7	3	1		23	<1%
Yellowspine Thistle ^{ie} (<i>Cirsium ochrocentrum</i>)	2						2	<1%
Orange Tree ^e (<i>Citrus sinensis</i>)	3			1			4	<1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	11		6	12		3	32	1%
Carrotwood ^e (<i>Cupaniopsis anacardioides</i>)				1			1	<1%
Brittlebush (<i>Encelia farinosa</i>)	1		2				3	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2022.

Host Plant Species (listed alphabetically by scientific name)	2001-2017	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Thickleaf Yerba Santa (<i>Eriodictyon crassifolium</i>)	3				1	2	6	<1%
Yerba Santa sp. (<i>Eriodictyon</i> sp.)	1						1	<1%
Fig ^e (<i>Ficus</i> sp.)	1						1	<1%
Shamel Ash ^e (<i>Fraxinus udei</i>)						1	1	<1%
Arizona Ash (<i>Fraxinus velutina</i>)				1		1	2	<1%
Ash sp. (<i>Fraxinus</i> sp.)	1			3	2	1	7	<1%
Common Sunflower (<i>Helianthus annuus</i>)	1			1			2	<1%
Toyon (<i>Heteromeles arbutifolia</i>)	28		1				29	1%
Coast Goldenbush (<i>Isocoma menziesii</i>)						1	1	<1%
Southern California Black Walnut ^f (<i>Juglans californica</i>)	17	1	1	2	1	1	23	<1%
Summer Cypress ^e (<i>Kochia scoparia</i>)				1			1	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	6		1	2		1	10	<1%
Dead Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	1						1	<1%
Privet sp. ^e (<i>Ligustrum</i> sp.)	1		1				2	<1%
Chaparral Mallow (<i>Malacothamnus fasciculatus</i>)			1	2			3	<1%
Bush mallow sp. (<i>Malacothamnus</i> sp.)					1		1	<1%
Laurel Sumac (<i>Malosma laurina</i>)	20	9	8	11	9	7	64	1%
Wild Cucumber (<i>Marah macrocarpa</i>)				1			1	<1%
White Mulberry ^e (<i>Morus alba</i>)	1		2	2	2	1	8	<1%
Lollypop Tree ^{ie} (<i>Myoporum laetum</i>)	1						1	<1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)	1	1	2	1			5	<1%
Olive ^e (<i>Olea europaea</i>)			1				1	<1%
Blue Palo Verde (<i>Parkinsonia florida</i>)			1	1			2	<1%
Western Sycamore (<i>Platanus racemosa</i>)	9	2	2	4	10	5	32	1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2022.

Host Plant Species (listed alphabetically by scientific name)	2001-2017	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Arrowweed (<i>Pluchea sericea</i>)	4	1	2	2		2	11	<1%
Cape Leadwort ^e (<i>Plumbago auriculata</i>)	2						2	<1%
Black Cottonwood (<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>)	3					1	4	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	124	21	17	45	33	36	276	5%
Dead Fremont Cottonwood (<i>Populus fremontii</i>)	2						2	<1%
Holly Leaf Cherry (<i>Prunus ilicifolia</i>)	1			1			2	<1%
Spanish False Fleabane ^e (<i>Pulicaria paludosa</i>)					1		1	<1%
Callery Pear ^e (<i>Pyrus calleryana</i>) ¹			1	1		3	5	<1%
Coast Live Oak (<i>Quercus agrifolia</i>)	2				3	2	7	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)	6	1	1	4	2	1	15	<1%
Oak sp. (<i>Quercus</i> sp.)	1						1	<1%
Fragrant Sumac (<i>Rhus aromatica</i>)	1						1	<1%
Sugar Sumac (<i>Rhus ovata</i>)	2	1					3	<1%
Golden Currant (<i>Ribes aureum</i>)	5						5	<1%
Castor bean ^{ie} (<i>Ricinus communis</i>)	2						2	<1%
Coulter's Matilija Poppy ^r (<i>Romneya coulteri</i>)	1						1	<1%
California Wild Rose (<i>Rosa californica</i>)	8	1	1	1	2		13	<1%
California Blackberry (<i>Rubus ursinus</i>)	3			5	6	6	20	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	132	26	40	42	28	15	283	5%
Dead Narrowleaf Willow (<i>Salix exigua</i>)	1			1			2	<1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	347	24	35	35	40	29	510	10%
Dead Goodding's Black Willow (<i>Salix gooddingii</i>)	1						1	<1%
Dead Goodding's Black Willow covered with living Goodding's Black Willow (<i>Salix gooddingii</i>)	1						1	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2022.

Host Plant Species (listed alphabetically by scientific name)	2001-2017	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Red Willow (<i>Salix laevigata</i>)	310	22	31	35	34	38	470	9%
Pacific Willow (<i>Salix lasiandra</i>)	19		2	6	3		30	1%
Arroyo Willow (<i>Salix lasiolepis</i>)	600	62	69	98	69	86	984	19%
Dead Arroyo Willow (<i>Salix lasiolepis</i>)	1	1	1				3	<1%
Willow sp. (<i>Salix</i> sp.)	8	3		3	5		19	<1%
Dead Willow sp. (<i>Salix</i> sp.)	5						5	<1%
Black Sage (<i>Salvia mellifera</i>)	1	1					2	<1%
Blue Elderberry (<i>Sambucus mexicana</i>)	175	5	36	30	20	10	276	5%
Dead Blue Elderberry (<i>Sambucus mexicana</i>)	1						1	<1%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)	15	4	1	3	3	3	29	1%
Brazilian Pepper Tree ^{ie} (<i>Schinus terebinthifolius</i>)	1						1	<1%
Milk Thistle ^{ie} (<i>Silybum marianum</i>)	1						1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	10	5	6	7	2	5	35	1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	24		1	3	3	4	35	1%
Chinese Elm ^e (<i>Ulmus parvifolia</i>)	1						1	<1%
Hoary Nettle (<i>Urtica dioica</i>)	1		1				2	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	147	19	27	21	18	22	254	5%
Rough Cockelburr (<i>Xanthium strumarium</i>)	2						2	<1%
Fresh water reed (<i>Typha</i> sp.) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Goodding's Black Willow (<i>S. gooddingii</i>)	1	1					2	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and California Wild Rose (<i>R. californica</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Peruvian Pepper Tree ^{ie} (<i>S. molle</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	5						5	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2022.

Host Plant Species (listed alphabetically by scientific name)	2001-2017	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Desert Wild Grape (<i>V. girdiana</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Dead Goodding's Black Willow (<i>S. gooddingii</i>) and Hoary Nettle (<i>U. dioica</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Perennial Pepperweed ^{ie} (<i>L. latifolium</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Red Willow (<i>S. laevigata</i>) and Wild Cucumber (<i>Marah macrocarpa</i>)	1						1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and dead Hoary Nettle (<i>U. dioica</i>)	1						1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and Black Mustard ^{ie} (<i>B. nigra</i>)	1						1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and Sweet Fennel ^{ie} (<i>Foeniculum vulgare</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.) and California Blackberry (<i>Rubus ursinus</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.) and Perennial Pepperweed ^{ie} (<i>L. latifolium</i>)	1						1	<1%
Castor bean ^{ie} (<i>R. communis</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
California Blackberry (<i>Rubus ursinus</i>) and dead unknown				1			1	<1%
Black Mustard ^{ie} (<i>B. nigra</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)			1				1	<1%
Black Mustard ^{ie} (<i>B. nigra</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Coyote Brush (<i>B. pilularis</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Mulefat (<i>B. salicifolia</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)	2						2	<1%
Deadfall	5			6	7	5	23	<1%
Unknown/No data	27	22	29	6	2	3	89	2%
Total	3,068	333	420	520	412	408	5,161	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹misidentified as *Cydonia oblonga* from 2019-21

Appendix B-3. Brown-headed Cowbird trapping effort and results, 2000-2022.

Parameter	2000-2017*	2018	2019	2020	2021	2022	Combined*
Fall/Winter ¹							
Number of Traps	n/a	4	4	7	6	8	n/a
Number of Trap Days	n/a	598	666	639	722	977	n/a
Number of Males Removed	n/a	853	1,784	1,656	1,836	1,613	n/a
Number of Females Removed	n/a	1,656	2,379	1,506	2,347	2,427	n/a
Number of Juveniles Removed	n/a	1,384	1,842	1,626	2,515	1,006	n/a
Total Number of Cowbirds Removed	73,694	3,893	6,005	4,788	6,698	5,046	100,124
Spring/Summer ²							
Number of Traps	806	39	42	44	50	51**	n/a
Number of Trap Days	88,340	4,182	4,686	4,925	6,217	5,671	114,021
Number of Males Removed	22,914	2,234	2,035	2,596	2,210	895	32,884
Number of Females Removed	10,462	724	843	1,003	1,395	379	14,806
Number of Juveniles Removed	4,234	90	191	358	150	195	5,218
Total Number of Cowbirds Removed	37,610	3,048	3,069	3,957	3,755	1,469	52,908
Total							
Number of Trap Days	n/a	4,780	5,352	5,564	6,939	6,648	n/a
Number of Cowbirds Removed	111,304	6,941	9,074	8,745	10,453	6,515	153,032
Average Number of Cowbirds Removed Per Day	n/a	1.45	1.70	1.57	1.51	0.98	n/a

*Cumulative totals are not provided if data for that parameter is not available for one or more years

**One trap in the Prado/Chino Hills area was relocated mid-season due to a persistent wasp infestation. GPS coordinates were recorded for 52 different trap locations; however, only 51 traps were concurrently in operation during the season.

¹"Fall/Winter" for each year refers to the trapping period outside of vireo nesting season that ended in March of that year; i.e., "Winter 2020" reflects the trapping season that ran from August 2019 through March 2020.

²"Spring/Summer" refers to the trapping period during vireo nesting season from mid-March through August.

APPENDIX C: SUMMARY TABLES BY MANAGED SITE, 2000-2022

Appendix C-1-A. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

San Jacinto

	Parameter	2003-2017 (n=15 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	74	63	108	91	73	n/a
B.	Number of known pairs	221	34	44	83	52	41	475
C.	Number of known breeding (nesting) pairs	181	30	44	72	27	36	390
D.	Number of breeding pairs that were well-monitored throughout the breeding season	58	18	7	29	0	6	118
E.	Number of known fledged young observed	318	60	117	145	24	53	717
F.	Number of known fledged young produced by pairs monitored throughout the season	155	40	35	77	n/a	10	317
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.8	2	2.7	2.0	0.9	1.5	1.8
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.7	2.2	5.0	2.7	n/a	1.7	2.7
I.	Number of nests that were discovered	140	38	47	69	20	29	343
J.	Number of well-tracked nests	113	30	35	56	0	26	260
K.	Number of successful well-tracked nests	52% 59 / 113	63% 19 / 30	69% 24 / 35	63% 35 / 56	n/a	50% 13 / 26	58% 150 / 260
L.	Rate of cowbird parasitism (well-tracked nests) ²	14% 16 / 113	10% 3 / 30	26% 5 / 19	15% 7 / 46	n/a	13% 3 / 24	15% 34 / 232
	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 5 / 113	7% 2 / 30	3% 1 / 35	4% 2 / 56	n/a	8% 2 / 26	5% 12 / 260
	B. Number of well-tracked nests that failed as a result of parasitism	7% 8 / 113	7% 2 / 30	3% 1 / 35	4% 2 / 56	n/a	12% 3 / 26	6% 16 / 260
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	36% 41 / 113	23% 7 / 30	26% 9 / 35	27% 15 / 56	n/a	23% 6 / 26	30% 78 / 260
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 113	0% 0 / 30	0% 0 / 35	4% 2 / 56	n/a	8% 2 / 26	2% 4 / 260
M.	Average clutch size	n/a	3	3.5	3.5	n/a	3.2	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	21	3	6	9	6	4	49
P.	Number of 'manipulated' parasitized nests ³	11	3	6	7	n/a	0	27
Q.	Number of successful 'manipulated' nests ³	45% 5 / 11	33% 1 / 3	67% 4 / 6	29% 2 / 7	n/a	n/a	44% 12 / 27
R.	Number of vireo fledged from 'manipulated' nests ³	13	1	11	4	n/a	n/a	29
S.	Number of cowbird young fledged by vireo observed	7	0	0	0	0	0	7
T.	Number of repaired nests	3	0	0	2	0	1	6
U.	% of successful repaired nests	100% 3 / 3	n/a	n/a	50% 1 / 2	n/a	0% 0 / 1	67% 4 / 6
V.	Number of vireo fledged from repaired nests	10	n/a	n/a	1	n/a	n/a	11
W.	Numbers of cowbirds removed from study area	22,587	2,099	1,774	1,674	1,376	716	30,226
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	12,353	659	480	586	719	566	15,363
Y.	Average number of cowbirds trapped per trap day (W/X)	1.83	3.19	3.70	2.86	1.91	1.27	1.97

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-B. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

San Timoteo Canyon

	Parameter	2001-2017 (n=17)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	156	124	139	118	98	n/a
B.	Number of known pairs	1,208	104	92	105	83	59	1,651
C.	Number of known breeding (nesting) pairs	1,027	85	75	86	69	51	1,393
D.	Number of breeding pairs that were well-monitored throughout the breeding season	496	30	39	58	43	34	700
E.	Number of known fledged young observed	2,285	161	170	207	149	118	3,090
F.	Number of known fledged young produced by pairs monitored throughout the season	1,508	86	123	173	117	96	2,103
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	2.2	1.9	2.3	2.4	2.2	2.3	2.2
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.0	2.9	3.2	3.0	2.7	2.8	3.0
I.	Number of nests that were discovered	1,042	75	96	104	79	63	1,459
J.	Number of well-tracked nests	935	63	90	99	77	59	1,323
K.	Number of successful well-tracked nests	57% 533 / 935	44% 28 / 63	44% 40 / 90	52% 51 / 99	49% 38 / 77	61% 36 / 59	55% 726 / 1,323
L.	Rate of cowbird parasitism (well-tracked nests) ²	10% 115 / 935	0% 0 / 63	15% 12 / 80	0% 0 / 85	0% 0 / 62	0% 0 / 46	10% 127 / 1,271
	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 44 / 935	8% 5 / 63	4% 4 / 90	6% 6 / 99	9% 7 / 77	2% 1 / 59	5% 67 / 1,323
	B. Number of well-tracked nests that failed as a result of parasitism	3% 28 / 935	0% 0 / 63	8% 7 / 90	0% 0 / 99	0% 0 / 77	0% 0 / 59	3% 35 / 1,323
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	35% 327 / 935	48% 30 / 63	43% 39 / 90	34% 34 / 99	36% 28 / 77	32% 19 / 59	36% 477 / 1,323
M.	D. Number of well-tracked nests that failed for unknown reasons	0% 3 / 935	0% 0 / 63	0% 0 / 90	8% 8 / 99	5% 4 / 77	5% 3 / 59	1% 18 / 1,323
N.	Average clutch size	n/a	3.4	3.7	3.6	3.6	3.4	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	136	2	12	0	0	0	150
P.	Number of 'manipulated' parasitized nests ³	94	n/a	8	n/a	n/a	n/a	102
Q.	Number of successful 'manipulated' nests ³	50% 47 / 94	n/a	38% 3 / 8	n/a	n/a	n/a	49% 50 / 102
R.	Number of vireo fledged from 'manipulated' nests ³	102	n/a	4	n/a	n/a	n/a	106
S.	Number of cowbird young fledged by vireo observed	2	0	0	0	0	0	2
T.	Number of repaired nests	9	1	3	4	3	2	22
U.	% of successful repaired nests	67% 6 / 9	0 0 / 1	33% 1 / 3	75% 3 / 4	33% 1 / 3	50% 1 / 2	55% 12 / 22
V.	Number of vireo fledged from repaired nests	18	0	3	11	3	1	36
W.	Numbers of cowbirds removed from study area	2,568	88	72	139	76	59	3,002
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	14,627	574	500	700	758	676	17,835
Y.	Average number of cowbirds trapped per trap day (W/X)	0.18	0.15	0.14	0.20	0.10	0.09	0.17

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-C. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Meridian Conservation Area*

	Parameter	2004-2017 (n= 14 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	20	14	14	13	14	n/a
B.	Number of known pairs	111	2	2	9	8	5	137
C.	Number of known breeding (nesting) pairs	89	2	2	7	6	5	111
D.	Number of breeding pairs that were well-monitored throughout the breeding season	16	0	0	6	0	0	22
E.	Number of known fledged young observed	186	2	2	24	4	7	225
F.	Number of known fledged young produced by pairs monitored throughout the season	69	n/a	n/a	22	n/a	n/a	91
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	2.1	n/a	n/a	3.4	0.7	1.4	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	4.3	n/a	n/a	3.7	n/a	n/a	4.1
I.	Number of nests that were discovered	31	0	0	8	3	1	43
J.	Number of well-tracked nests	30	n/a	0	8	0	0	38
K.	Number of successful well-tracked nests	77% 23 / 30	n/a	n/a	88% 7 / 8	n/a	n/a	79% 30 / 38
L.	Rate of cowbird parasitism (well-tracked nests) ²	0% 0 / 30	n/a	n/a	0% 0 / 8	n/a	n/a	0% 0 / 38
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 30	n/a	n/a	13% 1 / 8	n/a	n/a	3% 1 / 38
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 30	n/a	n/a	0% 0 / 8	n/a	n/a	0% 0 / 38
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	23% 7 / 30	n/a	n/a	0% 0 / 8	n/a	n/a	18% 7 / 38
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 30	n/a	n/a	0% 0 / 8	n/a	n/a	0% 0 / 38
N.	Average clutch size	n/a	n/a	n/a	3.8	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	1	n/a	n/a	0	0	0	1
P.	Number of 'manipulated' parasitized nests ³	0	n/a	n/a	n/a	n/a	n/a	0
Q.	Number of successful 'manipulated' nests ³	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests ³	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	n/a	n/a	0	0	0	0
T.	Number of repaired nests	0	0	n/a	0	0	0	0
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Numbers of cowbirds removed from study area	237	6	5	10	22	3	283
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,114	221	248	238	270	209	4,300
Y.	Average number of cowbirds trapped per trap day (W/X)	0.08	0.03	0.02	0.04	0.08	0.01	0.07

*Former March SKR Preserve

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-D. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Mockingbird Canyon

	Parameter	2003-2017 (n=15 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	43	43	45	37	24	n/a
B.	Number of known pairs	288	15	19	17	16	4	359
C.	Number of known breeding (nesting) pairs	247	10	12	14	12	3	298
D.	Number of breeding pairs that were well-monitored throughout the breeding season	65	0	3	9	0	0	77
E.	Number of known fledged young observed	441	10	24	26	8	1	510
F.	Number of known fledged young produced by pairs monitored throughout the season	197	n/a	3	20	n/a	n/a	220
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.8	n/a	2.0	1.9	0.7	0.3	1.7
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.0	n/a	1.0	2.2	n/a	n/a	2.9
I.	Number of nests that were discovered	185	0	12	18	5	3	223
J.	Number of well-tracked nests	158	n/a	11	17	0	2	188
K.	Number of successful well-tracked nests	53% 84 / 158	n/a	36% 4 / 11	35% 6 / 17	n/a	0% 0 / 2	50% 94 / 188
L.	Rate of cowbird parasitism (well-tracked nests) ²	10% 16 / 158	n/a	22% 2 / 9	6% 1 / 17	n/a	0% 0 / 1	10% 19 / 185
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 11 / 158	n/a	9% 1 / 11	6% 1 / 17	n/a	0% 0 / 2	7% 13 / 188
	B. Number of well-tracked nests that failed as a result of parasitism	4% 6 / 158	n/a	9% 1 / 11	0% 0 / 17	n/a	0% 0 / 2	4% 7 / 188
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	35% 55 / 158	n/a	45% 5 / 11	53% 9 / 17	n/a	100% 2 / 2	38% 71 / 188
	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 158	n/a	0% 0 / 11	6% 1 / 17	n/a	0% 0 / 2	2% 3 / 188
N.	Average clutch size	n/a	n/a	3.8	3.6	n/a	3.0	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	29	n/a	2	1	0	0	32
P.	Number of 'manipulated' parasitized nests ³	13	n/a	1	1	n/a	n/a	15
Q.	Number of successful 'manipulated' nests ³	31% 4 / 13	n/a	0% 0 / 1	0% 0 / 1	n/a	n/a	27% 4 / 15
R.	Number of vireo fledged from 'manipulated' nests ³	8	n/a	0	0	n/a	n/a	8
S.	Number of cowbird young fledged by vireo observed	1	n/a	0	0	0	0	1
T.	Number of repaired nests	3	n/a	0	0	0	0	3
U.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	n/a	n/a	100% 3 / 3
V.	Number of vireo fledged from repaired nests	7	n/a	n/a	n/a	n/a	n/a	7
W.	Numbers of cowbirds removed from study area	2,051	52	73	89	84	34	2,383
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	10,293	295	383	500	529	422	12,422
Y.	Average number of cowbirds trapped per trap day (W/X)	0.20	0.18	0.19	0.18	0.16	0.08	0.19

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-E. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.

	Parameter	2002-2017 (n=16 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	164	166	128	154	161	n/a
B.	Number of known pairs	445	96	72	54	78	67	812
C.	Number of known breeding (nesting) pairs	367	68	58	43	55	52	643
D.	Number of breeding pairs that were well-monitored throughout the breeding season	106	12	8	0	8	11	145
E.	Number of known fledged young observed	657	95	82	55	58	90	1,037
F.	Number of known fledged young produced by pairs monitored throughout the season	285	24	11	n/a	6	32	358
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.8	1.4	1.4	1.3	1.1	1.7	1.6
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.7	2	1.4	n/a	0.8	2.9	2.5
I.	Number of nests that were discovered	214	32	24	18	15	21	324
J.	Number of well-tracked nests	160	24	18	3	13	16	234
K.	Number of successful well-tracked nests	64% 103 / 160	63% 15 / 24	39% 7 / 18	0% 0 / 3	15% 2 / 13	63% 10 / 16	59% 137 / 234
L.	Rate of cowbird parasitism (well-tracked nests) ²	14% 22 / 160	21% 5 / 24	41% 7 / 17	n/a	20% 2 / 10	0% 0 / 16	16% 36 / 227
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 6 / 160	0% 0 / 24	22% 4 / 18	0% 0 / 3	15% 2 / 13	0% 0 / 16	5% 12 / 234
	B. Number of well-tracked nests that failed as a result of parasitism	7% 11 / 160	0% 0 / 24	17% 3 / 18	0% 0 / 3	0% 0 / 13	0% 0 / 16	6% 14 / 234
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	25% 40 / 160	38% 9 / 24	22% 4 / 18	100% 3 / 3	54% 7 / 13	25% 4 / 16	29% 67 / 234
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 160	0% 0 / 24	0% 0 / 18	0% 0 / 3	15% 2 / 13	13% 2 / 16	2% 4 / 234
N.	Average clutch size	n/a	3.2	4.0	n/a	3.2	3.4	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	27	6	7	0	2	0	42
P.	Number of 'manipulated' parasitized nests ³	20	5	5	n/a	2	n/a	32
Q.	Number of successful 'manipulated' nests ³	15% 3 / 20	60% 3 / 5	20% 1 / 5	n/a	0% 0 / 2	n/a	22% 7 / 32
R.	Number of vireo fledged from 'manipulated' nests ³	7	8	3	n/a	0	n/a	18
S.	Number of cowbird young fledged by vireo observed	4	0	0	0	0	0	4
T.	Number of repaired nests	1	0	0	0	0	0	1
U.	% of successful repaired nests	0% 0 / 1	n/a	n/a	n/a	n/a	n/a	0% 0 / 1
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0
W.	Numbers of cowbirds removed from study area	765	14	43	25	46	51	944
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	7,393	266	401	359	724	736	9,879
Y.	Average number of cowbirds trapped per trap day (W/X)	0.10	0.05	0.11	0.07	0.06	0.07	0.10

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-F. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana River (SAR) - Upstream -Hidden Valley, north side of river

	Parameter	2009-2017 (n=9 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	62	78	94	61	62	n/a
B.	Number of known pairs	105	38	37	61	38	45	324
C.	Number of known breeding (nesting) pairs	72	35	31	42	35	36	251
D.	Number of breeding pairs that were well-monitored throughout the breeding season	19	11	0	0	0	0	30
E.	Number of known fledged young observed	133	65	41	74	39	50	402
F.	Number of known fledged young produced by pairs monitored throughout the season	57	35	n/a	n/a	n/a	n/a	92
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.8	1.9	n/a	1.8	1.1	1.4	1.6
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.0	3.2	n/a	n/a	n/a	n/a	3.1
I.	Number of nests that were discovered	32	25	1	13	21	16	108
J.	Number of well-tracked nests	27	25	0	0	0	7	59
K.	Number of successful well-tracked nests	63% 17 / 27	56% 14 / 25	n/a	n/a	n/a	57% 4 / 7	59% 35 / 59
L.	Rate of cowbird parasitism (well-tracked nests) ²	19% 5 / 27	0% 0 / 25	n/a	n/a	n/a	29% 2 / 7	12% 7 / 59
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 27	0% 0 / 25	n/a	n/a	n/a	0% 0 / 7	0% 0 / 59
	B. Number of well-tracked nests that failed as a result of parasitism	15% 4 / 27	0% 0 / 25	n/a	n/a	n/a	0% 0 / 7	7% 4 / 59
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	19% 5 / 27	44% 11 / 25	n/a	n/a	n/a	14% 1 / 7	29% 17 / 59
	D. Number of well-tracked nests that failed for unknown reasons	4% 1 / 27	0% 0 / 25	n/a	n/a	n/a	29% 2 / 7	5% 3 / 59
N.	Average clutch size	n/a	3.7	n/a	n/a	n/a	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	6	0	n/a	0	0	2	8
P.	Number of 'manipulated' parasitized nests ³	4	n/a	n/a	n/a	n/a	2	6
Q.	Number of successful 'manipulated' nests ³	25% 1 / 4	n/a	n/a	n/a	n/a	50% 1 / 2	33% 2 / 6
R.	Number of vireo fledged from 'manipulated' nests ³	3	n/a	n/a	n/a	n/a	4	7
S.	Number of cowbird young fledged by vireo observed	0	0	n/a	0	0	0	0
T.	Number of repaired nests	0	0	0	0	0	1	1
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	100% 1 / 1	100% 1 / 1
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	3	3
W.	Numbers of cowbirds removed from study area	n/a	19	0	13	1	-6	27
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	113	2	68	133	79	395
Y.	Average number of cowbirds trapped per trap day (W/X)	n/a	0.2	0	0.19	0.01	-0.08*	0.1

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

*Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-1-G. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Lower Hole Creek

	Parameter	2019	2020	2021	2022	Combined
A.	Number of territorial males	3	2	3	3	n/a
B.	Number of known pairs	1	1	3	3	8
C.	Number of known breeding (nesting) pairs	1	1	2	3	7
D.	Number of breeding pairs that were well-monitored throughout the breeding season	1	0	1	3	5
E.	Number of known fledged young observed	0	1	3	5	9
F.	Number of known fledged young produced by pairs monitored throughout the season	0	n/a	2	5	7
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	0	1.0	1.5	1.7	1.3
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	0	n/a	2.0	1.7	1.4
I.	Number of nests that were discovered	1	0	2	5	8
J.	Number of well-tracked nests	1	n/a	2	5	8
K.	Number of successful well-tracked nests	0% 0 / 1	n/a	100% 2 / 2	40% 2 / 5	50% 4 / 8
L.	Rate of cowbird parasitism (well-tracked nests) ²	0% 0 / 1	n/a	0% 0 / 2	0% 0 / 5	0% 0 / 8
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 1	n/a	0% 0 / 2	0% 0 / 5	0% 0 / 8
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 1	n/a	0% 0 / 2	0% 0 / 5	0% 0 / 8
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	100% 1 / 1	n/a	0% 0 / 2	60% 3 / 5	50% 4 / 8
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 1	n/a	0% 0 / 2	0% 0 / 5	0% 0 / 8
N.	Average clutch size	4.0	n/a	3.0	3.4	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	0	n/a	0	0	0
P.	Number of 'manipulated' parasitized nests ³	n/a	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests ³	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests ³	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0
T.	Number of repaired nests	0	n/a	0	0	0
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a
W.	Numbers of cowbirds removed from study area	n/a	n/a	n/a	n/a	n/a
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	n/a	n/a	n/a
Y.	Average number of cowbirds trapped per trap day (W/X)	n/a	n/a	n/a	n/a	n/a

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-H. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana River (SAR) - Upstream -Hidden Valley, south side of river

	Parameter	2000-2017 (n=18 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	141	140	176	159	140	n/a
B.	Number of known pairs	580	60	79	102	118	91	1,030
C.	Number of known breeding (nesting) pairs	503	46	77	91	97	76	890
D.	Number of breeding pairs that were well-monitored throughout the breeding season	96	28	39	51	53	45	312
E.	Number of known fledged young observed	846	88	209	187	200	180	1,710
F.	Number of known fledged young produced by pairs monitored throughout the season	257	67	148	126	156	134	888
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.7	1.9	2.7	2.1	2.1	2.4	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.7	2.4	3.8	2.5	2.9	3.0	2.8
I.	Number of nests that were discovered	207	47	78	113	109	98	652
J.	Number of well-tracked nests	163	45	76	109	102	94	589
K.	Number of successful well-tracked nests	64% 104 / 163	49% 22 / 45	63% 48 / 76	46% 50 / 109	54% 55 / 102	51% 48 / 94	56% 327 / 589
L.	Rate of cowbird parasitism (well-tracked nests) ²	3% 9 / 163	0% 0 / 45	9% 6 / 64	21% 18 / 86	22% 18 / 83	20% 16 / 82	13% 67 / 523
	A. Number of well-tracked nests that failed as a result of reproductive failure	2% 4 / 163	4% 2 / 45	3% 2 / 76	0% 0 / 109	3% 3 / 102	0% 0 / 94	2% 11 / 589
	B. Number of well-tracked nests that failed as a result of parasitism	4% 6 / 163	0% 0 / 45	1% 1 / 76	5% 5 / 109	5% 5 / 102	4% 4 / 94	4% 21 / 589
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	29% 47 / 163	47% 21 / 45	33% 25 / 76	43% 47 / 109	34% 35 / 102	35% 33 / 94	35% 208 / 589
M.	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 163	0% 0 / 45	0% 0 / 76	6% 7 / 109	4% 4 / 102	10% 9 / 94	4% 22 / 589
N.	Average clutch size	n/a	3.5	3.8	3.7	3.5	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	10	0	6	18	19	16	69
P.	Number of 'manipulated' parasitized nests ³	3	n/a	6	17	14	12	52
Q.	Number of successful 'manipulated' nests ³	100% 3 / 3	n/a	67% 4 / 6	35% 6 / 17	71% 10 / 14	50% 6 / 12	56% 29 / 52
R.	Number of vireo fledged from 'manipulated' nests ³	8	n/a	8	11	21	15	63
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	0	1	0	1	2	3	7
U.	% of successful repaired nests	n/a	100% 1 / 1	n/a	0% 0 / 1	50% 1 / 2	33% 1 / 3	43% 3 / 7
V.	Number of vireo fledged from repaired nests	n/a	3	n/a	0	2	1	6
W.	Numbers of cowbirds removed from study area	708	n/a	n/a	1	1	4	714
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	5,215	n/a	n/a	61	134	244	5,654
Y.	Average number of cowbirds trapped per trap day (W/X)	0.14	n/a	n/a	0.02	0.01	0.02	0.13

*As of 2010, reported as south side of the river

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-I. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana River (SAR) - Upstream -Goose Creek, Norco to I-15

	Parameter	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	91	90	88	73	67	n/a
B.	Number of known pairs	592	56	58	58	47	47	858
C.	Number of known breeding (nesting) pairs	555	46	52	47	42	45	787
D.	Number of breeding pairs that were well-monitored throughout the breeding season	186	16	10	22	21	30	285
E.	Number of known fledged young observed	1,086	86	110	114	73	102	1,571
F.	Number of known fledged young produced by pairs monitored throughout the season	561	43	41	78	43	77	843
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	2.0	1.9	2.1	2.4	1.7	2.3	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.0	2.7	4.1	3.5	2.0	2.6	3.0
I.	Number of nests that were discovered	381	28	25	36	41	52	563
J.	Number of well-tracked nests	325	25	24	34	34	51	493
K.	Number of successful well-tracked nests	66% 214 / 325	64% 16 / 25	71% 17 / 24	68% 23 / 34	44% 15 / 34	51% 26 / 51	63% 311 / 493
L.	Rate of cowbird parasitism (well-tracked nests) ²	5% 17 / 325	0% 0 / 25	0% 0 / 23	3% 1 / 30	21% 6 / 29	0% 0 / 41	5% 24 / 473
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 13 / 325	0% 0 / 25	8% 2 / 24	6% 2 / 34	3% 1 / 34	2% 1 / 51	4% 19 / 493
	B. Number of well-tracked nests that failed as a result of parasitism	1% 4 / 325	0% 0 / 25	0% 0 / 24	3% 1 / 34	6% 2 / 34	0% 0 / 51	1% 7 / 493
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	29% 93 / 325	36% 9 / 25	21% 5 / 24	24% 8 / 34	44% 15 / 34	45% 23 / 51	31% 153 / 493
	D. Number of well-tracked nests that failed for unknown reasons	0% 1 / 325	0% 0 / 25	0% 0 / 24	0% 0 / 34	3% 1 / 34	2% 1 / 51	1% 3 / 493
	N. Average clutch size	n/a	3.8	3.6	3.8	3.6	3.4	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	23	0	0	1	8	0	32
P.	Number of 'manipulated' parasitized nests ³	16	n/a	n/a	0	6	n/a	22
Q.	Number of successful 'manipulated' nests ³	69% 11 / 16	n/a	n/a	n/a	67% 4 / 6	n/a	68% 15 / 22
R.	Number of vireo fledged from 'manipulated' nests ³	18	n/a	n/a	n/a	10	n/a	28
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	3	1	0	1	1	1	7
U.	% of successful repaired nests	67% 2 / 3	100% 1 / 1	n/a	100% 1 / 1	0% 0 / 1	0% 0 / 1	57% 4 / 7
V.	Number of vireo fledged from repaired nests	8	3	n/a	4	0	n/a	15
W.	Numbers of cowbirds removed from study area	575	11	2	0	8	3	599
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,808	110	96	4	136	123	3,277
Y.	Average number of cowbirds trapped per trap day (W/X)	0.20	0.10	0.02	0.00	0.06	0.02	0.18

*Starting in 2015 Goose Creek Golf Club to I-15 only. Formerly monitored as Goose Creek Golf Club to River Rd.

**Starting in 2016 includes Goose Creek mitigation funded by IERCD

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

Appendix C-1-J. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Norco Bluffs (I-15 to River Rd., non-mitigation)*

	Parameter	2015-2017 (n=3 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	36	101	133	113	137	n/a
B.	Number of known pairs	76	17	50	65	48	62	318
C.	Number of known breeding (nesting) pairs	75	17	48	65	47	55	307
D.	Number of breeding pairs that were well-monitored throughout the breeding season	20	13	16	25	22	14	110
E.	Number of known fledged young observed	164	39	139	159	125	119	745
F.	Number of known fledged young produced by pairs monitored throughout the season	68	35	87	81	85	43	399
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	2.2	2.3	2.9	2.4	2.7	2.2	2.4
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	3.4	2.7	5.4	3.2	3.9	3.1	3.6
I.	Number of nests that were discovered	51	16	35	47	30	34	213
J.	Number of well-tracked nests	47	15	35	43	30	34	204
K.	Number of successful well-tracked nests	70% 33 / 47	73% 11 / 15	89% 31 / 35	70% 30 / 43	90% 27 / 30	68% 23 / 34	76% 155 / 204
L.	Rate of cowbird parasitism (well-tracked nests) ²	0% 0 / 47	0% 0 / 15	0% 0 / 35	0% 0 / 41	0% 0 / 28	0% 0 / 31	0% 0 / 197
	A. Number of well-tracked nests that failed as a result of reproductive failure	9% 4 / 47	7% 1 / 15	6% 2 / 35	2% 1 / 43	0% 0 / 30	0% 0 / 34	4% 8 / 204
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 47	0% 0 / 15	0% 0 / 35	0% 0 / 43	0% 0 / 30	0% 0 / 34	0% 0 / 204
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	21% 10 / 47	20% 3 / 15	6% 2 / 35	26% 11 / 43	10% 3 / 30	32% 11 / 34	20% 40 / 204
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 47	0% 0 / 15	0% 0 / 35	2% 1 / 43	0% 0 / 30	0% 0 / 34	<1% 1 / 204
M.	Average clutch size	n/a	3.6	3.8	3.7	3.8	3.6	n/a
N.	Number of cowbird eggs or nestlings found in or near vireo nests	0	0	0	0	0	0	0
O.	Number of 'manipulated' parasitized nests ³	n/a	n/a	n/a	n/a	n/a	n/a	n/a
P.	Number of successful 'manipulated' nests ³	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Q.	Number of vireo fledged from 'manipulated' nests ³	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
S.	Number of repaired nests	0	0	0	0	0	0	0
T.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
U.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
V.	Numbers of cowbirds removed from study area	n/a	n/a	2	3	2	0	7
W.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	113	130	128	124	495
X.	Average number of cowbirds trapped per trap day (W/X)	n/a	n/a	0.02	0.02	0.02	0.00	0.01

*Formerly monitored as part of Goose Creek Golf Club to River Rd.

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters

Appendix C-1-K. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Upper Canyon

	Parameter	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	32	35	45	43	39	n/a
B.	Number of known pairs	213	25	24	30	34	23	349
C.	Number of known breeding (nesting) pairs	185	15	19	27	33	22	301
D.	Number of breeding pairs that were well-monitored throughout the breeding season	60	7	9	8	9	9	102
E.	Number of known fledged young observed	336	23	58	52	50	32	551
F.	Number of known fledged young produced by pairs monitored throughout the season	156	13	37	26	19	23	274
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.8	1.5	3.1	1.9	1.5	1.5	1.8
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.6	1.9	4.1	3.3	2.1	2.6	2.7
I.	Number of nests that were discovered	127	13	22	14	19	22	217
J.	Number of well-tracked nests	86	10	19	12	17	15	159
K.	Number of successful well-tracked nests	67% 58 / 86	50% 5 / 10	74% 14 / 19	67% 8 / 12	47% 8 / 17	53% 8 / 15	64% 101 / 159
L.	Rate of cowbird parasitism (well-tracked nests) ²	5% 4 / 86	0% 0 / 10	0% 0 / 17	0% 0 / 11	0% 0 / 17	0% 0 / 13	3% 4 / 154
	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 3 / 86	0% 0 / 10	0% 0 / 19	0% 0 / 12	6% 1 / 17	7% 1 / 15	3% 5 / 159
	B. Number of well-tracked nests that failed as a result of parasitism	2% 2 / 86	0% 0 / 10	0% 0 / 19	0% 0 / 12	0% 0 / 17	0% 0 / 15	1% 2 / 159
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	27% 23 / 86	50% 5 / 10	26% 5 / 19	25% 3 / 12	47% 8 / 17	33% 5 / 15	31% 49 / 159
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 86	0% 0 / 10	0% 0 / 19	8% 1 / 12	0% 0 / 17	7% 1 / 15	1% 2 / 159
M.	Average clutch size	n/a	3.1	3.7	3.7	3.4	3.3	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	0	0	0	0	0	4
P.	Number of 'manipulated' parasitized nests ³	1	n/a	n/a	n/a	n/a	n/a	1
Q.	Number of successful 'manipulated' nests ³	100% 1 / 1	n/a	n/a	n/a	n/a	n/a	100% 1 / 1
R.	Number of vireo fledged from 'manipulated' nests ³	1	n/a	n/a	n/a	n/a	n/a	1
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	2	0	1	0	1	0	4
U.	% of successful repaired nests	0% 0 / 2	n/a	100% 1 / 1	n/a	0% 0 / 1	n/a	25% 1 / 4
V.	Number of vireo fledged from repaired nests	0	n/a	3	n/a	0	n/a	3
W.	Numbers of cowbirds removed from study area	707	94	41	-1	8	3	852
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,321	118	113	128	126	119	3,925
Y.	Average number of cowbirds trapped per trap day (W/X)	0.21	0.80	0.36	0.00*	0.06	0.03	0.22

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

*Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-1-L. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Green River Golf Club

	Parameter	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	42	45	61	47	48	n/a
B.	Number of known pairs	263	38	34	42	35	36	448
C.	Number of known breeding (nesting) pairs	230	22	32	31	33	35	383
D.	Number of breeding pairs that were well-monitored throughout the breeding season	88	5	12	22	19	23	169
E.	Number of known fledged young observed	427	20	96	63	63	71	740
F.	Number of known fledged young produced by pairs monitored throughout the season	211	3	51	49	43	56	413
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.9	0.9	3.0	2.0	1.9	1.9	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.4	0.6	4.3	2.2	2.3	2.4	2.4
I.	Number of nests that were discovered	166	20	33	34	35	37	325
J.	Number of well-tracked nests	141	16	28	33	33	31	282
K.	Number of successful well-tracked nests	60% 85 / 141	25% 4 / 16	79% 22 / 28	48% 16 / 33	48% 16 / 33	61% 19 / 31	57% 162 / 282
L.	Rate of cowbird parasitism (well-tracked nests) ²	3% 4 / 141	0% 0 / 16	0% 0 / 26	17% 5 / 29	0% 0 / 28	0% 0 / 27	3% 9 / 267
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	6% 9 / 141	0% 0 / 16	7% 2 / 28	0% 0 / 33	18% 6 / 33	3% 1 / 31	6% 18 / 282
	B. Number of well-tracked nests that failed as a result of parasitism	1% 1 / 141	0% 0 / 16	0% 0 / 28	0% 0 / 33	0% 0 / 33	0% 0 / 31	<1% 1 / 282
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 46 / 141	69% 11 / 16	14% 4 / 28	45% 15 / 33	33% 11 / 33	29% 9 / 31	34% 96 / 282
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 141	6% 1 / 16	0% 0 / 28	6% 2 / 33	0% 0 / 33	6% 2 / 31	2% 5 / 282
N.	Average clutch size	n/a	3.4	3.7	3.9	3.5	3.3	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	0	0	6	0	0	10
P.	Number of 'manipulated' parasitized nests ³	2	n/a	n/a	5	n/a	n/a	7
Q.	Number of successful 'manipulated' nests ³	100% 2 / 2	n/a	n/a	40% 2 / 5	n/a	n/a	57% 4 / 7
R.	Number of vireo fledged from 'manipulated' nests ³	6	n/a	n/a	6	n/a	n/a	12
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	5	0	2	5	2	3	17
U.	% of successful repaired nests	80% 4 / 5	n/a	100% 2 / 2	60% 3 / 5	100% 2 / 2	67% 2 / 3	76% 13 / 17
V.	Number of vireo fledged from repaired nests	10	n/a	3	8	4	6	31
W.	Numbers of cowbirds removed from study area	1,067	-1	4	n/a	6	8	1,084
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,639	83	114	n/a	254	229	5,319
Y.	Average number of cowbirds trapped per trap day (W/X)	0.23	0.00*	0.04	n/a	0.02	0.03	0.20

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

*Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-1-M. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Featherly Regional Park

	Parameter	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined
A.	Number of territorial males	n/a	66	69	79	64	66	n/a
B.	Number of known pairs	386	25	33	48	34	43	569
C.	Number of known breeding (nesting) pairs	314	18	28	42	27	32	461
D.	Number of breeding pairs that were well-monitored throughout the breeding season	96	8	8	17	13	15	157
E.	Number of known fledged young observed	439	25	76	66	43	52	701
F.	Number of known fledged young produced by pairs monitored throughout the season	179	17	45	40	23	31	335
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success') ¹	1.4	1.4	2.7	1.6	1.6	1.6	1.5
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	1.9	2.1	5.6	2.4	1.8	2.1	2.1
I.	Number of nests that were discovered	217	18	30	46	30	31	372
J.	Number of well-tracked nests	162	12	28	41	28	29	300
K.	Number of successful well-tracked nests	43% 70 / 162	50% 6 / 12	64% 18 / 28	37% 15 / 41	39% 11 / 28	48% 14 / 29	45% 134 / 300
L.	Rate of cowbird parasitism (well-tracked nests) ²	3% 5 / 162	0% 0 / 12	0% 0 / 26	0% 0 / 31	21% 4 / 19	0% 0 / 25	3% 9 / 275
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 8 / 162	0% 0 / 12	14% 4 / 28	10% 4 / 41	7% 2 / 28	0% 0 / 29	6% 18 / 300
	B. Number of well-tracked nests that failed as a result of parasitism	1% 2 / 162	0% 0 / 12	0% 0 / 28	0% 0 / 41	0% 0 / 28	0% 0 / 29	1% 2 / 300
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	51% 82 / 162	42% 5 / 12	21% 6 / 28	49% 20 / 41	46% 13 / 28	48% 14 / 29	47% 140 / 300
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 162	8% 1 / 12	0% 0 / 28	5% 2 / 41	7% 2 / 28	3% 1 / 29	2% 6 / 300
N.	Average clutch size	n/a	3	3.6	3.5	3.4	3.3	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	5	0	0	0	4	0	9
P.	Number of 'manipulated' parasitized nests ³	3	n/a	n/a	n/a	4	n/a	7
Q.	Number of successful 'manipulated' nests ³	33% 1 / 3	n/a	n/a	n/a	50% 2 / 4	n/a	43% 3 / 7
R.	Number of vireo fledged from 'manipulated' nests ³	2	n/a	n/a	n/a	4	n/a	6
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	8	0	0	3	1	0	12
U.	% of successful repaired nests	75% 6 / 8	n/a	n/a	67% 2 / 3	0% 0 / 1	n/a	67% 8 / 12
V.	Number of vireo fledged from repaired nests	18	n/a	n/a	3	0	n/a	21
W.	Numbers of cowbirds removed from study area	470	26	-1	15	22	10	542
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,459	239	237	245	316	269	5,765
Y.	Average number of cowbirds trapped per trap day (W/X)	0.11	0.11	0.00*	0.06	0.07	0.04	0.09

¹Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

² Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

³Only well-tracked nests are counted for these parameters.

*Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-2-A. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

San Jacinto

Host Plant Species (listed alphabetically by scientific name)	2004-2017 (n=13 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Western False Indigo (<i>Amorpha fruticosa</i>)			1				1	<1%
Coyote Brush (<i>Baccharis pilularis</i>)	6	3	9		1	4	23	7%
Mulefat (<i>Baccharis salicifolia</i>)	36	1	1	17	6	6	67	20%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	1			1			2	1%
Blue Palo Verde (<i>Parkinsonia florida</i>)				1			1	<1%
Arrowweed (<i>Pluchea sericea</i>)	1	1	2	2			6	2%
Fremont Cottonwood (<i>Populus fremontii</i>)		1	1	3		3	8	2%
California Scrub Oak (<i>Quercus berberidifolia</i>)				1			1	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	61	23	24	22	3	5	138	41%
Dead Narrowleaf Willow (<i>Salix exigua</i>)	1						1	<1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	12	5	4	13	9	9	52	16%
Red Willow (<i>Salix laevigata</i>)	3						3	1%
Arroyo Willow (<i>Salix lasiolepis</i>)				1			1	<1%
Blue Elderberry (<i>Sambucus mexicana</i>)				3	1		4	1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	2	3	4	5		2	16	5%
Unknown/No data	7	1	1				9	3%
Total	130	38	47	69	20	29	333	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

Appendix C-2-B. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

San Timoteo Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Boxelder (<i>Acer negundo</i>)	2						2	<1%
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)	1						1	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	19		1	1			21	1%
Fourwing Saltbush (<i>Atriplex canescens</i>)	1		1	1			3	<1%
Coyote Brush (<i>Baccharis pilularis</i>)					1		1	<1%
Mulefat (<i>Baccharis salicifolia</i>)	272	19	8	6	13	4	322	22%
Willow Baccharis (<i>Baccharis salicina</i>)	1						1	<1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	1		1				2	<1%
Mustard sp. ^{ie} (<i>Brassica</i> sp.)	4						4	<1%
Orange Tree ^e (<i>Citrus sinensis</i>)				1			1	<1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)			1				1	<1%
Brittlebush (<i>Encelia farinosa</i>)			2				2	<1%
Ash sp. (<i>Fraxinus</i> sp.)					1		1	<1%
Toyon (<i>Heteromeles arbutifolia</i>)	22		1				23	2%
Southern California Black Walnut ^r (<i>Juglans californica</i>)	2	1					3	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	1					1	2	<1%
Chaparral Mallow (<i>Malacothamnus fasciculatus</i>)			1	2			3	<1%
White Mulberry ^e (<i>Morus alba</i>)	1		2	2	2	1	8	1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)			1				1	<1%
Olive ^e (<i>Olea europaea</i>)			1				1	<1%
Western Sycamore (<i>Platanus racemosa</i>)	1				1		2	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	43	8	6	13	4	5	79	5%
Dead Fremont Cottonwood (<i>Populus fremontii</i>)	1						1	<1%

Appendix C-2-B continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

San Timoteo Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Callery Pear ^e (<i>Pyrus calleryana</i>)*			1	1		3	5	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)	1	1	1	1			4	<1%
Oak sp. (<i>Quercus</i> sp.)	1						1	<1%
Golden Currant (<i>Ribes aureum</i>)	5						5	<1%
California Wild Rose (<i>Rosa californica</i>)	2						2	<1%
Fragrant Sumac (<i>Rhus aromatica</i>)	1						1	<1%
Sugar Sumac (<i>Rhus ovata</i>)		1					1	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	29	1	4				34	2%
Goodding's Black Willow (<i>Salix gooddingii</i>)	76	3	9	3	4		95	7%
Red Willow (<i>Salix laevigata</i>)	164	6	23	22	27	9	251	17%
Arroyo Willow (<i>Salix lasiolepis</i>)	229	26	18	33	13	28	347	24%
Pacific Willow (<i>Salix lasiandra</i>)	12			4	1		17	1%
Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Dead Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Blue Elderberry (<i>Sambucus mexicana</i>)	44	1	7	5	2	1	60	4%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)						1	1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	2						2	<1%
Hoary Nettle (<i>Urtica dioica</i>)			1				1	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	77	8	5	9	9	9	117	8%
Desert Wild Grape (<i>V. girdiana</i>) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and Sweet Fennel ^{ie} (<i>Foeniculum vulgare</i>)	1						1	<1%
Deadfall	2				1	1	4	<1%
Unknown/No data	2		1				3	<1%
Total	1,023	75	96	104	79	63	1,440	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

*misidentified as *Cydonia oblonga* in 2019-21 reports

Appendix C-2-C. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Meridian Conservation Area*

Host Plant Species (listed alphabetically by scientific name)	2004-2017 (n=6 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Mulefat (<i>Baccharis salicifolia</i>)	2				1	1	4	9%
Goodding's Black Willow (<i>Salix gooddingii</i>)	10			1	1		12	28%
Red Willow (<i>Salix laevigata</i>)	9			1			10	23%
Arroyo Willow (<i>Salix lasiolepis</i>)	9			5	1		15	35%
Dead Willow sp. (<i>Salix</i> sp.)	1						1	2%
Deadfall	0			1			1	2%
Total	31	0	0	8	3	1	43	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

*Former March SKR Preserve

Appendix C-2-D. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Mockingbird Canyon

Host Plant Species (listed alphabetically by scientific name)	2003-2016 (n=14 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Wild Celery ^e (<i>Apium graveolens</i>)	1						1	<1%
Fourwing Saltbush (<i>Atriplex canescens</i>)	1		1				2	1%
Coyote Brush (<i>Baccharis pilularis</i>)			1	3			4	2%
Mulefat (<i>Baccharis salicifolia</i>)	15			1			16	7%
Willow Baccharis (<i>Baccharis salicina</i>)	2						2	1%
Southern California Black Walnut ^r (<i>Juglans californica</i>)	1						1	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	3			1			4	2%
Dead Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	2						2	1%

Appendix C-2-D continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Mockingbird Canyon

Host Plant Species (listed alphabetically by scientific name)	2003-2016 (n=14 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Western Sycamore (<i>Platanus racemosa</i>)	1						1	<1%
Arrowweed (<i>Pluchea sericea</i>)	1						1	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	2		1	2			5	2%
Hollyleaf Cherry (<i>Prunus ilicifolia</i>)	1						1	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	1						1	<1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	31		2		1		34	15%
Red Willow (<i>Salix laevigata</i>)	56			4	2	1	63	29%
Arroyo Willow (<i>Salix lasiolepis</i>)	16		1	3			20	9%
Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Dead Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Blue Elderberry (<i>Sambucus mexicana</i>)	29		5	1		2	37	17%
Peruvian Pepper Tree ^e (<i>Schinus molle</i>)	4						4	2%
Tamarisk ^e (<i>Tamarix ramosissima</i>)			1	1			2	1%
Desert Wild Grape (<i>Vitis girdiana</i>)	7						7	3%
Desert Wild Grape (<i>V. girdiana</i>) and Goodding's Black Willow (<i>S. gooddingii</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Perennial Pepperweed ^{le} (<i>L. latifolium</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.) and Perennial Pepperweed ^{le} (<i>L. latifolium</i>)	1						1	<1%
Coyote Brush (<i>B. pilularis</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Deadfall				2	1		3	1%
Unknown/No data	2				1		3	1%
Total	182	0	12	18	5	3	220	100%

^l = invasive

^e = non-native

^r = endangered, threatened, or sensitive

Appendix C-2-E. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.

Host Plant Species (listed alphabetically by scientific name)	2002-2017 (n=14 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
White Alder (<i>Alnus rhombifolia</i>)	1						1	<1%
Coyote Brush (<i>Baccharis pilularis</i>)			1		1		2	1%
Mulefat (<i>Baccharis salicifolia</i>)	58	10	3	1	1	2	75	24%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)			1				1	<1%
Ash sp. (<i>Fraxinus</i> sp.)				3			3	1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)	1		1				2	1%
Western Sycamore (<i>Platanus racemosa</i>)	3					2	5	2%
Fremont Cottonwood (<i>Populus fremontii</i>)	12		2	3	4	1	22	7%
Holly Leaf Cherry (<i>Prunus ilicifolia</i>)				1			1	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)	2				2	1	5	2%
California Wild Rose (<i>Rosa californica</i>)	2						2	1%
California Blackberry (<i>Rubus ursinus</i>)	1			1*			2	1%
Narrowleaf Willow (<i>Salix exigua</i>)	10			3		1	14	5%
Dead Narrowleaf Willow (<i>Salix exigua</i>)				1			1	<1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	20	5	1		2		28	9%
Dead Goodding's Black Willow (<i>Salix gooddingii</i>)	1						1	<1%
Red Willow (<i>Salix laevigata</i>)	14	6	1	2		3	26	8%
Arroyo Willow (<i>Salix lasiolepis</i>)	49	3	3	1	2	9	67	22%
Pacific Willow (<i>Salix lasiandra</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.)	1	1		1			3	1%
Blue Elderberry (<i>Sambucus mexicana</i>)	7				1		8	3%

Appendix C-2-E continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.

Host Plant Species (listed alphabetically by scientific name)	2002-2017 (n=14 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Tamarisk ^e (<i>Tamarix ramosissima</i>)	2						2	1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	1						1	<1%
Hoary Nettle (<i>Urtica dioica</i>)	1						1	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	12	4	5	1	2	1	25	8%
Desert Wild Grape (<i>V. girdiana</i>) and Goodding's Black Willow (<i>S. gooddingii</i>)		1					1	<1%
Dead Goodding's Black Willow (<i>S.</i> <i>gooddingii</i>) and Hoary Nettle (<i>U. dioica</i>)	1						1	<1%
Unknown/No Data		2	6			1	9	3%
Total	200	32	24	17	15	21	309	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

* Corrected after the release of the 2020 report

Appendix C-2-F. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana River (SAR) - Upstream - Hidden Valley, north side of river

Host Plant Species (listed alphabetically by scientific name)	2010-2017 (n=5 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Arundo ⁱ (<i>Arundo donax</i>)		1			1	1	3	3%
Mulefat (<i>Baccharis salicifolia</i>)	12	15		5	3	7	42	39%
Shamel Ash ^e (<i>Fraxinus udei</i>)						1	1	1%
Western Sycamore (<i>Platanus racemosa</i>)		1					1	1%
Fremont Cottonwood (<i>Populus fremontii</i>)	4	1		1	1		7	6%
California Blackberry (<i>Rubus ursinus</i>)	1						1	1%
Narrowleaf Willow (<i>Salix exigua</i>)	1			4	4		9	8%
Goodding's Black Willow (<i>Salix gooddingii</i>)		2			3	1	6	6%
Red Willow (<i>Salix laevigata</i>)	3				1		4	4%
Arroyo Willow (<i>Salix lasiolepis</i>)	5	5		3	6	3	22	20%
Blue Elderberry (<i>Sambucus mexicana</i>)	3						3	3%
Desert Wild Grape (<i>Vitis girdiana</i>)	3						3	3%
Deadfall					2	2	4	4%
Unknown/No Data			1			1	2	2%
Total	32	25	1	13	21	16	108	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

Appendix C-2-G. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Lower Hole Creek

Host Plant Species (listed alphabetically by scientific name)	2019	2020	2021	2022	Combined	Percentage of Combined
Mulefat (<i>Baccharis salicifolia</i>)	1			1	2	25%
Western Sycamore (<i>Platanus racemosa</i>)			2	1	3	38%
Red Willow (<i>Salix laevigata</i>)				2	2	25%
Deadfall				1	1	13%
Total	1	0	2	5	8	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

Appendix C-2-H. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana River (SAR) - Upstream - Hidden Valley, south side of river*

Host Plant Species (listed alphabetically by scientific name)	2000-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Douglas' Sagewort (<i>Artemisia douglasiana</i>)				1			1	<1%
Giant Reed ^{ie} (<i>Arundo donax</i>)						1	1	<1%
Big Saltbush (<i>Atriplex lentiformis</i>)					2		2	<1%
Coyote Brush (<i>Baccharis pilularis</i>)	1		1				2	<1%
Mulefat (<i>Baccharis salicifolia</i>)	52	17	16	24	34	27	170	26%
Dead Mulefat (<i>Baccharis salicifolia</i>)	1						1	<1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)				5		2	7	1%
Arizona Ash (<i>Fraxinus velutina</i>)				1		1	2	<1%
Ash sp. (<i>Fraxinus</i> sp.)					1	1	2	<1%
Common Sunflower (<i>Helianthus annuus</i>)				1			1	<1%
Summer Cypress ^e (<i>Kochia scoparia</i>)				1			1	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)			1	1			2	<1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)				1			1	<1%
Western Sycamore (<i>Platanus racemosa</i>)			1	1			2	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	1		3	9	8	10	31	5%
Coast Live Oak (<i>Quercus agrifolia</i>)						1	1	<1%
California Wild Rose (<i>Rosa californica</i>)	1		1	1			3	<1%
California Blackberry (<i>Rubus ursinus</i>)					2	1	3	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	4	1	3	7	9	2	26	4%
Goodding's Black Willow (<i>Salix gooddingii</i>)	21	5	8	10	13	8	65	10%
Red Willow (<i>Salix laevigata</i>)	18	2	5	3		18	46	7%

Appendix C-2-H continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana River (SAR) - Upstream - Hidden Valley, south side of river*

Host Plant Species (listed alphabetically by scientific name)	2000-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Arroyo Willow (<i>Salix lasiolepis</i>)	62	17	30	28	30	21	188	29%
Pacific Willow (<i>Salix lasiandra</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.)	2						2	<1%
Blue Elderberry (<i>Sambucus mexicana</i>)	5		3	7	3	1	19	3%
Dead Blue Elderberry (<i>Sambucus mexicana</i>)	1						1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)		1		1	2	2	6	1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	1			2			3	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	12	4	4	6	5	2	33	5%
Fresh water reed (Typha sp.) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and California Wild Rose (<i>R. californica</i>)	1						1	<1%
Red Willow (<i>S. laevigata</i>) and Wild Cucumber (<i>Marah macrocarpa</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.) and California Blackberry (<i>Rubus ursinus</i>)	1						1	<1%
Mulefat (<i>B. salicifolia</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)	1						1	<1%
Unknown/No data	9		2	3			14	2%
Total	197	47	78	113	109	98	642	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

*As of 2010, reported as south side of the river

Appendix C-2-I. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana River (SAR) - Upstream - Goose Creek, Norco to I-15

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)			1				1	<1%
California Sagebrush (<i>Artemisia californica</i>)		1			1	1	3	1%
Giant Reed ^{ie} (<i>Arundo donax</i>)				1	3	2	6	1%
Coyote Brush (<i>Baccharis pilularis</i>)					3	1	4	1%
Mulefat (<i>Baccharis salicifolia</i>)	127	9	4	2	1	5	148	26%
Dead Mulefat (<i>Baccharis salicifolia</i>)	6						6	1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	4			1		1	6	1%
Ash sp. (<i>Fraxinus</i> sp.)	1						1	<1%
Southern California Black Walnut ^r (<i>Juglans californica</i>)	1						1	<1%
Arrowweed (<i>Pluchea sericea</i>)						2	2	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	15	3	1	5	9	6	39	7%
Dead Fremont Cottonwood (<i>Populus fremontii</i>)	1						1	<1%
California Wild Rose (<i>Rosa californica</i>)					2		2	<1%
California Blackberry (<i>Rubus ursinus</i>)				3	4	2	9	2%
Narrowleaf Willow (<i>Salix exigua</i>)	13	1	1	3	3	2	23	4%
Goodding's Black Willow (<i>Salix gooddingii</i>)	53		5	1	1	1	61	11%
Red Willow (<i>Salix laevigata</i>)	10	6	1	2	3	6	28	5%
Pacific Willow (<i>Salix lasiandra</i>)	1			1	1		3	1%
Arroyo Willow (<i>Salix lasiolepis</i>)	115	5	7	8	5	13	153	27%
Dead Arroyo Willow (<i>Salix lasiolepis</i>)	2						2	<1%
Willow sp. (<i>Salix</i> sp.)	1	2					3	1%

Appendix C-2-I continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana River (SAR) - Upstream - Goose Creek, Norco to I-15

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Dead Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Blue Elderberry (<i>Sambucus mexicana</i>)	4		1	3	2	4	14	2%
Tamarisk ⁱ ^e (<i>Tamarix ramosissima</i>)			1			1	2	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	20	1	3	2	1	4	31	6%
Goodding's Black Willow (<i>S. gooddingii</i>) and Poison Hemlock ⁱ ^e (<i>C. maculatum</i>)	1						1	<1%
Deadfall				3	2	1	6	1%
Unknown/No data	3			1			4	1%
Total	379	28	25	36	41	52	561	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

*Starting in 2015 Goose Creek Golf Club to 1-15 only. Formerly monitored as Goose Creek Golf Club to River Rd.

**Includes Goose Creek mitigation funded by IERCD

Appendix C-2-J. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Norco Bluffs (I-15 to River Rd., non-mitigation)*

Host Plant Species (listed alphabetically by scientific name)	2015-2017 (n=3 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Douglas' Sagewort (<i>Artemisia douglasiana</i>)					1		1	<1%
Coyote Brush (<i>Baccharis pilularis</i>)			1				1	<1%
Mulefat (<i>Baccharis salicifolia</i>)	12	4	8	15	3	9	51	24%
Fremont Cottonwood (<i>Populus fremontii</i>)						1	1	<1%
California Wild Rose (<i>Rosa californica</i>)		1					1	<1%
California Blackberry (<i>Rubus ursinus</i>)				1		2	3	1%
Narrowleaf Willow (<i>Salix exigua</i>)	2		2	3	6	5	18	8%
Goodding's Black Willow (<i>Salix gooddingii</i>)	10	3	2	7	4	5	31	15%
Red Willow (<i>Salix laevigata</i>)				1			1	<1%
Pacific Willow (<i>Salix lasiandra</i>)			2	1	1		4	2%
Arroyo Willow (<i>Salix lasiolepis</i>)	20	5	10	15	12	8	70	33%
Dead Arroyo Willow (<i>Salix lasiolepis</i>)		1	1				2	1%
Blue Elderberry (<i>Sambucus mexicana</i>)			2		1		3	1%
Desert Wild Grape (<i>Vitis girdiana</i>)	5	2	6	3	1	4	21	10%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	2						2	1%
California Blackberry (<i>Rubus ursinus</i>) and dead unknown				1			1	<1%
Deadfall					1		1	<1%
Unknown/No Data			1				1	<1%
Total	51	16	35	47	30	34	213	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

*Formerly monitored as part of Goose Creek Golf Club to River Rd.

Appendix C-2-K. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana Canyon (SAC) - Upper Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Coyote Brush (<i>Baccharis pilularis</i>)	1			1			2	1%
Mulefat (<i>Baccharis salicifolia</i>)	47	7	8	7	6	14	89	41%
Desertbroom Baccharis (<i>Baccharis sarothroides</i>)	1						1	<1%
Mustard sp. ^{ie} (<i>Brassica</i> sp.)	2						2	1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	2						2	1%
Toyon (<i>Heteromeles arbutifolia</i>)	1						1	<1%
Southern California Black Walnut ^f (<i>Juglans californica</i>)					1	1	2	1%
Laurel Sumac (<i>Malosma laurina</i>)		1	1			1	3	1%
Western Sycamore (<i>Platanus racemosa</i>)	1			1			2	1%
Fremont Cottonwood (<i>Populus fremontii</i>)	8	1	1		4	1	15	7%
Coast Live Oak (<i>Quercus agrifolia</i>)	1				2		3	1%
California Scrub Oak (<i>Quercus berberidifolia</i>)	2			1			3	1%
Castorbean ^{ie} (<i>Ricinus communis</i>)	1						1	<1%
California Wild Rose (<i>Rosa californica</i>)	3						3	1%
Narrowleaf Willow (<i>Salix exigua</i>)	1						1	<1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	12		3				15	7%
Red Willow (<i>Salix laevigata</i>)	3	1					4	2%
Arroyo Willow (<i>Salix lasiolepis</i>)	3			1			4	2%
Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Blue Elderberry (<i>Sambucus mexicana</i>)	20	2	6	2	4		34	16%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)	2	1					3	1%

Appendix C-2-K continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana Canyon (SAC) - Upper Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Coyote Brush (<i>Baccharis pilularis</i>)	1			1			2	1%
Milk Thistle ^{ie} (<i>Silybum marianum</i>)	1						1	<1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	5		1		2	4	12	6%
Desert Wild Grape (<i>Vitis girdiana</i>)	4		2				6	3%
Rough Cockelbur (<i>Xanthium strumarium</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Black Mustard ^{ie} (<i>B. nigra</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Unknown/No Data				1		1	2	1%
Total	125	13	22	14	19	22	215	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

*Data corrected after the release of the 2020 report

Appendix C-2-L. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)		1					1	<1%
California Sagebrush (<i>Artemisia californica</i>)	1						1	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	1						1	<1%
Giant Reed ^{ie} (<i>Arundo donax</i>)	1		1				2	1%
Coyote Brush (<i>Baccharis pilularis</i>)	3	1					4	1%
Mulefat (<i>Baccharis salicifolia</i>)	62	6	7	11	14	14	114	35%
Black Mustard ^{ie} (<i>Brassica nigra</i>)			4				4	1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	2						2	1%
Carrotwood ^e (<i>Cupaniopsis anacardioides</i>)				1			1	<1%
Yerba Santa sp. (<i>Eriodictyon</i> sp.)	1						1	<1%
Toyon (<i>Heteromeles arbutifolia</i>)	2						2	1%
Southern California Black Walnut ^f (<i>Juglans californica</i>)	4		1				5	2%
Privet sp. ^e (<i>Ligustrum</i> sp.)	1						1	<1%
Bush mallow sp. (<i>Malacothamnus</i> sp.)					1		1	<1%
Laurel Sumac (<i>Malosma laurina</i>)	7	3	4	5	6	4	29	9%
Lollypop Tree ^{ie} (<i>Myoporum laetum</i>)	1						1	<1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)		1					1	<1%
Cape Leadwort ^e (<i>Plumbago auriculata</i>)	2						2	1%
Black Cottonwood (<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>)						1	1	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	9	4	1	4	1	4	23	7%
Coast Live Oak (<i>Quercus agrifolia</i>)					1	1	2	1%

Appendix C-2-L continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed alphabetically by scientific name)	2001-2017 (n=17 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
California Scrub Oak (<i>Quercus berberidifolia</i>)				1			1	<1%
California Blackberry (<i>Rubus ursinus</i>)						1	1	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	2				1		3	1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	16	1	1		2	4	24	7%
Red Willow (<i>Salix laevigata</i>)	6				1		7	2%
Arroyo Willow (<i>Salix lasiolepis</i>)	6				1	3	10	3%
Blue Elderberry (<i>Sambucus mexicana</i>)	16	1	10	7	3	3	40	12%
Peruvian Pepper Tree ^e (<i>Schinus molle</i>)	9	2	1	3	3	2	20	6%
Brazilian Pepper Tree ^e (<i>Schinus terebinthifolius</i>)	1						1	<1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	5			1	1		7	2%
Desert Wild Grape (<i>Vitis girdiana</i>)	4		2				6	2%
Desert Wild Grape (<i>V. girdiana</i>) and Peruvian Pepper Tree ^e (<i>S. molle</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Unknown/No data	1		1	1			3	1%
Total	166	20	33	34	35	37	325	100%

^l = invasive

^e = non-native

^r = endangered, threatened, or sensitive

Appendix C-2-M. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed alphabetically by scientific name)	2002-2017 (n=16 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
White Alder (<i>Alnus rhombifolia</i>)	1						1	<1%
Fiddleneck sp. (<i>Amsinckia</i> sp.)	1						1	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)			1		1		2	1%
Coyote Brush (<i>Baccharis pilularis</i>)				1		1	2	1%
Mulefat (<i>Baccharis salicifolia</i>)	50	5	7	17	7	13	99	27%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	5		2	2	1		10	3%
Yellowspine Thistle ^{ie} (<i>Cirsium ochrocentrum</i>)	2						2	1%
Orange Tree ^e (<i>Citrus sinensis</i>)	3						3	1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	3		4	6			13	3%
Thickleaf Yerba Santa (<i>Eriodictyon crassifolium</i>)	3				1	2	6	2%
Toyon (<i>Heteromeles arbutifolia</i>)	1						1	<1%
Coast Goldenbush (<i>Isocoma menziesii</i>)						1	1	<1%
Southern California Black Walnut ^f (<i>Juglans californica</i>)	9			2			11	3%
Laurel Sumac (<i>Malosma laurina</i>)	13	5	3	6	3	2	32	9%
Wild Cucumber (<i>Marah macrocarpa</i>)				1			1	<1%
Blue Palo Verde (<i>Parkinsonia florida</i>)			1				1	<1%
Western Sycamore (<i>Platanus racemosa</i>)	3	1	1	2	7	2	16	4%
Black Cottonwood (<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>)	3						3	1%
Fremont Cottonwood (<i>Populus fremontii</i>)	24	3	1	5	2	5	40	11%
Spanish False Fleabane ^e (<i>Pulicaria paludosa</i>)					1		1	<1%
Castor bean ^{ie} (<i>Ricinus communis</i>)	1						1	<1%

Appendix C-2-M continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2022.

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed alphabetically by scientific name)	2002-2017 (n=16 years)	2018	2019	2020	2021	2022	Combined	Percentage of Combined
Coulter's Matilija Poppy ^r (<i>Romneya coulteri</i>)	1						1	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	6		6		2		14	4%
Goodding's Black Willow (<i>Salix gooddingii</i>)	22				1	1	24	6%
Dead Goodding's Black Willow covered with living Goodding's Black Willow (<i>Salix gooddingii</i>)	1						1	<1%
Red Willow (<i>Salix laevigata</i>)	4	1	1				6	2%
Arroyo Willow (<i>Salix lasiolepis</i>)	8	1				1	10	3%
Willow sp. (<i>Salix</i> sp.)	1			2	1		4	1%
Black Sage (<i>Salvia mellifera</i>)	1	1					2	1%
Blue Elderberry (<i>Sambucus mexicana</i>)	31		2	2	2	1	38	10%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)		1					1	<1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	11						11	3%
Desert Wild Grape (<i>Vitis girdiana</i>)	1					2	3	1%
Rough Cockelburr (<i>Xanthium strumarium</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	2						2	1%
Arroyo Willow (<i>S. lasiolepis</i>) and Black Mustard ^{ie} (<i>B. nigra</i>)	1						1	<1%
Castorbean ^{ie} (<i>R. communis</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Black Mustard (<i>B. nigra</i>) and Poison Hemlock (<i>C. maculatum</i>)			1				1	<1%
Unknown/No data	3				1		4	1%
Total	217	18	30	46	30	31	372	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

APPENDIX D: SUMMARY TABLES BY MANAGED SITE, 2000-2022

Available by request under separate cover.

APPENDIX E: ERRATA

While we have made every effort to accurately represent our data and results, the reader should recognize that data management and analysis are ongoing activities. In an effort to maintain a high level of accuracy, this erratum was produced to document *minor* errors that do not invalidate or alter the conclusions of the associated report. The following numbers were corrected after the release of the 2021 *Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2021, and Summary Data by Site and Watershed-wide, 2000-2021* report.

Appendix B-1: Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana Watershed, 2000-2021 (sites vary by year).

Page Number	Row	Parameter	Data Listed in the 2021 Report		Corrected Data	
			2021 Column	Combined Column	2021 Column	Combined Column
B-2	F	Number of known fledged young produced by pairs monitored throughout the breeding season	500	6,256	494	6,250
	W	Number of cowbirds removed from study area	1,988	45,885	1,987	45,884
	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,628	100,326	4,619	100,317

Appendix B-2: Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2021.

Appendix Number	Page Number	Row	Data Listed in the 2021 Report			Corrected Data		
			2021 Column	Combined Column	Percentage of Combined Column	2021 Column	Combined Column	Percentage of Combined Column
B-2	B-3	Desert Wild Grape (<i>Vitis girdiana</i>)	19	233	5%	18	232	4%
	B-5	Coyote Brush (<i>Baccharis pilularis</i>)	5	40	1%	6	41	1%

Appendix B-3: Brown-headed Cowbird Trapping Effort and Results, 2000-2021.

Page Number	Parameter	Data Listed in the 2021 Report		Corrected Data	
		2021 Column	Combined Column	2021 Column	Combined Column
B-8	Number of Trap Days (Fall/Winter)	729	n/a	722	n/a
	Number of Trap Days (Spring/Summer)	6,231	108,364	6,217	108,350
	Number of Juveniles Removed (Spring/Summer)	151	5,024	150	5,023
	Total Number of Cowbirds Removed (Spring/Summer)	3,756	51,440	3,755	51,439
	Total Number of Trap Days	6,960	n/a	6,939	n/a
	Total Number of Cowbirds Removed	10,454	146,518	10,543	146,517
	Average Number of Cowbirds Removed Per Day	1.50	n/a	1.51	n/a

Appendix C-1. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Appendix Number	Page Number	Row	Parameter	Data Listed in the 2021 Report		Corrected Data	
				2021 Column	Combined Column	2021 Column	Combined Column
C-1-D	C-5	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	530	12,001	529	12,000
C-1-J	C-11	G	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.6	n/a	2.7	n/a
C-1-K	C-12	W	Number of cowbirds removed from study area	358	5,032	357	5,031
		X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	664	15,163	662	15,161
C-1-M	C-14	F	Number of known fledged young produced by pairs monitored throughout the breeding season	25	257	19	251
		H	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.8	2.7	2.1	2.7
		X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	127	3,807	126	3,806
C-1-N	C-15	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	257	5,093	254	5,090
C-1-O	C-15	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	318	5,498	316	5,496
Appendix Number	Page Number	Row	Parameter	Data Listed in the 2021 Report		Corrected Data	
				2020 Column	Combined Column	2020 Column	Combined Column
C-1-F	C-7	G	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.7	n/a	1.8	n/a

Appendix C-2: Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2021.

Appendix Number	Page Number	Row	Data Listed in the 2021 Report			Corrected Data		
			2021 Column	Combined Column	Percentage of Combined	2021 Column	Combined Column	Percentage of Combined
C-2-A	C-17	Desert Wild Grape (<i>Vitis girdiana</i>)	1	1	<1%	0	0	0%
C-2-A	C-17	Coyote Brush (<i>Baccharis pilularis</i>)	0	18	6%	1	19	6%