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

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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 2020-2021 at four dairies in Prado Basin and two dairies in San Jacinto. SAWA biologists documented 1,378 Least Bell's Vireo (hereafter "vireo") territories in the Santa Ana Watershed (excluding Prado Basin) in 2021, of which 720 were known to be paired. This represents a 12% decrease in territories from 2020 (n=1,574). Nine hundred twenty-nine fledglings were also documented. Prado Basin reported another 596 vireos in 2021, a 17% decrease from the 719 documented in 2020. Excluding Prado Basin, watershed-wide nesting success was 52% overall and 189 well-monitored pairs had a 2.6 reproductive success rate. Ninety-seven percent of 412 vireo nests were placed in native vegetation.

In 2021, the watershed-wide cowbird parasitism rate of vireo nests was 11%, up from 8% in 2020. Santa Ana River – Upstream (Riverside Ave. to Van Buren, Hidden Valley – South, and Goose Creek) and Santa Ana Canyon – Featherly Park were sites in which parasitism was documented in 2021. During the nesting season, 3,756 cowbirds were removed from 50 traps in the watershed. Additionally, 6,698 cowbirds were removed from the watershed during the fall and winter of 2020-2021. Over 146,000 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 2021; however, six migrant Willow Flycatchers (*Empidonax traillii* ssp.) were documented within the watershed. All wildlife species detected (158 avian, 18 mammalian, 20 herpetofauna, and three 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 2000-2021 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 2021, nest monitoring occurred at several locations discussed here as monitored sites: San Timoteo Canyon, proposed and current restoration areas within Santa Ana River (SAR – Upstream) from Riverside Ave. downstream to I-15, Norco Bluffs, and the Santa Ana Canyon (SAC) below Prado Dam. Abundance and distribution data were collected at San Jacinto, Mockingbird Canyon, Hidden Valley – North, Temescal Canyon, and Chino Hills. Thirty-five additional peripheral drainages within the watershed were sampled (≥3 visits) and incidental sightings were documented at six sites visited on one or two occasions. Due to COVID-19 restrictions, some locations were not surveyed in 2021.

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, 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 Evans Lake Drain, Anza/Old Ranch Creek, Hidden Valley – South side of the river (San Bernardino Valley Municipal Water District restoration sites and a control site), Lower Hole Creek, 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 timeframes at the peak of the vireo breeding season. In 2021, the first assessment surveys were conducted between April 23-May 4, the second surveys between May 24- June 2, and the third between June 21-June 28. 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 (Sampled)

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*). 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 2021, some areas of the creek were unable to be surveyed due to access 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 (*Oncosiphon pilulifer*) is becoming more prevalent.

Although the reservoir and basin are protected from development at this time, residential development remains an issue in Mockingbird Canyon. Residents extend their property 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 St. and Markham St. 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 Ave. in the City of Riverside downstream to Interstate 15 in Norco. The site is divided into five different sections: Riverside Ave. to Van Buren Blvd., 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 Ave. to Van Buren Blvd. 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 Ave. in Riverside). The Riverside Ave. to Van Buren Blvd. 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, with COVID-19 restrictions reduced, monitoring resumed at both sites.

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. Within the riparian habitat, there are over 200 homeless encampments. 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 areas monitored exclusively by SAWA in 2019-2021 (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 2019-2021.

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 monthly follow-up treatments have continued through 2021.

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 subcontractors cleared approximately 200 acres of arundo using various heavy equipment type mulchers. The removal area is located one mile upstream of River Rd. Bridge. Additional monthly follow-up treatments were conducted by SAWA and monitored by a biologist as needed during the 2020 and 2021 nesting season.

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

Norco Bluffs is almost exclusively comprised of riparian vegetation without adjacent upland. Native species of willow, predominantly Goodding's black willow, dominate much of the

landscape, but large swaths are still heavily dominated by invasive arundo. 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. 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 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 not surveyed because access has been denied.

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 without 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 riparian habitat patches 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)

Santa Ana Canyon (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 ran throughout the season. Phase 5a concluded and mitigation was installed prior to nesting season. The Burlington Northern Santa Fe (BNSF) railroad bridge construction project commenced in 2018 and continued in 2020 and 2021. The project located in Green River Golf Club removed vegetation from two territories and partially impacted two additional territories in 2018. 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. The Aliso Bridge Project in Green River Golf Course started in 2021 and the last work was done at the beginning of the season. No additional vegetation removal occurred in 2021. Each of these project phases is followed by habitat restoration upon completion.

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 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.

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 found in 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.

Habitat restoration work, which included mowing, spraying, and hand-pulling of invasive plants, followed the completion of the Reach 9 project phases at Green River. 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 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 snow 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 snow 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 2021 and had a successful nest.

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 birds did occupy some of the less damaged patches.

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 Blvd. and Weir Canyon Rd. 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 reinforcement 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 downstream to Brush Canyon in 2019, removing vegetation from another three and a half territories. 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 2021 nesting season.

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 Southwestern Willow Flycatchers to determine accurate territory numbers, breeding status, and to enhance breeding output through management. Not all territories were monitored sufficiently to determine pairing success. 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. 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. Coordinates were not typically taken at nest locations. 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, San Bernardino Valley Municipal Water District, and the USFWS. Banded vireos are reported annually to the original bander, Barbara Kus of the U. S. Geological Survey (USGS) and the appropriate agencies. No playback of vireo vocalizations was used during surveys. Field data were collected using an iPhone with ESRI's ArcGIS Collector 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 monitoring 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 species detection documented while conducting an unrelated activity.
> 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, though never finding nest.

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 on-site 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 2021, a total of 50 traps were deployed; forty-two traps were deployed in or near vireo habitat and the remaining eight were placed on dairy farms (Figure 5). The USACE and the USFWS funded 24 habitat traps and eight dairy traps. The San Bernardino Valley Municipal Water District funded nine traps. The SAWA/IERCD Reach 3B project funded four traps. The San Bernardino County Transportation Authority funded two traps in San Timoteo Canyon. One trap in Yorba Linda (Cielo Vista) was funded by the North County BRS Project, LLC. The remaining two traps, located at the Meridian Conservation Area, were contracted by the Rivers and Lands Conservancy. All traps were opened by March 18 and were closed by July 30.

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 USGS 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 2021, SAWA documented a total of 1,378 vireo territories, including 720 known pairs and 929 known fledglings at all monitored, sampled, and incidental sites. This represents a 12% decrease in territories from 2020 (n=1,574). OCWD reported 596 territories in Prado Basin in 2021 (preliminary data; Bonnie Johnson, personal communication) for a total of 1,974 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 2021, monitoring efforts at most sites were similar to 2020; notable exceptions were San Jacinto, Mockingbird Canyon, and Meridian Conservation Area, all of which were sampled instead of monitored. At SAR-Upstream, Riverside Ave to Van Buren Blvd. (including Evans Lake Drain and Anza/Old Ranch Creek) and Lower Hole Creek restoration areas, numerous homeless encampments and concerns about COVID-19 continued to hamper observer visits, although limited nest monitoring did occur. The decrease in territory numbers detected at SAR-Riverside Ave. to Van Buren Blvd. in 2020 was a result of access issues and 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. As in 2020, some assessment areas were not surveyed in 2021 due to COVID-19 safety concerns. Monitored sites at which sampling efforts were consistent from 2020 to 2021 had decreases in territory numbers ranging from 4% (SAC-Upper Canyon) to 23% (SAC-Green River Golf Club; Table 1). Territory

number decreases were found at most sites throughout the watershed (see Results and Discussion by Site). Since vireos arrived later and more slowly in 2021 than typical years, this decrease may be an effect of unknown factors relating to migration or wintering grounds. A total of 3,397 SAWA biologist hours were spent monitoring and surveying for vireos in 2021.

Chronology of Breeding Activity

Surveys at monitored sites began between March 17 and March 30 and ended between September 2 and September 30. The first vireos were detected on March 29 at San Jacinto, Goose Creek, and Norco Bluffs. The estimated earliest date for the arrival of 50% of vireo males was on April 6 at Green River Golf Club. The estimated earliest date for 50% of males paired was April 20 at Featherly Regional Park. The first nest was found on April 7 at Norco Bluffs - I-15 to River Road. The first date a nest fledged was May 8 at Featherly Regional Park. The last date a nest fledged was July 21 at Hidden Valley – South. The last date a vireo was detected was September 22 at Hidden Valley – South (Table 2).

Reproductive Success

Reproductive success, as measured by productivity of well-monitored pairs, was 2.6 (n=189) watershed-wide in 2021, slightly lower than 2.8 in 2020 (n=247) and substantially lower than 3.8 (n=151) in 2019. Nest success was 52% (n=336), a slight decrease from 53% (n=455) in 2020 (Appendix B-1). Average clutch size was 3.5 based on 278 complete clutches (Table 3). See Appendix C-1 for individual site data over time. Metrics specific to San Bernardino Valley Municipal Water District 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 (22%), arroyo willow (17%), and Goodding's black willow (10%) were the primary plant species used for nest placement by vireos in 2021 (n=412; Appendix B-2). Three other abundantly used riparian plant species were Fremont cottonwood (8%), red willow (8%), and narrowleaf willow (7%). Blue elderberry (*Sambucus nigra*) and desert wild grape (*Vitis girdiana*) each held another 5%. Thirteen (3%) nests were placed in non-native vegetation. Seven (2%) 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 2021 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 2021, the watershed-wide predation rate for well-tracked nests was 36% (n=336), consistent with the rate of 36% (n=455) in 2020 (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 10% and 54% (Table 3). Over all years, nest loss due to predation is 34% (n=4,040) watershed-wide (Appendix B-1). Nest losses are typically due to unknown predators. Vireos were observed scolding or chasing California Scrub-jays (*Aphelocoma californica*) at several sites and during one such instance, the California Scrub-jay was carrying an egg assumed to belong to the vireo pair. A female vireo was observed scolding a Great Horned Owl (*Bubo virginianus*) at San Timoteo Canyon. In Featherly Park, ants were found in a vireo nest with nestling skeletal remains. On one occasion at Hidden Valley Golf Club, a vireo intensely scolded a coyote (*Canis latrans*). In Hidden Valley – South Non-Restoration, a vireo pair was observed scolding a southern alligator lizard (*Elgaria multicarinata*) perched above their nest. In Hidden Valley – North, vireos were observed scolding a gopher snake (*Pituophis catenifer annectens*). Other suspected nest predators 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. Feral pigs (*Sus scrofa*) are another potential predator. This species 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 2021, 11% (n=278) of well-tracked nests were parasitized by cowbirds, an increase from 8% in 2020 (n=384). This was the highest annual watershed-wide parasitism rate since 2008 (14%, n=188; Appendix B-1); the rate ranged from 2% to 10% between 2009 and 2020 (Appendix D). Parasitism was documented on the Santa Ana River within Evans Lake Drain Restoration (Table 3B), Hidden Valley – South, and Goose Creek, as well as at Featherly Regional Park in SAC (Table

3). Despite the increase in parasitism rate this year, recent watershed-wide parasitism rates are much lower than rates of 21-28% recorded in the early 2000s (Appendix D), likely due to SAWA's extensive cowbird trapping program.

In 2021, failure of well-tracked nests due to parasitism was 2%, 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, 304 nests have been manipulated and 138 of these nests successfully fledged 298 vireos (Appendix B-1).

Repaired Vireo Nests

Ten nests were repaired in 2021, four (40%) of which were ultimately successful and fledged nine young. Since SAWA began monitoring vireos in the watershed, 73 nests have been repaired and successfully fledged 125 young (Appendix B-1).

Results and Discussion by Site

San Jacinto (Sampled)

In 2021, 91 territories were detected at San Jacinto, a 16% decrease from 108 territories detected in 2020 (Table 1). This decrease can be partially attributed to a decrease in sampling due to time constraints and personnel availability. Of the 91 territories in San Jacinto, 17 were documented in the San Jacinto Wildlife Area, 25 were in the riparian habitat between Bridge Street to Sanderson Avenue, eight in the riparian habitat between Sanderson Avenue and State Street, and 41 in the section of riparian habitat from State Street to Lake Park Drive. Fifty-two males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Twenty-four fledglings were detected across all pairs in 2021; no pairs were well-monitored in 2021.

Nest monitoring has occurred at San Jacinto at varying intensities since 2004. Twenty nests were found in 2021, none of which were well-tracked (Table 3). Goodding's black willow (45%) and mulefat (30%) were most frequently used for nest placement in nests found in 2021. The remaining nests were in various native substrates (Table 4); no nests were found in invasive substrates. A total of 115.75 biologist hours were spent monitoring vireos at the San Jacinto site in 2021.

Brown-headed Cowbird trapping has occurred in San Jacinto since 2003, except for 2015, and a total of 29,510 cowbirds have been removed during the breeding season over 14,797 trap days, mostly from local dairies (Appendix C-1-A). In 2021, three traps placed adjacent to riparian habitat caught 117 cowbirds over 323 trap days (Table 6). Three additional traps were placed at local dairies during the breeding season and captured 1,259 cowbirds over 396 trap days. Altogether, the six traps captured 1,376 cowbirds over 719 trap days during vireo nesting season. No nest monitoring occurred in 2021; therefore, the parasitism rate is unknown. However, in 2020, seven nests (15%; n=46) were parasitized by cowbirds and subsequently two (4%; n=56) failed as a result. The 2020 parasitism rate remains a marked decrease from a high of 75% (n=6) in 2016 (Appendix D). Although parasitism by cowbirds still occurs at a rate of 15% (n=208), over the 16 years monitoring has occurred, only 6% (n=234) of nests have failed due to parasitism (Appendix C-1-A).

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, numerous homeless camps have been established, which have resulted in refuse in the habitat and vegetation clearing.

Several proposed commercial, residential, and infrastructure projects may potentially impact the San Jacinto River and areas adjacent the San Jacinto Wildlife Area. The indirect impacts associated with the construction and future use of a 40-million-square-foot World Logistics Center (Esquivel, 2015; Patch CA, 2016), the San Jacinto Gateway (City of San Jacinto, 2015), and 11,350 residential units (The Villages of Lakeview, 2017) remain to be seen.

San Timoteo Canyon (Monitored)

In 2021, 118 vireo territories were documented in San Timoteo Canyon, down 15% from the 139 documented in 2020 (Table 1). 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 21 years. This increase can be attributed to the removal of invasive species and subsequent restoration of native vegetation, nest monitoring, and cowbird management.

Eighty-three pairs and 149 fledglings were detected in 2021, though not all territories were monitored sufficiently to determine pairing success. Nesting success was 49%, slightly lower than the 52% documented in 2020 (Appendix C-1-B). Nesting success is 55% over 21 years of monitoring (n=1,264). Forty-three well-monitored pairs had a 2.7 reproductive success rate in 2021, down from 3.0 in 2020. Overall reproductive success based on productivity of well-monitored pairs in the last 21 years is 3.0 (n=666). Nest losses in 2021 were primarily due to

predation, accounting for 36% of total nest outcomes. Predation (36%) has been the major cause of nest loss in the last 21 years (n=1,264; Appendix C-1-B).

Red willow (34%), arroyo willow (16%), and mulefat (16%) were the most frequently used substrates for nest placement in 2021 (n=79). Two (3%) nests were placed in non-native vegetation in 2021; the remaining nests were built in various native substrates (Table 4). Arroyo willow (23%), mulefat (23%), and red willow (18%) have been the primary plant species used for nest placement in San Timoteo since 2001. Only 23 nests found from 2001-2021 have been placed in non-native vegetation (n=1,377; Appendix C-2-B).

Brown-headed cowbird trapping has occurred in San Timoteo Canyon since 2001 and a total of 2,943 cowbirds have been removed during this time. No parasitism by cowbirds of well-tracked nests was documented in either 2020 or 2021. In 2019, 12 nests (15%; n=80) were parasitized by cowbirds and subsequently seven nests (8%; n=90) failed as a result. However, in 2019 cowbird traps were not placed in the area in which the majority of parasitism occurred. In 2020 and 2021, two traps were deployed in the vicinity of where most parasitism was documented in 2019 and cowbirds were removed from the habitat. The 2019 parasitism rate remains a marked decrease from a high of 75% (n=4) in 2001. Although parasitism by cowbirds still occurs at a rate of 10% (n=1,225), over 21 years only 3% (n=1,264) of nests have failed due to parasitism (Appendix C-1-B). A total of 542.75 biologist hours were spent monitoring vireos at the San Timoteo site in 2021.

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 2021, 37 vireo territories, 16 pairs, and eight fledglings were detected in Mockingbird Canyon, a decrease of 18% from 45 territories in 2020. This decrease is slightly higher than the watershed-wide (including Prado Basin) decrease of 14% in territories from the record high territory number in 2020 (Table 1). No nest monitoring was conducted in 2021; however, five nests were located, and no parasitism was observed at the site.

Beginning 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 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=184; Appendix C-1-D). Since 2003, a total of 2,349

cowbirds have been removed from Mockingbird Canyon (Appendix C-1-D). A total of 132.25 biologist hours were spent monitoring vireos at the Mockingbird Canyon site in 2021.

There are a multitude of threats to the 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. In 2021, a vireo nest was destroyed by vegetation removal immediately to the west of the conservation easement. Homes are under construction on Mariposa Ave., Brettonwoods Place, and Corrine Way, creating noise disturbance to the nesting birds and infringing upon riparian strips in the area. Due to this construction, the Estates cowbird trap was closed and removed early (July 18) and will likely need to be deployed to a different area in 2022. 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. In the 2021 nesting season, some of this understory vegetation showed signs of recovery, particularly in areas of the Mockingbird Canyon Archaeological Site on Harley John Road. 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 vireo territories in the 2021 breeding season. 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 2021, 450 vireo territories were documented in the upstream portion of the Santa Ana River (Table 3B). In 2021, surveys resumed in areas (Evans Lake Drain and Anza/Old Ranch Creeks) that were not surveyed in 2020 due to the high density of homeless camps and concerns associated with the COVID-19 outbreak. Despite the increase in survey area, vireo territories decreased 8% from the 488 territories documented 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. However, the watershed-wide (including Prado Basin) territory numbers decreased by 14% in 2021 (Table 1), which is in line with the decrease at this site. 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 2021, 284 pairs and 373 fledglings were documented. Apparent nest success was 49% (n=151), similar to the 50% (n=146) documented in 2020 (Table 3B; Zembal et al., 2020). The overall parasitism

rate in SAR-Upstream was 21% (n=124); however, only 5% (n=151) of nests failed due to parasitism after cowbird eggs were removed. The most common cause of nest failure in 2021 was predation (38%; n=151). Other causes of nest failure were unknown causes (5%), and reproductive failure (4%; Table 3B). Nine cowbird traps were placed in this section of the river and a total of 56 cowbirds were removed over 1,127 trap days (Table 3B). A total of 1,215 biologist hours were spent monitoring vireos at the SAR-Upstream site in 2021.

SAR-Riverside Ave. to Van Buren Blvd.

Historically, SAR-Riverside Ave. to Van Buren Blvd. was analyzed as one site. In 2019, SAR-Riverside Ave. to Van Buren Blvd. 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 Ave. to Van Buren Blvd. overall, in addition to the three sub-sections.

SAR-Riverside Ave. to Van Buren Blvd. Overall

In 2021, 154 territories were detected at SAR-Riverside Ave. to Van Buren Blvd, a 17% increase from the 128 territories detected in 2020 (Table 1). However, Evans Lake Drain and Anza/Old Ranch Creeks were not surveyed in 2020 due to the large number of homeless camps and safety concerns regarding the COVID-19 pandemic. Therefore, the 2021 survey area size was more comparable to the area surveyed in 2019, and a 7% decrease in territory numbers was observed between the two years (n=166; Table 1). Seventy-eight males were known to be paired; eight of which were well-monitored. Fifty-eight fledglings were observed. Fifteen nests were found, 13 of which were well-tracked. There was a relatively high rate of parasitism at this site (20%, n=10); however, none of these nests failed as a result of parasitism, likely due to nest manipulation (Table 3). Only 15% of the well-monitored nests were successful; 54% of nests failed due to predation, 15% due to reproductive failure, and 15% due to unknown reasons (n=13; Table 3). Information specific to each sub-section can be found in the following sections and Table 3B.

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

One hundred ninety-four homeless camps, compounds, and related sites were documented in this stretch of the Santa Ana River in 2021. 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

were 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 Ave., campers have created 'roads' using thousands of square feet of carpet and plywood.

Brush fires occur regularly in and near the river bottom. 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 Ave. to Van Buren Blvd (Figure 6). On August 26, 2021, nearly 30 acres of Evans Lake Drain burned in the Boy Scout Fire. While vireo had completed nesting by this time, the fire burned most of the habitat that had been occupied. On October 31, 2019, the Sunnyslope Fire burned approximately 325 acres of the Santa Ana River bottom near the old Louis Rubidoux Nature Center and habitat remained degraded in 2021; at least four vireo territories were still displaced.

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.

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

In 2021, 128 vireo territories were documented along the Santa Ana River in the Riverside Avenue to Van Buren Blvd. Non-Restoration section, a 4% increase from the 123 documented in 2020. Fifty-eight pairs and 40 fledglings were detected in 2021 (Table 3B). While efforts were made to count all territories and pairs in this section, the dangers in some parts of this site (e.g., homeless camps, marijuana grows, off-leash dogs, and open drug use) limit the number of areas that can be safely monitored. No nest monitoring occurred in 2021.

Prior to the start of the 2014, 2016, 2018, and 2021 nesting seasons, Riverside County Flood Control conducted routine mowing of vegetation from Riverside Ave. to Mission Blvd. 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, where there was a slight increase (6%) in vireo territories immediately following mowing (Table 1). 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 893 cowbirds have been removed during this time (Appendix C-1-E). In 2021, 10 cowbirds were removed from the study area over 459 trap days (Table 3B).

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

Five territories were detected at Evans Lake Drain in 2021. Four males were paired, of which three were well-monitored. Six nests were found, four of which were well-tracked. Apparent nest success was 0% (n = 4). One (25%) nest failed due to predation, one (25%) due to reproductive failure, and two (50%) failed due to unknown causes (Table 3B). Cowbird parasitism was observed at two (50%) nests, with one cowbird egg found in each nest. The cowbird eggs were removed, but neither nest was successful. No fledglings were detected, resulting in an average of 0.0 fledglings produced per well-monitored pair (Table 3B). Three nests were placed in Fremont cottonwood, two in Goodding's black willow, and one in blue elderberry. Estimated territory size of the vireos ranged between 0.5 to 2.6 acres.

Twenty-three cowbirds were captured over 133 trap days at a trap located approximately 0.25 miles away at Fairmount Park (Table 3B). Prior to 2019, only a small portion of Evans Lake Drain had been surveyed by SAWA, so it is unknown how many vireos occupied the site historically. 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 nesting activities, the Boy Scout Fire burned most of the area that had been occupied by vireos.

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

In 2021, 21 territories were detected in Anza/Old Ranch Creeks (Table 3B). This site was not formally surveyed in 2020 due to the large number of homeless encampments and the COVID-19 outbreak. Sixteen males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Eighteen fledglings were detected across all

pairs, six of which fledged from five well-monitored pairs, resulting in an average of 1.2 fledglings produced per well-monitored pair (Table 3B). Estimated territory size ranged from 0.5 to 3.3 acres.

Nine nests were found in 2021, all of which were well-tracked. Apparent nest success was 22% (n=9). Six (67%) nests failed due to predation and one (11%) failed due to reproductive failure. The parasitism rate was 0% (n=6) and no cowbirds were incidentally observed (Table 3B). The three most common nest substrates used in 2021 were desert wild grape (22%; n=9), arroyo willow (22%), and scrub oak (22%). The remaining nests were found in an assortment of native substrates (Table 4; data included in SAR-Riverside Ave. to Van Buren Blvd. numbers). 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 2021, three territories were detected whereas two were detected in 2020 (Table 1). Three males were determined to be paired, one of which was well-monitored. Three fledglings were detected across all pairs, two of which fledged from one well-monitored pair, resulting in an average of 2.0 fledglings produced per well-monitored pair (Table 3). Two nests were found in 2021, both of which were well-tracked and placed in Western sycamore (Table 4). Apparent nest success was 100% (n=2). The parasitism rate was 0% (n=1) and no cowbirds were incidentally observed. In 2021, estimated territory size ranged from 0.9 to 1.7 acres. 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-one territories were detected in 2021, a 35% decrease from 94 territories detected in 2020. Thirty-eight males were observed to be paired and 39 fledglings were observed, though no pairs were well-monitored in 2021 (Table 1). Nest monitoring occurred at Hidden Valley – North in 2010, 2014, and 2016-2018, but did not occur in 2021. The average number of fledglings produced per well-monitored pair has ranged from 2.0 in 2014 (n=4; Appendix D) to 4.0 in 2017 (n=6; Appendix C-1-F). 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 Ave. to Van Buren Blvd. (Figure 6). This fire occurred early in the nesting season, when SAWA biologists were in the process of documenting vireo arrivals and territory establishment. Consequently, the number of

territories recorded within the burn area is likely smaller than the actual number of territories displaced. Nine territories were documented within the burn area that are excluded from the territory numbers for Hidden Valley – North in order to avoid overestimating population size, as birds displaced by the fire likely moved to new locations within the site or to other nearby sites. Territories displaced by the fire likely account for a large portion of the decrease in territory numbers in 2021. Additionally, three nests were documented within the burn area that were destroyed by the fire and not included in the nest number data for Hidden Valley – North.

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 2021, many of which were established prior to 2018 and likely involved understory vegetation removal at the time they were established. 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. 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 portable toilets and large dumpsters at the park near the parking area, but human waste and large amounts of trash continue to accumulate in the riparian habitat near the riverbank.

SAR-Hidden Valley – South (Monitored)

Historically, Hidden Valley – South has been analyzed as one site. Because of a new restoration project, Hidden Valley – South was split into two sites in 2019: Hidden Valley – South Restoration and Hidden Valley – South Non-Restoration. However, to keep comparability with prior years, results are reported herein for both Hidden Valley – South Overall and the two sub-sections.

SAR-Hidden Valley — South Overall

In 2021, 159 territories were detected at Hidden Valley – South, a 10% decrease from 176 territories detected in 2020 (Table 1). One hundred eighteen males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Fifty-three pairs were well-monitored. Two hundred fledglings were detected across all pairs in 2021, 156 of which fledged from 53 well-monitored pairs, resulting in an average of 2.9 fledglings produced per well-monitored pair (Table 3B). The average number of fledglings produced per

well-monitored pair has ranged from 2.1 in 2010 (n=9; Appendix D) to 4.8 in 2017 (n=4; Appendix C-1-H).

Nest monitoring has occurred at Hidden Valley – South every year since 2000 with widely varying numbers of nests monitored. One hundred nine nests were found in 2021, 102 of which were well-tracked. In 2021, apparent nest success was 54% (n=102), higher than in 2020 (46%; n=109). Predation was the most common cause of nest failure accounting for 35 (34%) nests in 2021. The cause of four (4%) nest failures was unknown and three (3%) nests failed due to reproductive failure. Though 18 (22%; n=83) nests were parasitized by cowbirds, just five (5%; n=102) failed due to parasitism (Table 3B). Predation has been the leading cause of failure every year since 2002 (Appendix D).

Eighteen nests were parasitized, of which 14 were manipulated; four nests were abandoned at the time the cowbird egg was first observed, precluding manipulation. Ten (71%) of the 14 manipulated nests were successful, fledging 21 vireos. Parasitism was down from a high of 44% (n=9; Appendix D) in 2007; however, parasitism was up from 21% (n=86) in 2020 (Appendix-C-1-H). Eight incidental adult cowbirds were observed at Hidden Valley – South in 2021, though some of these observations could have been the same individuals observed on different days.

Mulefat (31%) and arroyo willow (28%) were most frequently used for nest placement in 2021. Two nests (2%, n=109) were placed in invasive substrate, both of which were in tamarisk. The remaining nests were located in various native substrates (Table 4).

A portion of Hidden Valley – South had 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. Three homeless camps were found during fieldwork at Hidden Valley – South in 2021. Portions of Hidden Valley South are used by recreationists for swimming. The shore of the Santa Ana River in these areas often has abundant litter and human waste strewn about. Hidden Valley – South 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 2021, 31 territories were detected at Hidden Valley – South Restoration, which represents no net increase or decrease from 31 in 2020 (Table 3B; Zembal et al., 2020). Twenty-nine males were determined to be paired, 12 of which were well-monitored. Forty-six fledglings were detected across all pairs in 2021, 35 of which fledged from 12 well-monitored pairs, resulting in an average of 2.9 fledglings produced per well-monitored pair. Twenty-eight nests were found, 26 of which were well-tracked. Apparent nest success was 42% (n=26). The parasitism rate was 10% (n=20); however, no nests failed due to parasitism after cowbird eggs

were removed. Additional information specific to Hidden Valley – South Restoration can be found in Table 3B.

SAR-Hidden Valley — South Non-Restoration

In 2021, 128 territories were detected at Hidden Valley – South Non-Restoration, a 12% decrease from 145 in 2020 (Table 3B; Zembal et al., 2020). Eighty-nine males were determined to be paired, 41 of which were well-monitored. One hundred fifty-four fledglings were detected across all pairs in 2021, 121 of which fledged from the 41 well-monitored pairs, resulting in an average of 3.0 fledglings produced per well-monitored pair (reproductive success). Eighty-one nests were found, 76 of which were well-tracked. Apparent nest success was 58% (n=76). The parasitism rate was 25% (n=63); however only 7% (n=76) failed due to parasitism. Additional information specific to Hidden Valley – South Non-Restoration can be found in Table 3B.

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

In 2021, 73 vireo territories were documented in Goose Creek, a 17% decrease from the 88 territories documented in 2020 (Appendix C-1-I). Although this is a large decrease, it is only slightly greater than the watershed-wide (including Prado Basin) decrease of 14% of territories from the record high in 2020 (Table 1). Forty-seven pairs and 73 fledglings were documented (Table 1).

Nest success for 34 well-tracked nests in 2021 was 44%, a large decrease from 68% in 2020 (n=34) and 20% lower than the overall nesting success from 2001 to 2021 of 64% (n=442; Appendix C-1-I). In 2021, 15 of the 34 nests were lost to predation (44%). Six of 29 well-tracked nests were parasitized (21%), the highest recorded rate since 2006 (Appendix D). Though, due to nest manipulations, only 6% of nests failed due to parasitism; one of 34 nests failed due to reproductive failure (3%), and one nest failed due to unknown causes (3%; Table 3). Twenty-one well-monitored pairs had a reproductive success rate of 2.0 in 2021, lower than the average reproductive success rate between 2001 and 2021 of 3.0 at this site (Appendix C-1-I), and the 2021 watershed-wide rate of 2.8 (Appendix B-1). Of the four territorial males that were banded in 2020 as part of a USGS genetic study, only two were re-sighted in 2021. One bird remained throughout the season and nested. The second banded bird was seen from April 12-April 26 defending the territory in which he was banded in 2020. However, an unbanded bird, first sighted on May 10, bred in that territory and the banded bird was never observed again.

In 2021, nests were primarily placed in Fremont cottonwood (22%) and arroyo willow (12%). Three nests (7%) were placed in non-native substrates; all were placed in arundo and one successfully fledged young (Table 4). The successful nest was composed of both dead and live overhanging arundo, potentially providing more stability than is usually found in nests in this

substrate. Since 2000, most nests in Goose Creek have been placed in mulefat (28%) and arroyo willow (28%). Less frequently, nests have been placed in Goodding's black willow (12%), Fremont cottonwood (6%), and desert wild grape (5%; Appendix C-2-I).

Cowbird trapping has occurred at this site since 2004 and a total of 596 cowbirds have been removed over 3,154 trap days (Appendix C-1-I). In 2021, eight cowbirds were removed from one trap over 136 trap days (Table 3). Parasitism (21%) was documented at this site for the second year in a row in 2021 after no recorded parasitism since 2013 and increased the parasitism rate at the site by 2% overall, from 4% to 6% (n=403, n=432; Appendix D).

Due to low winter precipitation prior to the 2021 breeding season, vegetation did not grow as robustly as recent breeding seasons such as 2019 and 2020. 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 the 2021 breeding season.

Additional impacts to vireo habitat at Goose Creek relate primarily to human encroachment. A new 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 in 2021. Construction activity on the I-15 bridge over the Santa Ana River was completed and there was an influx of homeless encampments in this area in 2021. 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. Feral pigs are prevalent in the area and damage the habitat. Evidence of feral pig trapping and hunting was also observed in the area in 2021, including created trails through the understory, game cameras, 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. There is also significant tree die off due to polyphagous shot hole borer (*Euwallacea* sp.; PSHB).

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

In 2021, a total of 113 vireo territories were detected in Norco Bluffs, a 15% decrease from the 133 documented in 2020[1]. Forty-eight males were known to be paired, though not all territories were monitored sufficiently to determine pairing success; 125 fledged young were documented (Table 1). A total of 30 nests were found, all of which were well-tracked. Nesting

[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 2019-2021.

success of well-tracked nests was 90% (n=30), a large increase from 70% (n=43) in 2020. The reproductive success rate increased slightly from 3.2 in 2020 to 3.9 in 2021. Average clutch size was 3.8 in 2021, a slight increase from 3.7 in 2020. Of the well-tracked nests, 10% (n=30) were lost due to predation, a large decrease from 26% (n=43) in 2020, but still higher than the 6% (n=35) observed in 2019 (Appendix C-1-J). Norco Bluffs had a much lower percent of nest loss due to predation compared to all other monitored sites, which had predation rates ranging from 33-54% in 2021 (Table 3). Though there is no clear cause for the lower predation rate, there is a notable lack of California Scrub Jays within Norco Bluffs, a known nest predator and common species within other parts of the watershed. No nests failed due to reproductive failure or for unknown reasons. Estimated vireo territory size in Norco Bluffs ranged from approximately 0.4 to 1.6 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 2021 trapping season, two females were removed over the course of 128 trap days (Table 3). No cowbirds were detected in vireo habitat over the course of the season. Parasitism was not observed in 2021 and has not been documented since 2009 (Appendix D). A total of 171.25 biologist hours were spent monitoring vireos at Norco Bluffs in 2021.

As in past seasons, the primary sources of habitat degradation in 2021 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 River Valley by 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 53% (n=30) were placed in these two species in 2021 (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 three territorial male vireos were detected in 2021, a 30% decrease from the high count of 147 documented in 2020. Prior to 2020, the former high-count year 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. Thirty-five pairs and 24 fledglings were detected in 2021; no pairs were considered well-monitored. Five nests were observed incidentally, none of which were well-tracked (Table 3).

Five cowbird traps were open during the 2021 season in Temescal Canyon. 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 358 cowbirds over 664 trap days. Cowbird trapping has occurred during the nesting season in Temescal Canyon since 2001 and a total of 5,032 cowbirds have been removed during this time (Appendix C-1-K). Even with on-site cowbird trapping, parasitism has been documented in Temescal in 10 out of the 13 years in which the site was monitored, reaching a peak rate of 42% in 2007 (n=12; Appendix D). Two male cowbirds were detected in the habitat in 2021.

In 2021, 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 2021, Chino Hills was not monitored extensively due to inaccessibility to all potential vireo locations. Even though fewer site visits were conducted, and survey effort was reduced, 30 territories, nine pairs, and five fledglings were documented in 2021, representing a 17% decrease in territories from 2020 (n=36) and a 3% increase from 2019 (n=29; Appendix C-1-L).

Cowbird trapping occurred in Chino Hills between 2008-2019 and a total of 236 cowbirds were removed during this time (Appendix C-1-L). Prior to 2021, parasitism ranged from a low of 0% (n=2) in 2016 to a high of 60% (n=5) in 2007 (Appendix D). Since 2008, when cowbird control began, only two nests were found to be parasitized, in 2015 and 2018. No vireos were observed with cowbird fledglings in 2021. 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-four vireo territories were detected in SAC in 2021, a 17% decrease from the 185 territories detected in 2020 (compiled from Table 1). One hundred fifty-six fledglings were documented in SAC in 2021, a decrease from 181 fledglings observed in 2020. A total of 1,837 fledglings have been documented in SAC over the last 21 years (compiled from Appendix C-1) Nesting success for 78 well-tracked nests in SAC was 45% overall, a minor decrease from 46% in 2020. Thirty-two (41%) well-tracked nests were lost to predation, nine (12%) were lost to reproductive failure, and two (3%) were unsuccessful for unknown reasons. The reproductive success rate in SAC in 2021 was 2.2, a slight decrease from the success rate of 2.5 in 2020 (compiled from Appendix C-1-M to C-3-O). For comparison, the watershed-wide rate of reproductive success for well-monitored pairs in 2021 was 2.6 (n= 189) and the watershed-wide rate of reproductive success from 2001-2021 was 2.8 (n= 2,208; Appendix B-1). In 2021, mean clutch size was 3.4 (n=65), down 8% from 3.7 (n=83) in 2020. Vireo territory size in SAC is estimated to be between 0.3 acres and 3.5 acres.

Vireo used a variety of plant species (n= 16) for nest substrates in 2021. Of the 84 total nests found, the highest number of nests were found in mulefat (32%), blue elderberry (11%), laurel sumac (11%), Fremont cottonwood (8%), and Western sycamore (8%; 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 because of 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. Since 2001, a total of 2,457 cowbirds have been removed from SAC over 14,398 trap days during the vireo breeding season (compiled from Appendix C-1-M to C-1-O).

In 2021, only one phase of the USACE Reach 9 project remained active in Featherly Park. In Green River Golf Club, the Aliso Bridge Project that started in early 2021 was completed at the beginning of the season and the BNSF bridge project continued. 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.

The 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 is set to resume in 2021.

Upper Canyon (Monitored)

In 2021, 43 territories were detected at Upper Canyon, a 4% decrease from 45 territories detected in 2020 (Table 1). Thirty-four males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Nine pairs were well-monitored. Fifty fledglings were detected across all pairs in 2021, 25 of which fledged from nine

well-monitored pairs, resulting in an average of 2.8 fledglings produced per well-monitored pair (Table 3). Estimated territory size of the vireos in Upper Canyon ranged from 0.4 to 3.4 acres in 2021.

Nineteen nests were found in 2021, 17 of which were well-tracked. In 2021, apparent nest success was 47% (n=102), a decrease from 67% success in 2020, and a larger decrease from 74% in 2019. Predation was the most common cause of nest failure accounting for eight (47%) nests in 2021. One (6%) nest failed due to reproductive failure. Overall success of well-tracked nests for this site from 2001 to 2021 is 65% and the overall reproductive success rate of well-monitored pairs during this time is 2.8. A total of 519 fledglings have been documented over the last 21 years (Appendix C-1-M).

No nests failed due to parasitism. Cowbird trapping has occurred in Upper Canyon since 2001 when the first vireo was detected on-site. To date, 849 cowbirds have been removed from this area (Appendix C-1-M). Parasitism has only been documented two of the 21 years monitoring has occured and reached its highest rate in 2003 (18%; Appendix D), the last year parasitism was documented at this site. No cowbirds were detected in the habitat in 2021.

Mulefat (32%), blue elderberry (21%), and Fremont cottonwood (21%) were most frequently used for nest placement in 2021. No nests were found in non-native substrates. The remaining nests were located in various native substrates (Table 4).

No construction activities occurred within Upper Canyon in 2021. Unfortunately, this site continues to be plagued 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 2021, 47 territories were documented, a decrease of 23% (n=61) from 2020 (Table 1). Part of this decrease may be attributed to the October 2020 Blue Ridge Fire, which started October 26, 2020, and burned vireo habitat in the northern parts of the course, near the railroad tracks and border of Chino Hills State Park. The vireo population at Green River Golf Club has increased since monitoring began in 2001 when only 10 vireos were detected (Appendix D). In 2021, 35 males were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 63 fledglings were documented (Table 3). Nesting success for 33 well-tracked nests was 48%, the same as in 2020. Overall nest success from 2001 to 2021 is 57% (n=251). Eleven (33%) well-tracked nests failed due to predation and six (18%) nests failed due to reproductive failure. The reproductive success rate of 19 well-monitored pairs in 2021 increased slightly to 2.3 from 2.2 (n=22) in 2020. In comparison, the lowest reproductive rate observed was 0.6 in 2018, and the highest was 4.4 in 2017. The overall reproductive success rate

from 2001-2021 of well-monitored pairs is 2.4. A total of 669 fledglings have been documented over the last 20 years (Appendix C-1-N).

In 2021, nests were most frequently placed in mulefat (40%), laurel sumac (17%), Peruvian peppertree (9%), blue elderberry (9%), and Goodding's black willow (6%; Table 4). In 2021, estimated territory size of the vireos at Green River Golf Club ranged between 0.3 to 3.1 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 2021.

Cowbird trapping has occurred at the golf club since 2001, and a total of 1,076 cowbirds have been removed from this area (Appendix C-1-N). When SAWA began monitoring this site in 2001, the parasitism rate was 44% (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 and fledged a total of six vireos (Appendix C-1-N). Two cowbird traps were deployed at the site in 2021 and a total of six cowbirds were removed. No nests were found to be parasitized in 2021.

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 2021, 64 territorial males were detected in Featherly Regional Park, a 19% decrease from 2020 (n=79). Thirty-four territories were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 43 fledglings were detected. A total of 649 fledglings have been observed over the last 21 years at this site (Appendix C-1-O). These numbers still emphasize the vireo population recovery at this site over the last 21 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, productivity has greatly fluctuated at this site from a high of 2.7 in 2019 to a low of 0.9 in 2009 (Appendix C-1-O; Appendix D). In 2021, estimated territory size of the vireos in Featherly Park ranged between 0.33 to 3.27 acres. Of the four territorial males that were banded in 2020 as part of a USGS genetic study, only two were re-sighted. One of the territories with a banded male in 2020 was occupied by an unbanded male, the other territory remained unoccupied in 2021.

Nesting success for 28 well-tracked nests in 2021 was 39%, a slight increase from 2020 and still lower than the overall nesting success from 2002 to 2021 of 44%. Thirteen (46%) of 28 well-tracked nests were lost to predation (Appendix C-1-O). 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. Two (7%) well-tracked nests failed due to reproductive failure, and two (7%) for unknown causes (n=28). Thirteen well-monitored pairs had a low reproductive success rate of 1.8. The overall reproductive success rate of well-monitored pairs over 21 years of monitoring this site is 2.1 (Appendix C-1-O), compared to the watershed wide rate of 2.8 (Appendix B-1). Of the 30 nests found in 2021, two (7%) were placed in non-native vegetation, with the highest number of native nests placed equally in Western sycamore (23%) and mulefat (23%; Table 4).

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 attend to the nestlings. Other indications of ant predation in prior years include: in 2015, a nest was 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.

Cowbird trapping has occurred in Featherly Regional Park since 2002 when the first vireos were detected on-site, and 532 cowbirds have been removed during this time. Parasitism has been documented four out of the 21 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 (Table 3). 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.

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. 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 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 2021. However, 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), but subsequently decreased in 2021 (n=64; Appendix D).

Sampled Sites

Forty sites were sampled in 2021 and 595 vireo territories were documented (Table 1). Vireos were not detected at seven of the 40 sampled sites. Five (18%) out of a subset of 28 sites classified as "sampled sites" both in 2020 and 2021 reported an increase in detected vireo territories, while 20 (71%) of those sites reported a decrease in detected vireo territories. Three (11%) of the sampled sites reported the same number of territories in 2020 and 2021; of those three, two sites had zero territories. Chino Hills State Park, which had 37 territories in 2019, was not surveyed in 2020 or 2021 due to COVID-19 restrictions. A total of 343 biologist hours were spent surveying vireos at all sampled sites in the watershed in 2021.

Incidental Sites

In 2021, nine additional vireo territories were documented at six sites in which no formal surveys were conducted. Of those nine territories, three separate males were incidentally determined to be paired and to have produced at least one fledgling each (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 fifty-eight avian, 18 mammal, 20 herpetofauna, and three fish species were observed at monitored and sampled sites. Sensitive species were documented by site and a combined total

of 37 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 (*Polioptila californica*) were detected at three 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 et al., 2015). No Southwestern Willow Flycatchers were detected in the Prado Basin in 2021 (Bonnie Johnson, personal communication, October 14, 2021). In past years, the highest number of detections in the Prado Basin occurred in 2003, with nine individuals present.

In 2021, SAWA biologists detected six individual migrant Willow Flycatchers within the watershed. Willow Flycatchers are deemed migrants if they fail to remain on-site through June; none of the six migrants were found to remain through June. One adult was detected at Evans Lake Drain on May 12. On May 19, a singing male was found at Green River Golf Club; a second was found at the same site in a different location on May 27. Another individual was detected on May 24 at Santiago Creek above Irvine Lake. On June 5, an adult was observed at San Jacinto Wildlife Area. On June 7, another adult was found at Hidden Valley – South Non-Restoration.

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 2021

Fifty cowbird traps were deployed during the 2021 vireo season and 3,756 cowbirds were removed from all sites over 6,231 trap days. Of the 50 traps, eight were located at local dairies. The sexes and ages of the cowbirds removed in 2021 were 2,210 adult males, 1,395 adult females, and 151 juveniles. SAWA biologists and field assistants spent 3,657 hours servicing traps during the vireo season, including installation and removal of traps from the field (Table 6).

Cowbird captures decreased by 5% (n=3,957) from 2020. Fifteen percent fewer males (n=2,596), 39% more females (n=1,003), and 58% fewer juveniles (n=358) were trapped during the 2021 breeding season compared to 2020. In 2021, the overall capture rate was 0.60 cowbirds per trap day, a decrease from 0.80 in 2020 (Zembal et al., 2020). Since cowbird management began in 2001, over 51,000 cowbirds have been removed from the watershed by SAWA during the breeding season (Appendix B-3).

Non-target Captures in Cowbird Traps, March-July 2021

Nineteen non-target native species and three non-nuisance exotic species were captured in 50 traps in 2021. There were 3,927 non-target trapping occurrences (3,920 native and seven 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 (*Melozone crissalis*), Red-winged Blackbird (*Agelaius phoeniceu*s), and House Finch (*Haemorhous mexicanus*). The percent of trapping occurrences that resulted in mortality was 0.7% in 2021 (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 2020-2021 Brown-headed Cowbird Trapping and Non-target Captures

Six cowbird traps were deployed at dairies during the non-breeding season (fall/winter) of 2020-2021. Two dairies in the Prado Basin each had two traps and two dairies near the San Jacinto River each had one trap. A total of 6,698 cowbirds were removed (1,836 adult males, 2,347 adult females, and 2,515 juveniles) over 729 trap days (Table 8). In the fall/winter of 2019-2020, 4,788 cowbirds were removed from seven dairy traps over 639 trap days (Zembal et al.

2020). In 2020-2021, the capture rate was 9.19 cowbirds per trap day, an increase from 7.49 in 2019-2020 (Table 8; Zembal et al., 2020). Over 95,000 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 120 individual trapping occurrences, were captured in the six dairy traps in 2020-2021. The most common species captured was the Red-winged Blackbird (n=103). Six Red-winged Blackbirds died in traps in 2020-21, resulting in a mortality rate of five 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 2021, 1,974 vireo territories were documented watershed-wide (includes preliminary data from Prado Basin), a 14% decrease from 2020 (n=2,293; Figure 7). The significant population increase over 21 seasons of monitoring at four sites is illustrated in Figure 8. The 1,378 vireos detected by SAWA biologists outside of Prado Basin in 2021 represents a 12% decrease from 2020 (n=1,574; Table 1). Most survey sites throughout the watershed showed decreased territory numbers, one exception being the large area of SAR-Riverside Ave. to Van Buren Blvd., which showed a 20% increase between 2020 (n=128) and 2021 (n=154). This increase is mostly attributed to the increased survey area from the prior year, which was limited by COVID-19 safety concerns near homeless encampments. The effort at this site in 2021 is more comparable to that of 2019 (n=166), which when compared would result in a 7% decrease in territories. Survey efforts were otherwise similar at most sites with the exception of San Jacinto, Mockingbird Canyon, and Meridian, which were only sampled this year.

Nesting success watershed-wide was 52% (n=336) in 2021, lower than the overall nesting success of 58% (n=4,040) in the last 21 years. The overall reproductive success rate (average number of fledglings produced by well-monitored pairs) was 2.6 (n=189), just under the 21-year average of 2.8 (n=2,208) 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 2020-2021, 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). Another potential factor for the lower than average reproductive success rate was the later than normal arrival times and subsequent delay in nest initiation for most pairs. Typically, vireos begin arriving

in Southern California by mid-March and initiate nesting by early April. In 2021, the first vireos were detected in the watershed on March 29-30, which pushed back the first nest attempts to mid-April. Predation remains the primary cause of nest failure, with an overall 36% (n=336) of nests lost due to predation in 2021, slightly higher than the 34% (n=4,040) watershed-wide spanning all years of monitoring (Appendix B-1). Site-specific predation rates ranged from 10% at Norco Bluffs to 54% at SAR-Van Buren to Riverside Avenue (Appendix C-1). The Norco Bluffs site has had similarly low predation rates for the past five years. While the site anecdotally appears to have lower numbers of some major avian predators (e.g., corvids) than other sites, this anomaly deserves further study. The overall parasitism rate was 11% in 2021, though sites along the Santa Ana River ranged from 20% to 22%. However, nest loss from cowbird parasitism was only 2% (21-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 plan 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 9 shows the increase in vireo territories in relation to the rate of cowbird parasitism in the Santa Ana Watershed from 2001-2021. A comparison of watershed-wide nesting success, predation, and parasitism rates from 2003-2021 are shown in Figure 10. Nest losses due to reproductive failure and other unknown factors in 2021 was 7% and 4%, 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 146,000 cowbirds from the watershed in the last 21 years (Figure 11). SAWA has also removed nearly 5,300 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 2021 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 2021 (20% - 22%; Table 2). Vireo monitoring and cowbird trapping should continue along with the removal of non-native vegetation. The removal of arundo and other invasive vegetation, in conjunction with cowbird management, have had a positive influence on vireo territory numbers in the watershed since 2000. With the removal of nearly 5,300 acres of arundo and other invasive plants to date and an additional 600 acres in the process of being removed, 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 the activity is 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 homeless encampments 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

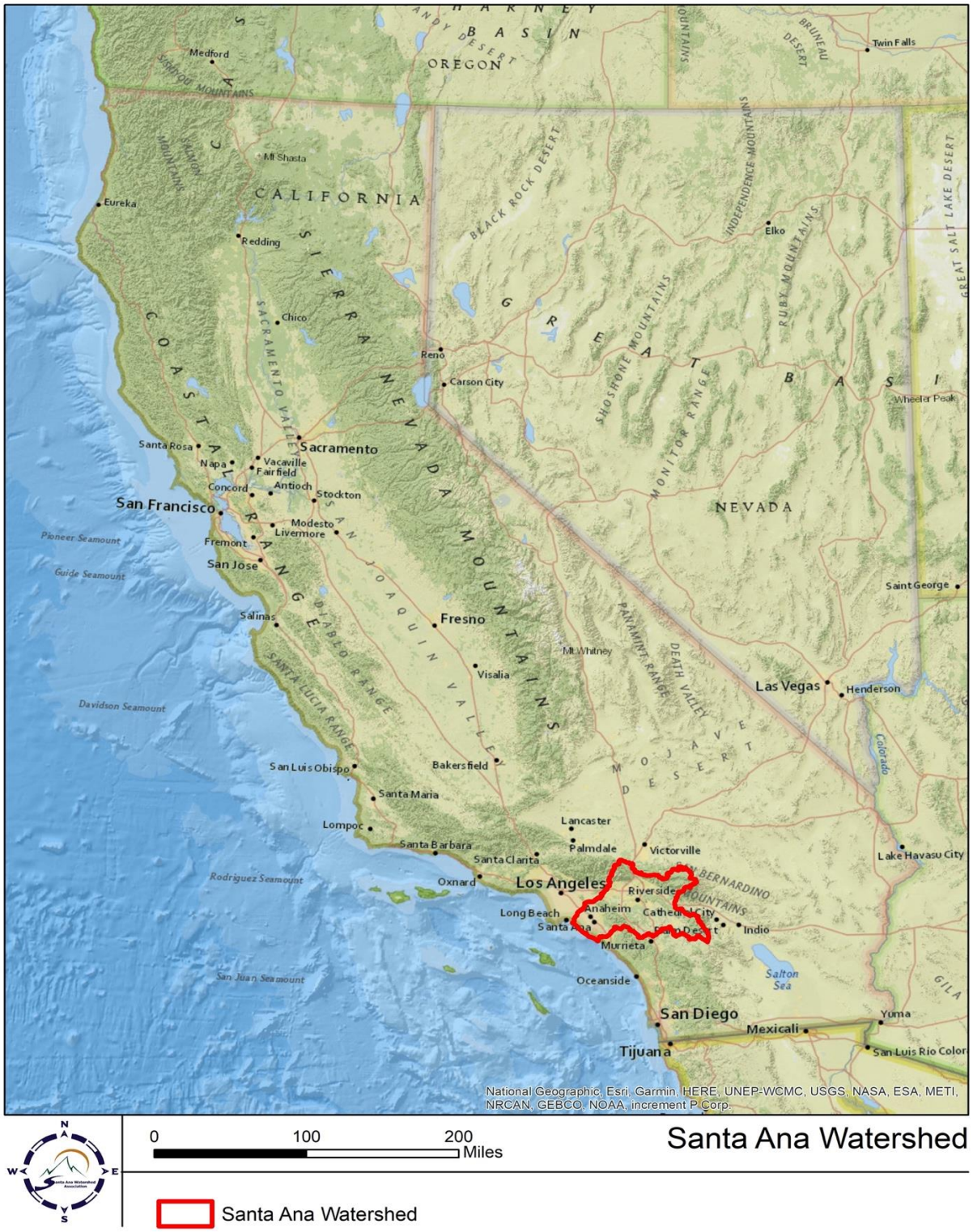

Figure 1. Location of the Santa Ana Watershed. The watershed, delineated in red, covers nearly 3,000 square miles in southern California and includes parts of San Bernardino, Riverside, Orange, and Los Angeles counties.

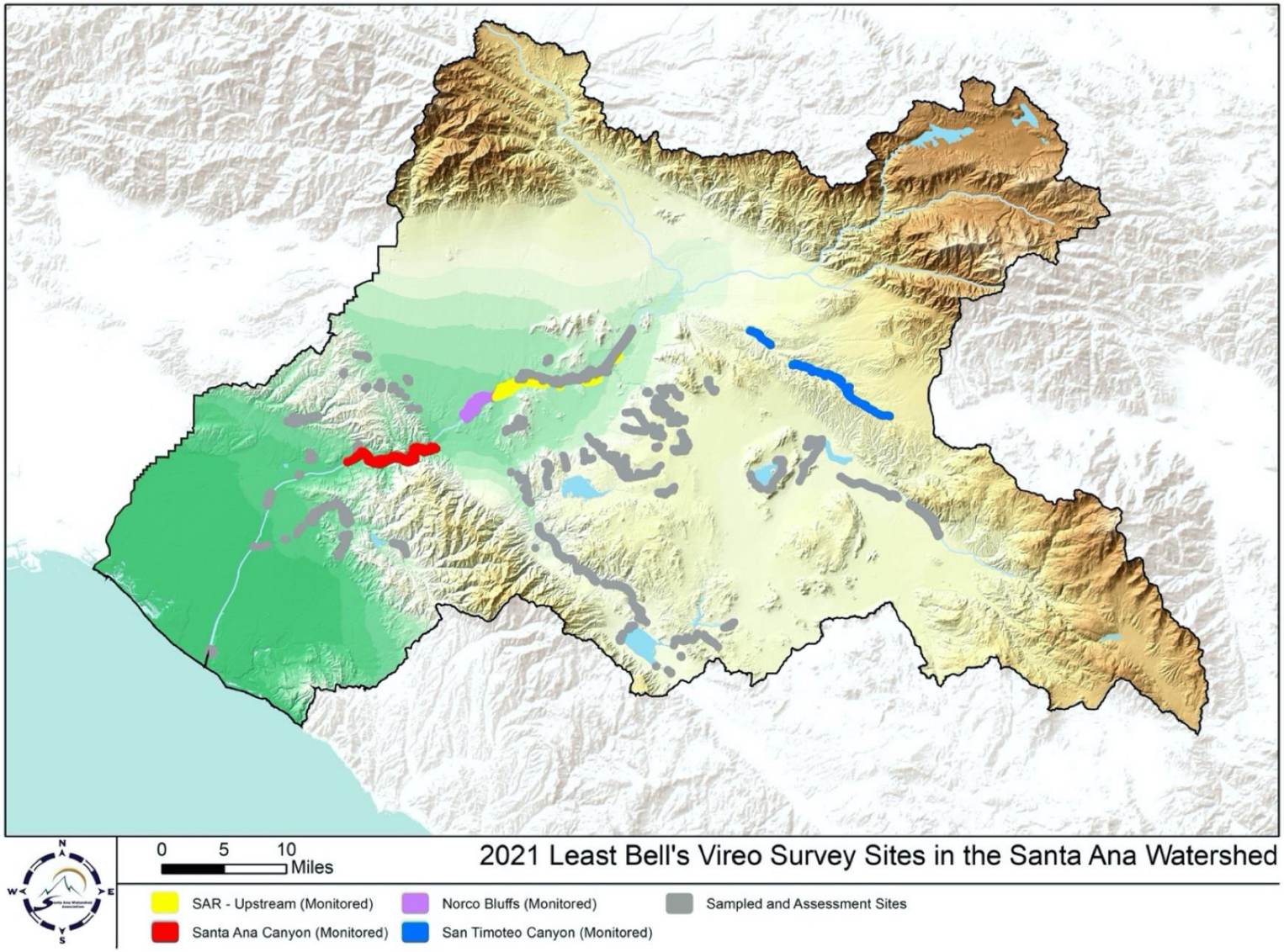

Figure 2. Least Bell's Vireo Survey Sites in the Santa Ana Watershed, 2021. Monitored sites are shown in various colors, while sampled/assessment sites are shown in gray. Monitored sites had well-monitored vireo territories, with eight or more visits and nest monitoring. Sampled/assessment sites were visited three or more times during the breeding season, and no or minimal nest monitoring occurred.

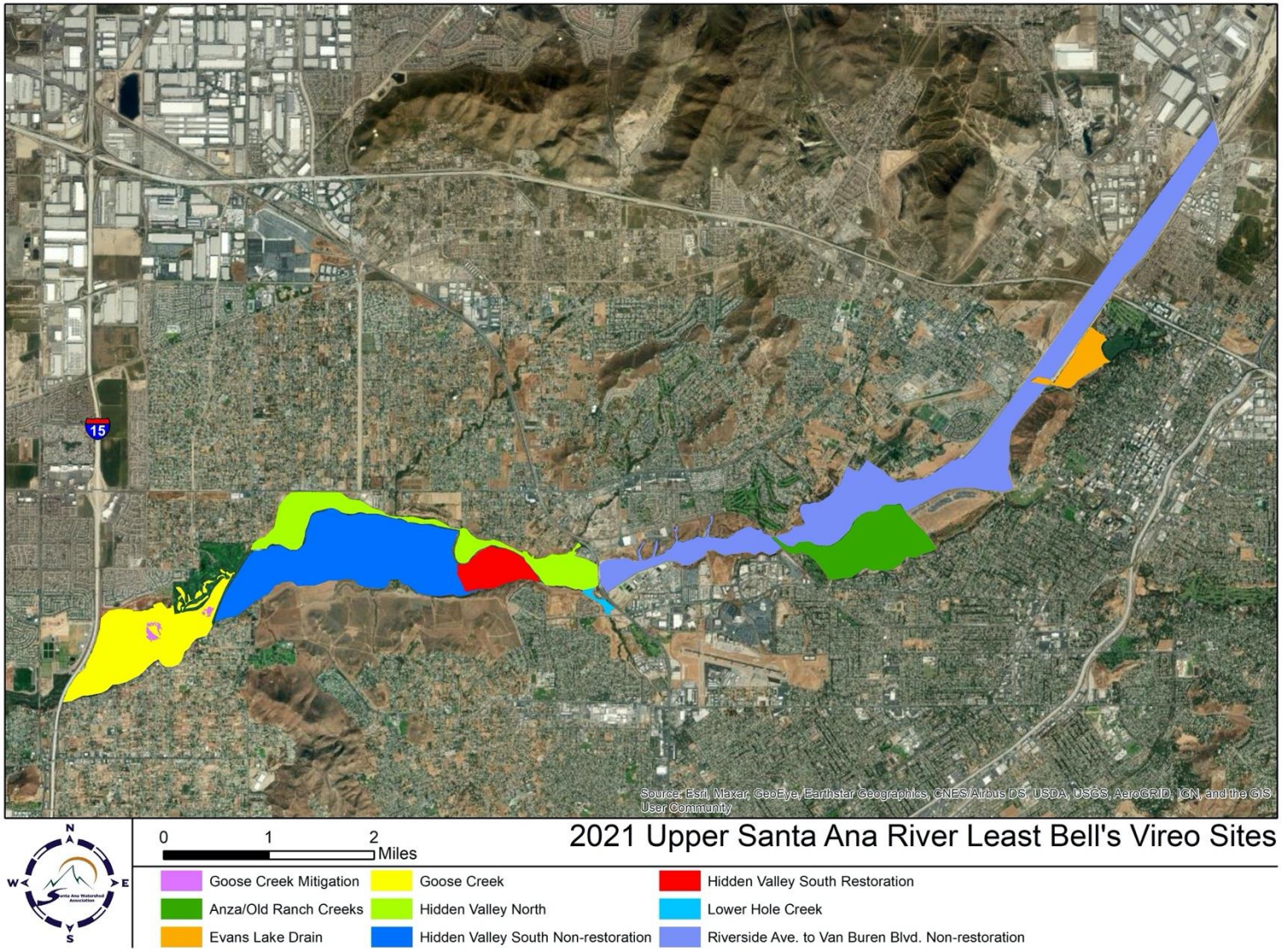

Figure 3. Upper Santa Ana River Least Bell's Vireo Sites, 2021. Riverside Ave. to Van Buren Blvd. and Hidden Valley – North were sampled sites in 2021 (three or more visits with no or minimal nest monitoring). All other sites were monitored (territories well-monitored with eight or more visits and regular nest monitoring).

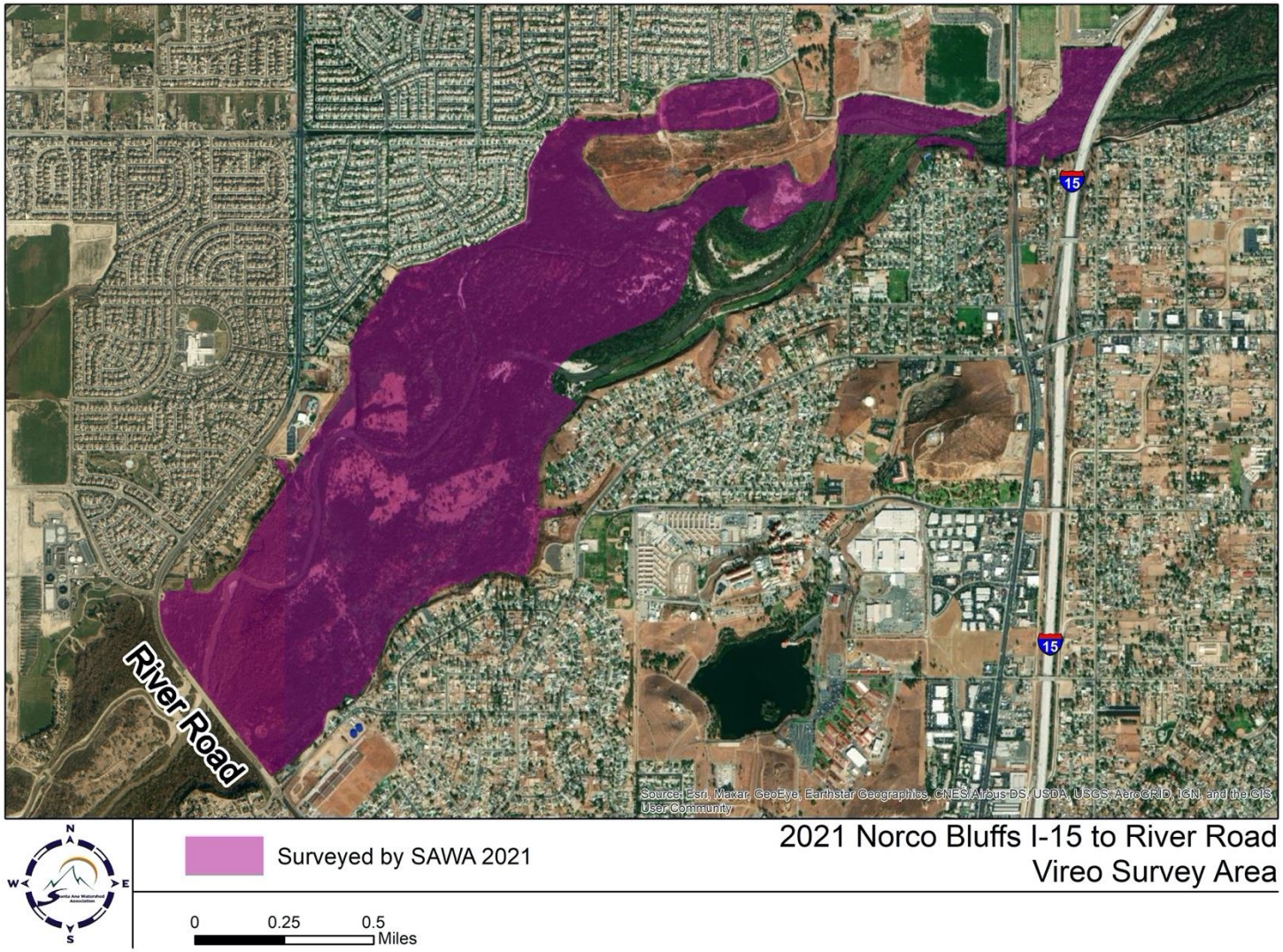

Figure 4. Norco Bluffs Least Bell's Vireo Survey Area, 2021. Norco Bluffs has been a monitored site since 2015 (territories well-monitored, with eight or more visits and regular nest monitoring). Area outside of the shaded polygon was not monitored due to access denial.

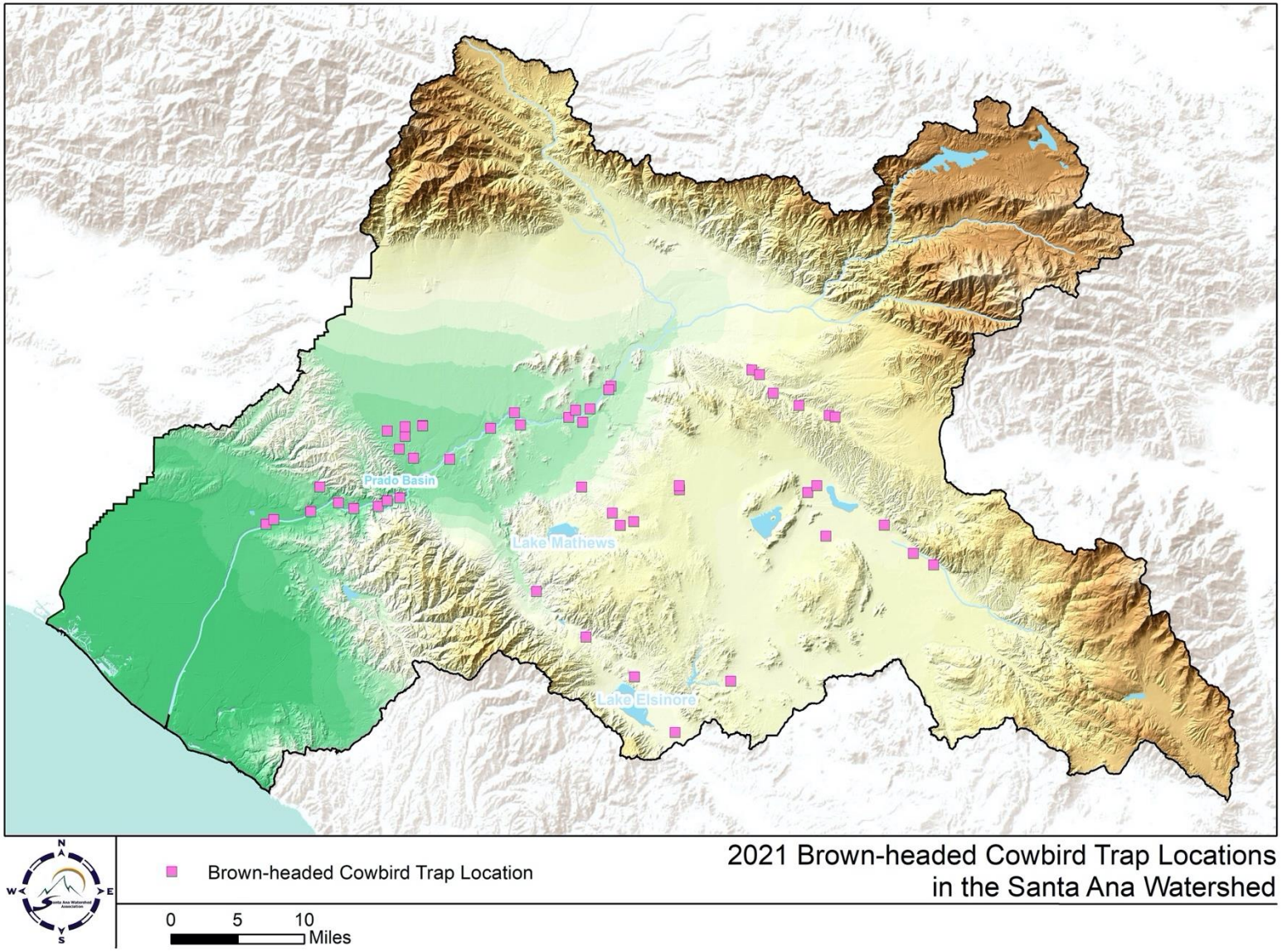

Figure 5. Brown-headed Cowbird Trap Locations in the Santa Ana Watershed, 2021. Fifty brown-headed cowbird traps were deployed and maintained in the Santa Ana Watershed during the 2021 vireo nesting season (March – July).

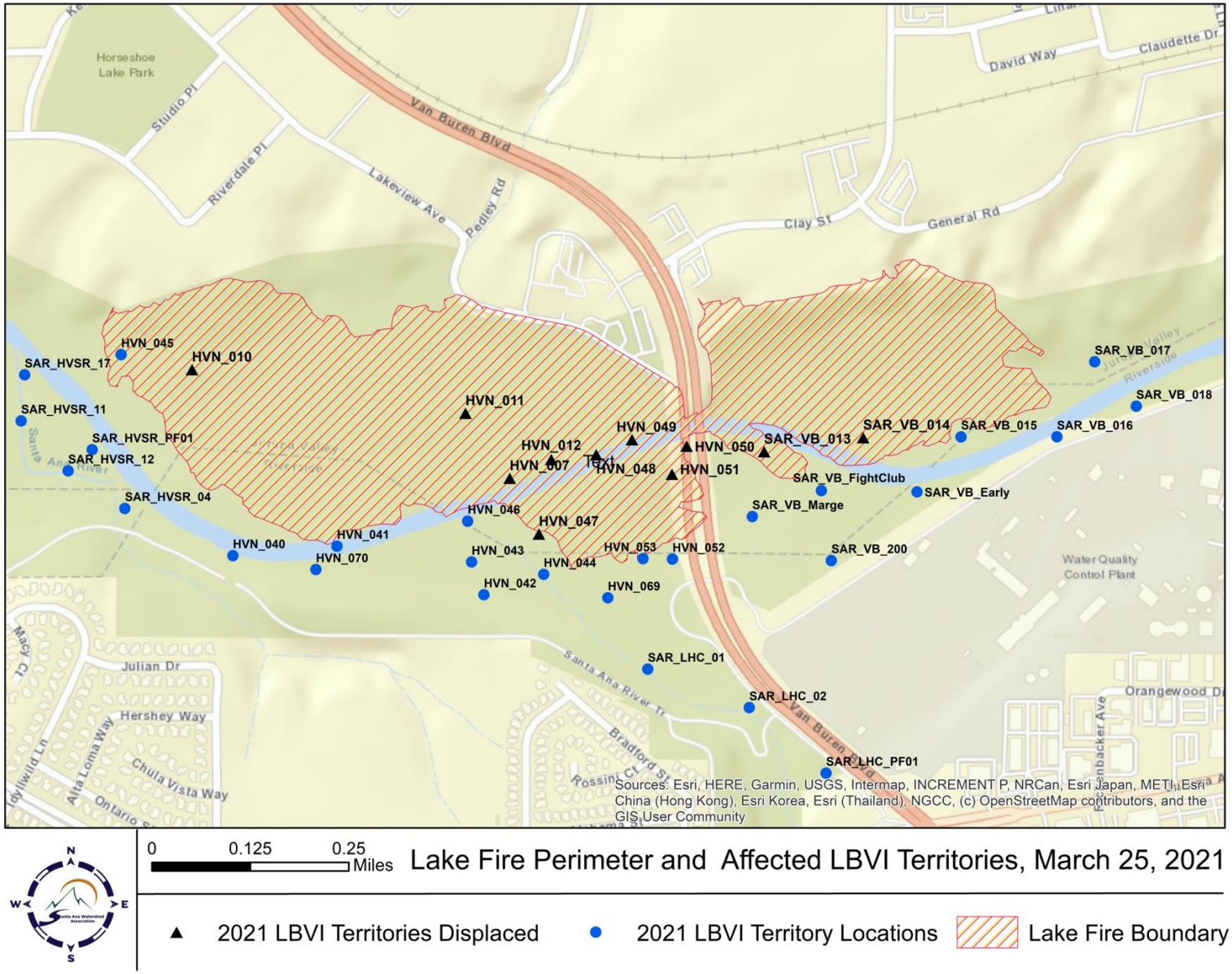

Figure 6. Lake Fire Boundaries and Affected Least Bell's Vireo Territories, 2021. The Lake Fire burned 115 acres along the Santa Ana River on May 24-25, 2021, predominately in Hidden Valley – North and partially in the Riverside to Van Buren Blvd. site. Many vireo territories were displaced during and post-fire and were not included in the final count.

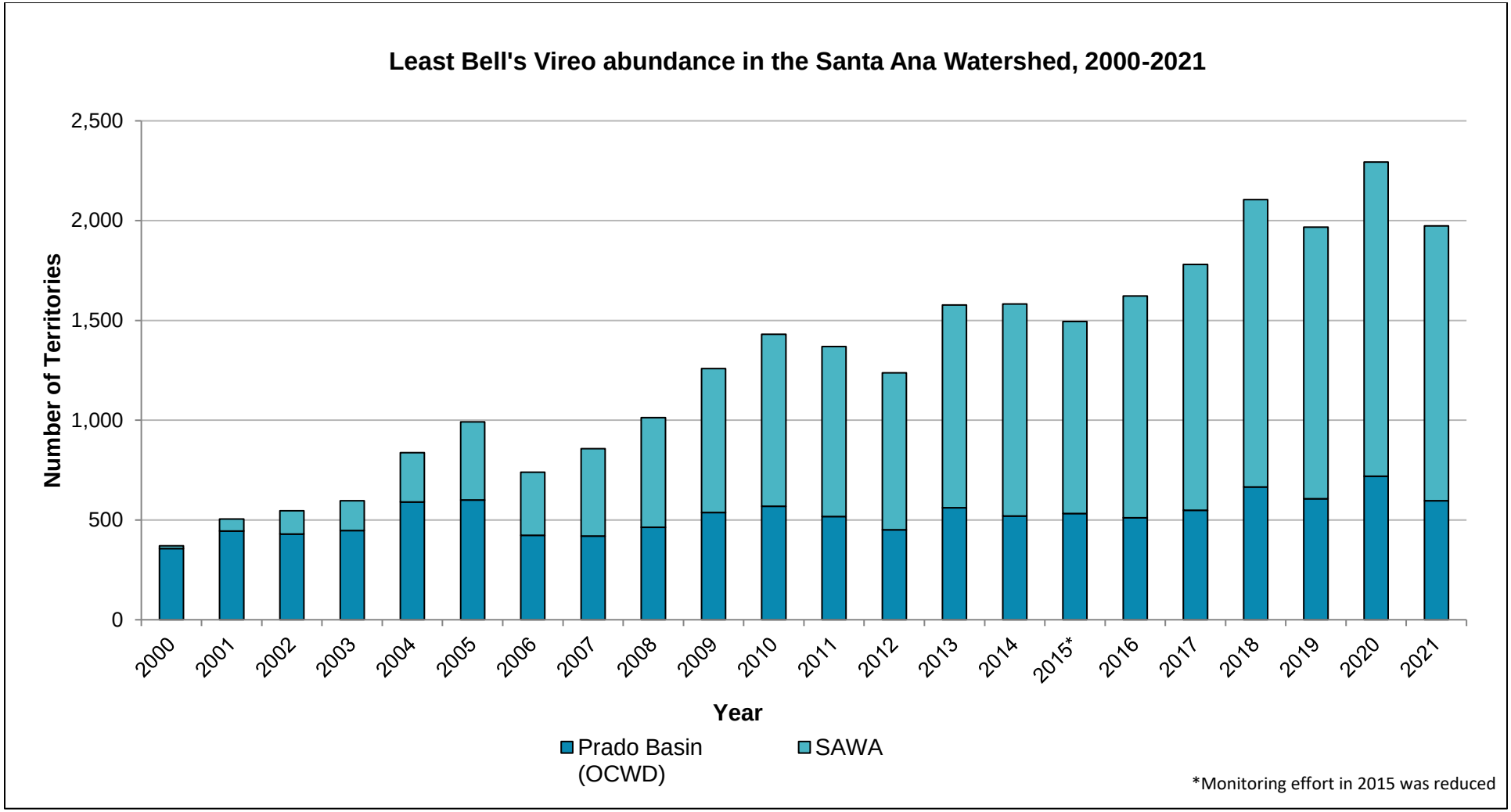

Figure 7. Least Bell's Vireo Abundance in the Santa Ana Watershed, Including Prado Basin, 2000-2021. Vireo population monitoring outside of Prado Basin began in 2000. Vireo abundance in the Santa Ana Watershed has increased dramatically in the past two decades.

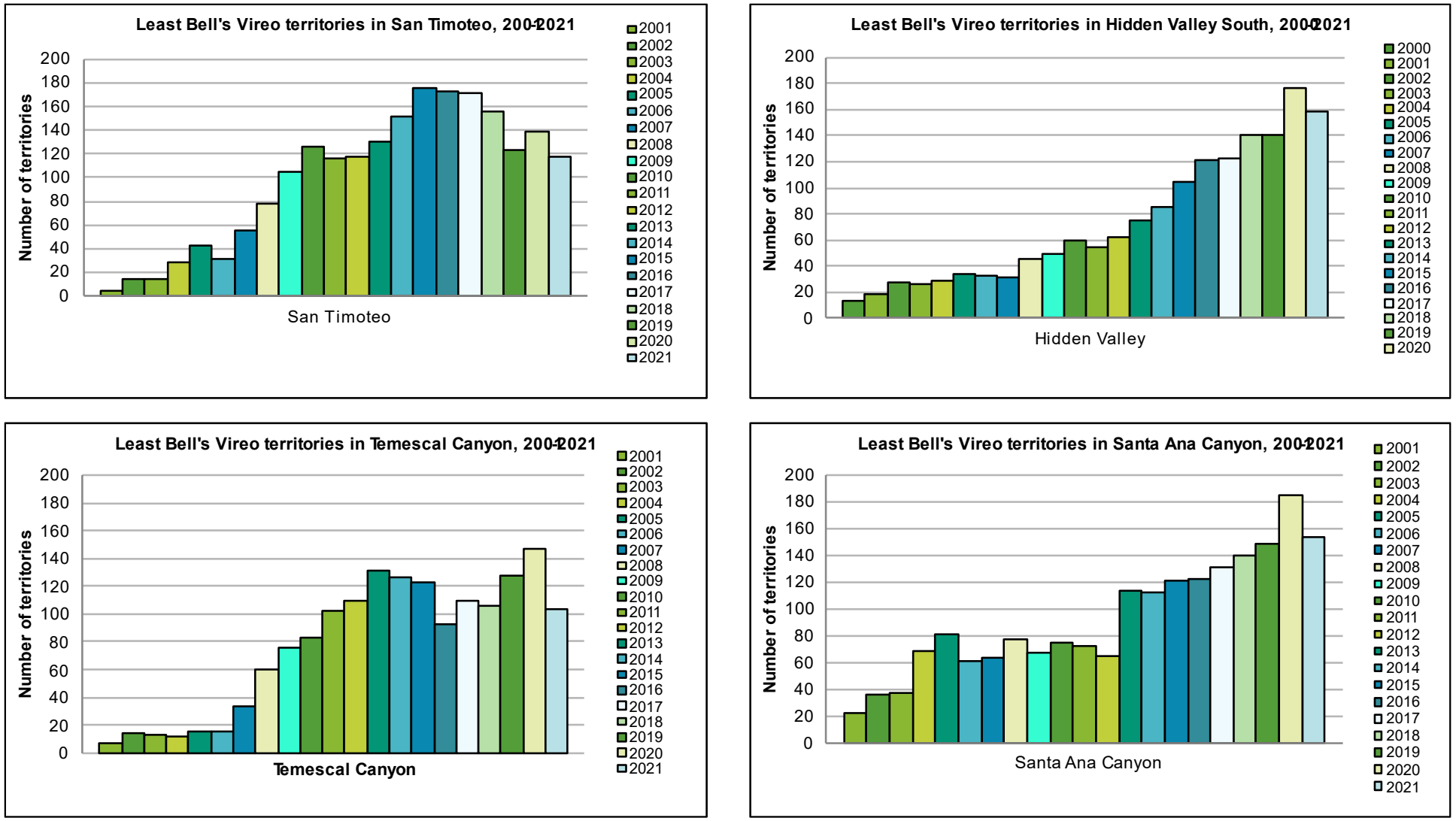

Figure 8. Least Bell's Vireo Territories at Four Sites in the Santa Ana Watershed, 2000-2021. Number of vireo territories at four sites that were comparatively monitored in the watershed. Data shows how vireo abundance has increased substantially over 21 seasons.

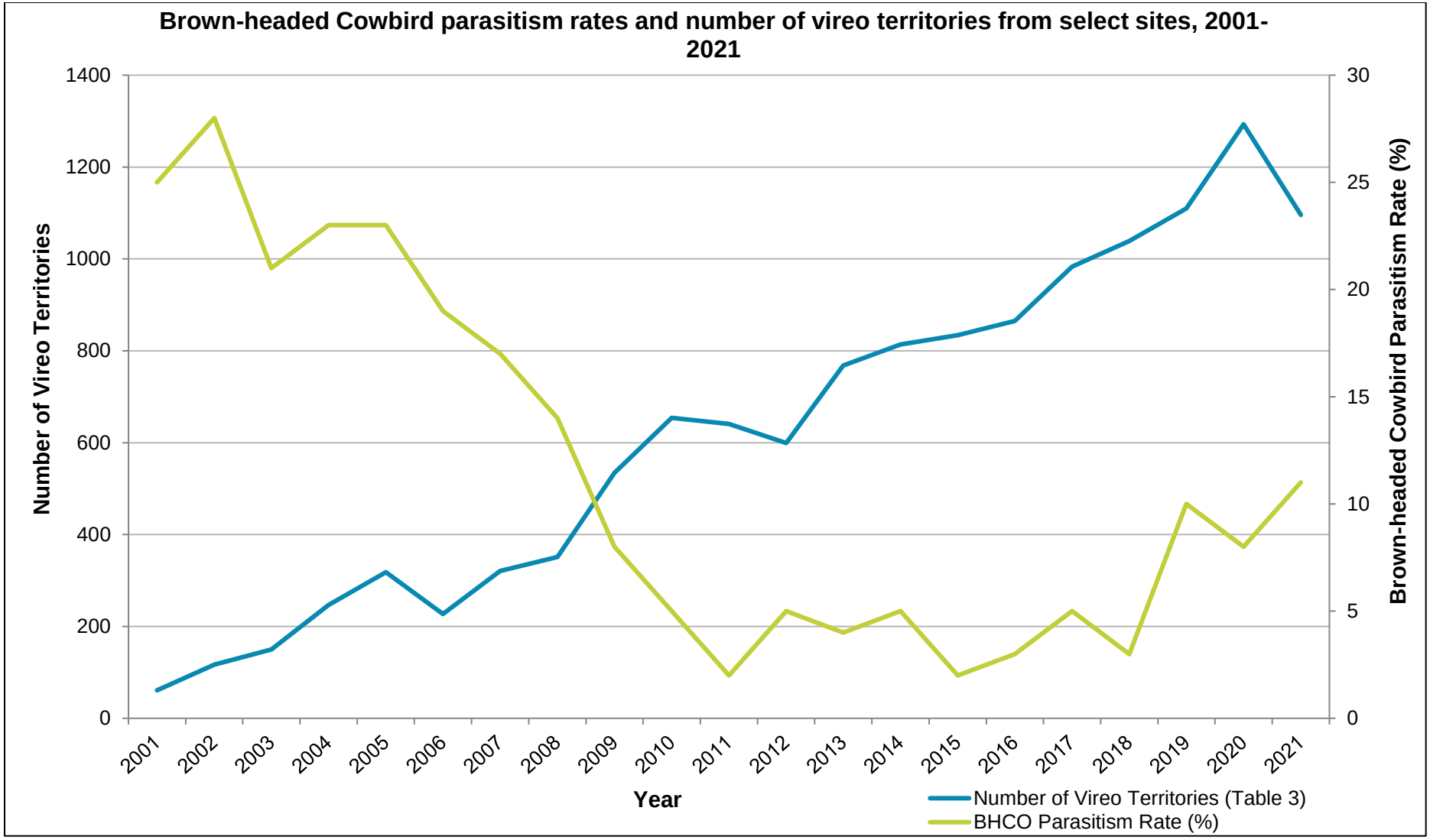

Figure 9. Vireo Territories vs. Parasitism Rates in the Santa Ana Watershed, 2001-2021. This graph shows the inverse relationship between vireo abundance and parasitism rates. Vireo territories have generally increased in number since 2001, while brown-headed cowbird parasitism rates have decreased due 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.

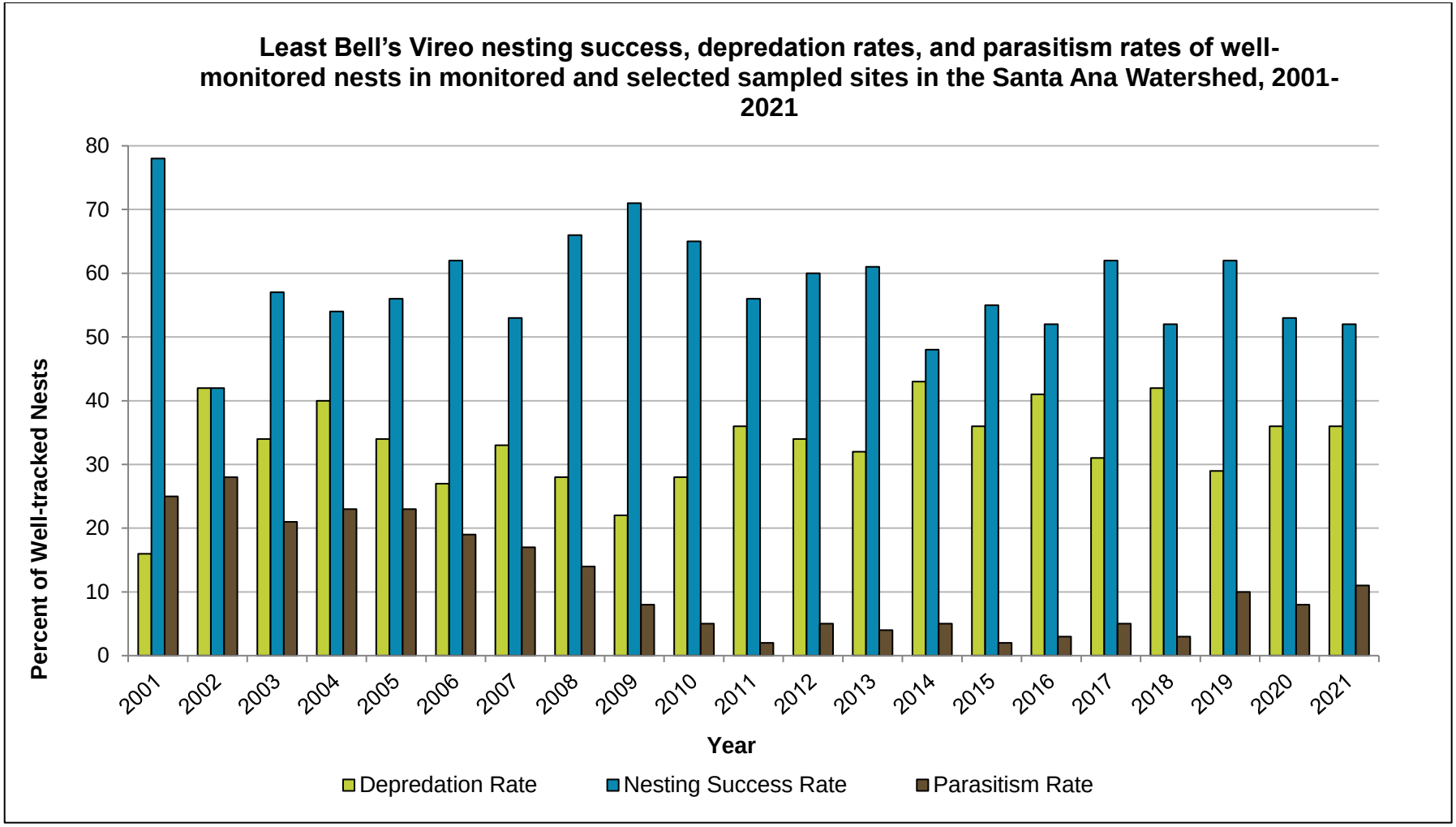

Figure 10. Least Bell's Vireo Nesting Success, Depredation Rates, and Parasitism Rates in the Santa Ana Watershed, 2001-2021. Nest failure due to parasitism remains low due to SAWA's cowbird management program, which includes trapping and removing cowbird eggs from vireo nests when found. Beginning in 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.

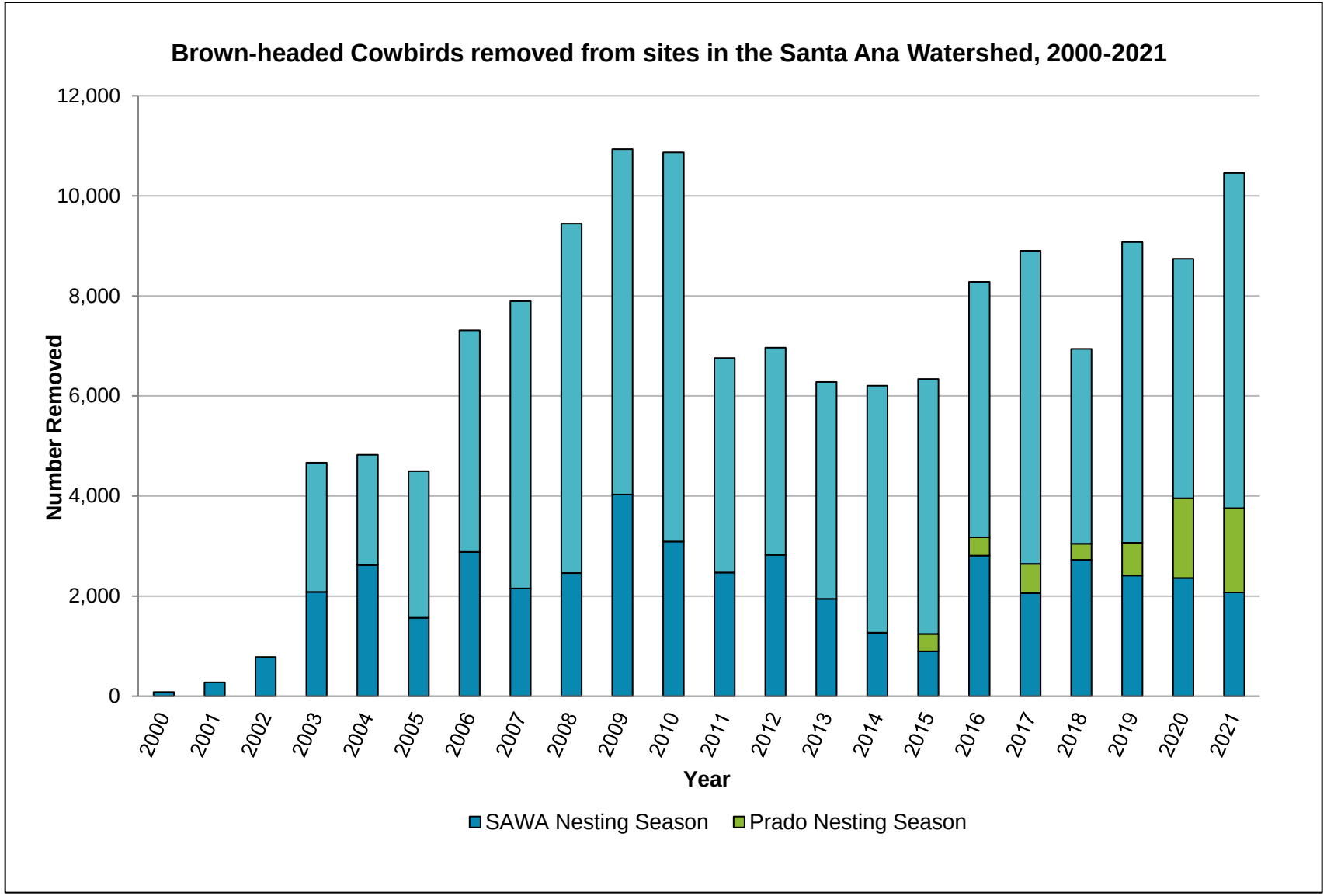

Figure 11. Brown-headed Cowbirds Removed from Sites in the Santa Ana Watershed, 2000-2021. SAWA biologists have trapped and removed over 146,000 cowbirds from the watershed in the last 21 years. "Winter" for each year refers to the period outside of vireo nesting season that ended in March of that year, i.e., "Winter 2021" refers to the trapping season that ran from August 2020 through March 2021.

Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2017-2021. Numbers of territories, pairs, and fledglings detected.

Site Name	2017	2018	2019	2020	2021
Monitored Locations					
San Timoteo Canyon	172 / 109 / 272	156 / 104 / 161	124 / 92 / 170	139 / 105 / 207	118 / 83 / 149
Santa Ana River (SAR) - Upstream					
Riverside Ave. to Van Buren Blvd.	155 / 95 / 169	164 / 96 / 95	166 / 72 / 82	128 / 54 / 55	154 / 78 / 58
Lower Hole Creek	n/s	n/s	3 / 1 / 0	2 / 1 / 1	3 / 3 / 3
Hidden Valley, north side of river	36 / 17 / 34	62 / 38 / 65	See Sampled Locations	See Sampled Locations	See Sampled Locations
Hidden Valley, south side of river	123 / 67 / 87	141 / 60 / 88	140 / 79 / 209	176 / 102 / 187	159 / 118 / 200
Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)	73 / 34 / 54	91 / 56 / 86	90 / 58 / 110	88 / 58 / 114	73 / 47 / 73
Meridian Conservation Area (former March SKR Preserve)	16 / 9 / 23	See Sampled Locations	See Sampled Locations	14 / 9 / 24	See Sampled Locations
Mockingbird Canyon	29 / 15 / 15	See Sampled Locations	43 / 19 / 24	45 / 17 / 26	See Sampled Locations
Norco Bluffs (I-15 to River Rd., non-mitigation)[1]	69 / 31 / 76	36 / 17 / 39	101 / 50 / 139	133 / 65 / 159	113 / 48 / 125
Santa Ana Canyon (SAC)					
Upper Canyon	30 / 21 / 32	32 / 25 / 23	35 / 24 / 58	45 / 30 / 52	43 / 34 / 50
Green River Golf Club	42 / 33 / 76	42 / 38 / 20	45 / 34 / 96	61 / 42 / 63	47 / 35 / 63
Featherly Regional Park	59 / 36 / 57	66 / 25 / 25	69 / 33 / 76	79 / 48 / 66	64 / 34 / 43
San Jacinto	45 / 27 / 48	74 / 34 / 60	63 / 44 / 117	108 / 83 / 145	See Sampled Locations
Sampled Locations					
Santa Ana River & Tributaries:					
Alessandro Arroyo/Prenda Arroyo	23 / 7 / 10	20 / 5 / 3	18 / 2 / 0	26 / 7 / 8	22 / 4 / 3
Box Springs	7 / 1 / 0	3 / 0 / 0	1 / 0 / 0	7 / 5 / 3	4 / 0 / 0
Burris Basin	1 / 1 / 0	0 / 0 / 0	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0
Canyon Crest	0 / 0 / 0	n/s	n/s	n/s	0 / 0 / 0
Carbon Canyon Regional Park	14 / 5 / 2	26 / 9 / 5	n/s	See Incidentals	30 / 9 / 4
Castleview Park	0 / 0 / 0	n/s	n/s	n/s	n/s
Chino Creek Wetlands Park	See Incidentals	See Incidentals	n/s	n/s	5 / 1 / 0
Chino Hills	25 / 7 / 3	26 / 9 / 3	29 / 17 / 19	36 / 10 / 10	30 / 9 / 5
Chino Hills State Park (CHSP)	20 / 4 / 4	32 / 9 / 0	37 / 17 / 13	n/s	n/s
City Creek (Highland)	1 / 1 / 0	1 / 0 / 0	2 / 0 / 0	n/s	n/s
Clearwater Pkwy. @ Glen Helen	0 / 0 / 0	n/s	n/s	n/s	n/s
Conrock Basin FHQ	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0	1 / 1 / 0	1 / 0 / 0
Corona Ave. at Gilmore	1 / 0 / 0	n/s	n/s	n/s	n/s

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2017-2021. Numbers of territories, pairs, and fledglings detected.

Site Name	2017	2018	2019	2020	2021
Sampled Locations					
Santa Ana River & Tributaries:					
Fresno Canyon	2 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s	n/s
Goldenstar	2 / 1 / 2	2 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s
Harrison Reservoir (aka McAllister Creek)	5 / 2 / 3	5 / 4 / 1	7 / 1 / 1	7 / 3 / 5	6 / 1 / 0
Hidden Valley Golf Club	9 / 1 / 0	9 / 1 / 1	8 / 2 / 1	12 / 3 / 3	16 / 10 / 9
Hidden Valley, north side of river	See Monitored Locations	See Monitored Locations	78 / 37 / 41	94 / 61 / 74	61 / 38 / 39
La Sierra	5 / 2 / 1	2 / 1 / 1	4 / 0 / 0	5 / 2 / 0	4 / 3 / 2
Mead Valley (Cajalco/Aqueduct)	13 / 8 / 7	9 / 4 / 0	7 / 3 / 1	9 / 5 / 1	6 / 1 / 1
Meridian Conservation Area (former March SKR Preserve)	See Monitored Locations	20 / 2 / 2	14 / 2 / 2	See Monitored Locations	13 / 8 / 4
Mockingbird Canyon	See Monitored Locations	43 / 15 / 10	See Monitored Locations	See Monitored Locations	37 / 16 / 8
Norco Hills Park Mitigation	0 / 0 / 0	n/s	n/s	n/s	n/s
Plunge Creek	2 / 0 / 0	5 / 0 / 0	2 / 0 / 0	2 / 0 / 0	n/s
Poorman Reservoir	9 / 4 / 5	6 / 2 / 0	6 / 1 / 0	6 / 4 / 3	7 / 4 / 2
Pyrite Channel	0 / 0 / 0	n/s	n/s	n/s	1 / 0 / 0
Quail Run	0 / 0 / 0	3 / 1 / 2	2 / 1 / 1	1 / 1 / 1	0 / 0 / 0
Ryan Bonaminio Park	0 / 0 / 0	n/s	n/s	n/s	See Incidentals
Sycamore Canyon	18 / 9 / 9	20 / 8 / 5	22 / 5 / 3	43 / 28 / 19	35 / 12 / 8
Talbert Park (Orange County)	8 / 0 / 0	6 / 0 / 0	3 / 0 / 0	n/s	2 / 0 / 0
Temescal Canyon	109 / 59 / 48	106 / 48 / 16	127 / 56 / 48	147 / 30 / 20	103 / 35 / 24
Tequesquite Arroyo	0 / 0 / 0	n/s	n/s	n/s	n/s
Tin Mine Rd. (Temescal)	n/s	n/s	4 / 0 / 0	10 / 1 / 1	8 / 3 / 3
Van Buren Blvd. (Bountiful)	1 / 0 / 0	0 / 0 / 0	2 / 0 / 0	0 / 0 / 0	1 / 0 / 0
Van Buren Blvd. (Porter Rd.)	0 / 0 / 0	n/s	n/s	n/s	n/s
Wardlow Wash	n/s	2 / 1 / 0	0 / 0 / 0	n/s	n/s
Woodcrest	1 / 0 / 0	1 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s
Wyle Labs	1 / 0 / 0	3 / 1 / 1	3 / 3 / 3	13 / 4 / 2	10 / 3 / 4
Yorba Linda (San Antonio Rd.)	0 / 0 / 0	n/s	n/s	n/s	n/s
Yorba Linda (Starlight Dr.)	4 / 0 / 0	5 / 0 / 0	9 / 1 / 1	15 / 4 / 4	11 / 0 / 0
Yorba Linda Lakebed Park	0 / 0 / 0	n/s	n/s	n/s	0 / 0 / 0

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2021. Numbers of territories, pairs, and fledglings detected.

Site Name	2017	2018	2019	2020	2021
Sampled Locations					
San Jacinto River Sub-watershed:					
San Jacinto	See Monitored Locations	See Monitored Locations	See Monitored Locations	See Monitored Locations	91 / 52 / 24
Cottonwood Canyon	2 / 0 / 0	2 / 1 / 1	1 / 0 / 0	n/s	2 / 2 / 3
Kabian Park	8 / 3 / 3	7 / 5 / 2	2 / 2 / 1	n/s	n/s
Lake Perris	n/s	8 / 3 / 0	6 / 2 / 1	8 / 6 / 1	5 / 2 / 2
Menifee (Salt Creek)	9 / 4 / 3	10 / 5 / 2	11 / 7 / 11	18 / 12 / 13	14 / 4 / 2
Santiago Creek Sub-watershed:					
Irvine Trust Management Area	0 / 0 / 0	n/s	1 / 0 / 0	2 / 0 / 0	1 / 0 / 0
Limestone Canyon	1 / 0 / 0	n/s	n/s	n/s	n/s
Peters Canyon	27 / 8 / 9	23 / 7 / 1	22 / 8 / 9	24 / 9 / 6	22 / 8 / 6
Santiago Basin	3 / 0 / 0	3 / 0 / 0	5 / 0 / 0	5 / 0 / 0	2 / 0 / 0
Santiago Canyon (Irvine Park)	14 / 1 / 0	18 / 5 / 2	20 / 10 / 8	28 / 13 / 17	29 / 10 / 8
Santiago Creek (above Irvine Lake)	5 / 0 / 0	12 / 2 / 1	5 / 0 / 0	12 / 2 / 1	10 / 2 / 1
Santiago Creek (Cambridge Road)	1 / 0 / 0	1 / 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	n/s	0 / 0 / 0
Santiago Oaks Regional Park (to Cannon Rd.)	2 / 0 / 0	1 / 0 / 0	2 / 0 / 0	n/s	2 / 0 / 0
Smith Basin	3 / 1 / 0	3 / 0 / 0	4 / 1 / 0	3 / 2 / 0	4 / 0 / 0
Incidental Sightings					
Ambriz Park (Orange)	n/s	n/s	n/s	n/s	2 / 0 / 0
Carbon Canyon Regional Park	See Sampled Locations	See Sampled Locations	n/s	14 / 0 / 0	See Sampled Locations
Chino Creek Wetlands Park	1 / 0 / 0	4 / 1 / 1	n/s	n/s	See Sampled Locations
Cielo Vista	n/s	n/s	1 / 0 / 0	1 / 0 / 0	2 / 1 / 1
Hwy 71	n/s	1 / 0 / 0	n/s	n/s	n/s
Irvine Lake	2 / 0 / 0	1 / 0 / 0	1 / 0 / 0	n/s	n/s
Moreno Valley (near Pigeon Pass Rd.)	n/s	n/s	1 / 0 / 0	n/s	n/s
Raceway Ford	n/d	1 / 0 / 0	n/d	n/d	n/d
Riverside (near Goldenstar)	n/s	n/s	1 / 0 / 0	n/s	n/s
Riverside (Van Buren & Jurupa)	n/s	n/s	1 / 0 / 0	1 / 0 / 0	n/s
Riverside (Near Alessandro Arroyo)	n/s	n/s	n/s	n/s	1 / 1 / 1

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2021. Numbers of territories, pairs, and fledglings detected.

Site Name	2017	2018	2019	2020	2021
Incidental Sightings					
RLC Alessandro Arroyo - 1.52 ac	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo	2 / 1 / 1	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo
Rock Vista Park	n/s	n/s	n/s	2 / 0 / 0	n/s
Ryan Bonaminio Park	See Sampled Locations	n/s	n/s	n/s	1 / 0 / 0
Santa Ana River - San Bernardino County Flood Control	n/s	30 / 3 / 5	8 / 0 / 0	2 / 0 / 0	1 / 0 / 0
Wolfskill	n/s	2 / 1 / 1	3 / 1 / 1	1 / 1 / 1	2 / 1 / 1
SUBTOTAL	1,208 / 623 / 1,052	1,347 / 646 / 728	1,361 / 686 / 1,247	1,574 / 828 / 1,292	1,378 / 720 / 929
Reported by other agencies					
Lake Perris[2]	10 / 0 / 0	See Lake Perris	See Lake Perris	See Lake Perris	See Lake Perris
SAR - Norco Bluffs USACE Mitigation Areas[3,4,5]	14 / n/a / n/a	76 / n/a / n/a	See Norco Bluffs	See Norco Bluffs	See Norco Bluffs
Santa Ana River - San Bernardino County[6]	Not reported	17 / 0 / 0	Not Reported	Not Reported	Not Reported
TOTAL FOR SANTA ANA WATERSHED EXCLUDING PRADO BASIN	**1,232 / 623 / 1,052**	**1,440 / 646 / 728**	**1,361 / 686 / 1,247**	**1,574 / 828 / 1,292**	**1,378 / 720 / 929**
PRADO BASIN[7]	549 / 218 / 409	665 / n/a / n/a	606 / n/a / n/a	719 / 373 / 577	596 / 281 / 417
TOTAL FOR SANTA ANA WATERSHED	**1,781 / 841 / 1,461**	**2,105 / 646 / 728**	**1,967 / 686 / 1,247**	**2,293 / 1,201 / 1,869**	**1,974 / 1,001 / 1,346**
Outside Watershed					
French Valley, Benton Channel[8]	n/s	1 / 0 / 0	n/s	n/s	n/s
French Valley, Warm Springs[8]	n/s	1 / 0 / 0	n/s	n/s	n/s
Temecula, Santa Gertrudis[8]	n/s	6 / 1 / 0	n/s	n/s	n/s
Wildomar, Helash Mitigation[8]	n/s	4 / 0 / 0	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
[1] USACE mitigation areas of varying size not surveyed by SAWA in 2016-2018. Survey numbers for these areas can be found in this table under SAR-Norco Bluffs USACE Mitigation Areas reported by other agencies.
[2]Reported by California State Parks.
[3]Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting.
[4]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
[5]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
[6]Reported by San Bernardino County Flood Control biologist Theresa Sims.
[7]Preliminary data. Bonnie Johnson personal communication.
[8]Outside Santa Ana Watershed, not included in totals.

Table 2. Least Bell's Vireo survey dates and breeding chronology, monitored and select sampled sites, 2021.

				Santa Ana River (SAR) - Upstream								Santa Ana Canyon (SAC)		
	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	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)	Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Upper Canyon	Green River Golf Club	Featherly Reg. Park
Survey Start Date[1]	16-Mar	18-Mar	31-Mar	18-Mar	6-Apr	22-Mar	17-Mar	23-Mar	23-Mar	1-Apr	8-Apr	30-Mar	30-Mar	18-Mar
Survey End Date	9-Sep	16-Sep	14-Sep	16-Sep	16-Sep	2-Sep	30-Sep	16-Sep	14-Sep	28-Jul	8-Jul	15-Sep	9-Sep	15-Sep
Date First Detected	29-Mar	30-Mar	1-Apr	30-Mar	6-Apr	8-Apr	30-Mar	29-Mar	29-Mar	1-Apr	8-Apr	30-Mar	30-Mar	30-Mar
50% Arrival Observed	16-Apr	19-Apr	15-Apr	17-Apr	8-Apr	n/a	12-Apr	22-Apr	19-Apr	n/a	n/a	12-Apr	6-Apr	9-Apr
50% Pairs Observed	n/a	27-Apr	n/a	24-Apr	n/a	n/a	23-Apr	29-Apr	26-Apr	n/a	n/a	5-May	27-Apr	20-Apr
First Nest Found	n/a	8-Apr	n/a	n/a	n/a	3-Jun	12-Apr	14-Apr	7-Apr	n/a	n/a	12-Apr	13-Apr	20-Apr
Last Nest Found	n/a	25-Jun	n/a	n/a	n/a	17-Jun	2-Jul	16-Jun	21-Jun	n/a	n/a	25-Jun	17-Jun	21-Jun
First Nest Fledge	n/a	16-May	n/a	n/a	n/a	27-Jun	19-May	15-May	11-May	n/a	n/a	17-May	13-May	8-May
Last Nest Fledge	n/a	20-Jul	n/a	n/a	n/a	10-Jul	21-Jul	15-Jul	20-Jul	n/a	n/a	4-Jul	8-Jul	8-Jul
Date Last Detected[2]	30-Aug	10-Sep	1-Sep	10-Sep	10-Sep	25-Aug	22-Sep	10-Sep	13-Sep	28-Jul	8-Jul	2-Sep	2-Sep	3-Sep

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

[2] May vary from last survey date as an incidental sighting as opposed to a targeted survey.

Table 3. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2021.

					Santa Ana River (SAR) - Upstream								Santa Ana Canyon (SAC)			
	Parameter	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	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)	Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Upper Canyon	Green River Golf Club	Featherly Reg. Park	Combined
A.	Number of territorial males	91	118	37	154	61	3	159	73	113	103	30	43	47	64	1,096
B.	Number of known pairs	52	83	16	78	38	3	118	47	48	35	9	34	35	34	630
C.	Number of known breeding (nesting) pairs	27	69	12	55	35	2	97	42	47	26	5	33	33	27	510
D.	Number of breeding pairs that were well-monitored throughout the season	0	43	0	8	0	1	53	21	22	0	0	9	19	13	189
E.	Number of known fledged young observed	24	149	8	58	39	3	200	73	125	24	5	50	63	43	864
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	n/a	117	n/a	6	n/a	2	156	43	85	n/a	n/a	25	43	23	500
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	0.9	2.2	0.7	1.1	1.1	1.5	2.1	1.7	2.7	0.9	1.0	1.5	1.9	1.6	1.7
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	n/a	2.7	n/a	0.8	n/a	2.0	2.9	2.0	3.9	n/a	n/a	2.8	2.3	1.8	2.6
I.	Number of nests that were discovered	20	79	5	15	21	2	109	41	30	5	1	19	35	30	412
J.	Number of well-tracked nests	0	77	0	13	0	2	102	34	30	0	0	17	33	28	336
K.	Number of successful well-tracked nests	n/a	49% 38 / 77	n/a	15% 2 / 13	n/a	100% 2 / 2	54% 55 / 102	44% 15 / 34	90% 27 / 30	n/a	n/a	47% 8 / 17	48% 16 / 33	39% 11 / 28	52% 174 / 336
L.	Rate of cowbird parasitism (well-tracked nests)[1]	n/a	0% 0 / 62	n/a	20% 2 / 10	n/a	0% 0 / 2	22% 18 / 83	21% 6 / 29	0% 0 / 28	n/a	n/a	0% 0 / 17	0% 0 / 28	21% 4 / 19	11% 30 / 278
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	n/a	9% 7 / 77	n/a	15% 2 / 13	n/a	0% 0 / 2	3% 3 / 102	3% 1 / 34	0% 0 / 30	n/a	n/a	6% 1 / 17	18% 6 / 33	7% 2 / 28	7% 22 / 336
	B. Number of well-tracked nests that failed as a result of parasitism	n/a	0% 0 / 77	n/a	0% 0 / 13	n/a	0% 0 / 2	5% 5 / 102	6% 2 / 34	0% 0 / 30	n/a	n/a	0% 0 / 17	0% 0 / 33	0% 0 / 28	2% 7 / 336

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, 2021.

					Santa Ana River (SAR) - Upstream								Santa Ana Canyon (SAC)			
	Parameter	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	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)	Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Upper Canyon	Green River Golf Club	Featherly Reg. Park	Combined
M.	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	n/a	36% 28 / 77	n/a	54% 7 / 13	n/a	0% 0 / 2	34% 35 / 102	44% 15 / 34	10% 3 / 30	n/a	n/a	47% 8 / 17	33% 11 / 33	46% 13 / 28	36% 120 / 336
	D. Number of well-tracked nests that failed for unknown reasons	n/a	5% 4 / 77	n/a	15% 2 / 13	n/a	0% 0 / 2	4% 4 / 102	3% 1 / 34	0% 0 / 30	n/a	n/a	0% 0 / 17	0% 0 / 33	7% 2 / 28	4% 13 / 336
	Average clutch size	n/a	3.6	n/a	3.2	n/a	3.0	3.5	3.6	3.8	n/a	n/a	3.4	3.5	3.4	3.5
N.	Number of eggs/Number of clutches	n/a	266 / 74	n/a	29 / 9	n/a	3 / 1	264 / 75	89 / 25	110 / 29	n/a	n/a	54 / 16	97 / 28	72 / 21	984 / 278
O.	Number of cowbird eggs or nestlings found in or near vireo nests	6	0	0	2	0	0	19	8	0	0	0	0	0	4	39
P.	Number of 'manipulated' parasitized nests[2]	n/a	n/a	n/a	2	n/a	n/a	14	6	n/a	n/a	n/a	n/a	n/a	4	26
Q.	Number of successful 'manipulated' nests[2]	n/a	n/a	n/a	0% 0 / 2	n/a	n/a	71% 10 / 14	67% 4 / 6	n/a	n/a	n/a	n/a	n/a	50% 2 / 4	62% 16 / 26
R.	Number of vireo fledged from 'manipulated' nests[2]	n/a	n/a	n/a	0	n/a	n/a	21	10	n/a	n/a	n/a	n/a	n/a	4	35
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T.	Number of repaired nests	0	3	0	0	0	0	2	1	0	0	0	1	2	1	10
U.	% of successful repaired nests	n/a	33% 1 / 3	n/a	n/a	n/a	n/a	50% 1 / 2	0% 0 / 1	n/a	n/a	n/a	0% 0 / 1	100% 2 / 2	0% 0 / 1	40% 4 / 10
V.	Number of vireo fledged from repaired nests	n/a	3	n/a	n/a	n/a	n/a	2	0	n/a	n/a	n/a	0	4	0	9
W.	Number of cowbirds removed from study area[3]	1,376	76	84	46	1	n/a	1	8	2	358	n/a	8	6	22	1,988
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)3	719	758	530	724	133	n/a	134	136	128	664	n/a	127	257	318	4,628
Y.	Average number of cowbirds trapped per day (W/X)	1.91	0.10	0.16	0.06	0.01	n/a	0.01	0.06	0.02	0.54	n/a	0.06	0.02	0.07	0.43

[1]Fifty-eight of the 336 "tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these 58 nests were excluded from the calculation of the rate of cowbird parasitism (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.

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, 2021.

	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 - Non - Restoration	Hidden Valley South - Restoration	Hidden Valley South - Overall	Goose Creek[3]	SAR Upstream - Overall
A.	Number of territorial males	5	21	128	154	61	3	128	31	159	73	450
B.	Number of known pairs	4	16	58	78	38	3	89	29	118	47	284
C.	Number of known breeding (nesting) pairs	4	15	36	55	35	2	73	24	97	42	231
D.	Number of breeding pairs that were well-monitored throughout the breeding season	3	5	0	8	0	1	41	12	53	21	83
E.	Number of known fledged young observed	0	18	40	58	39	3	154	46	200	73	373
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	0	6	n/a	6	n/a	2	121	35	156	43	207
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	0.0	1.2	1.1	1.1	1.1	1.5	2.1	1.9	2.1	1.7	1.6
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	0.0	1.2	n/a	0.8	n/a	2.0	3.0	2.9	2.9	2.0	2.5
I.	Number of nests that were discovered	6	9	0	15	21	2	81	28	109	41	188
J.	Number of well-tracked nests	4	9	n/a	13	0	2	76	26	102	34	151
K.	Number of successful well-tracked nests	0% 0 / 4	22% 2 / 9	n/a	15% 2 / 13	n/a	100% 2 / 2	58% 44 / 76	42% 11 / 26	54% 55 / 102	44% 15 / 34	49% 74 / 151
L.	Rate of cowbird parasitism (well-tracked nests)[1]	50% 2 / 4	0% 0 / 6	n/a	20% 2 / 10	n/a	0% 0 / 2	25% 16 / 63	10% 2 / 20	22% 18 / 83	21% 6 / 29	21% 26 / 124
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	25% 1 / 4	11% 1 / 9	n/a	15% 2 / 13	n/a	0% 0 / 2	3% 2 / 76	4% 1 / 26	3% 3 / 102	3% 1 / 34	4% 6 / 151
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 4	0% 0 / 9	n/a	0% 0 / 13	n/a	0% 0 / 2	7% 5 / 76	0% 0 / 26	5% 5 / 102	6% 2 / 34	5% 7 / 151

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, 2021.

	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 - Non - Restoration	Hidden Valley South - Restoration	Hidden Valley South - Overall	Goose Creek[3]	SAR Upstream - Overall
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	25% 1 / 4	67% 6 / 9	n/a	54% 7 / 13	n/a	0% 0 / 2	29% 22 / 76	50% 13 / 26	34% 35 / 102	44% 15 / 34	38% 57 / 151
M.	D. Number of well-tracked nests that failed for unknown reasons	50% 2 / 4	0% 0 / 9	n/a	15% 2 / 13	n/a	0% 0 / 2	4% 3 / 76	4% 1 / 26	4% 4 / 102	3% 1 / 34	5% 7 / 151
	Average clutch size	2.5	3.4	n/a	3.2	n/a	3.0	3.5	3.6	3.5	3.6	3.5
N.	Number of eggs/Number of clutches	5 / 2	24 / 7	n/a	29 / 9	n/a	3 / 1	193 / 55	71 / 20	264 / 75	89 / 25	385 / 110
O.	Number of cowbird eggs or nestlings found in or near vireo nests	2	0	n/a	2	0	0	17	2	19	8	29
P.	Number of 'manipulated' parasitized nests	2	n/a	n/a	2	n/a	n/a	12	2	14	6	22
Q.	Number of successful "manipulated' nests	0% 0 / 2	n/a	n/a	0% 0 / 2	n/a	n/a	75% 9 / 12	50% 1 / 2	71% 10 / 14	67% 4 / 6	64% 14 / 22
R.	Number of vireo fledged from 'manipulated' nests	0	n/a	n/a	0	n/a	n/a	19	2	21	10	31
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	n/a	0	0	0	2	0	2	1	3
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	50% 1 / 2	n/a	50% 1 / 2	0% 0 / 1	33% 1 / 3
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	2	n/a	2	0	2
W.	Number of cowbirds removed from study area[2]	23	13	10	46	1	n/a	1	n/a	1	8	56
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)[2]	133	132	459	724	133	n/a	134	n/a	134	136	1,127
Y.	Average number of cowbirds trapped per day (W/X)	0.17	0.10	0.02	0.06	0.01	n/a	0.01	n/a	0.01	0.06	0.05

[1] Some 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)

[2] All traps are not accounted for in this total. See Table 6.

[3] This 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, 2021.

Host Plant Species (listed in taxonomic order[1])	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream					Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	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		
Giant Reed[i*] (*Arundo donax*)					1			3							4	1%
Western Sycamore (*Platanus racemosa*)		1				2								7	10	2%
Desert Wild Grape (*Vitis girdiana*)	1	9		2			5	1	1						19	5%
Fremont Cottonwood (*Populus fremontii*)		4		4	1		8	9				4	1	2	33	8%
Narrowleaf Willow (*Salix exigua*)	3				4		9	3	6				1	2	28	7%
Goodding's Black Willow (*Salix gooddingii*)	9	4	1	2	3		13	1	4				2	1	40	10%
Red Willow (*Salix laevigata*)		27	2		1			3					1		34	8%
Arroyo Willow (*Salix lasiolepis*)		13		2	6		30	5	12				1		69	17%
Pacific Willow (*Salix lasiandra*)		1						1	1						3	1%
Willow sp. (*Salix* sp.)										4				1	5	1%
California Wild Rose (*Rosa californica*)								2							2	<1%
California Blackberry (*Rubus ursinus*)							2	4							6	1%
White Mulberry[a] (*Morus alba*)		2													2	<1%
Coast Live Oak (Quercus agrifolia)												2	1		3	1%
California Scrub Oak (*Quercus berberidifolia*)				2											2	<1%
Southern California Black Walnut[r] (*Juglans californica*)												1			1	<1%
Laurel Sumac (*Malosma laurina*)													6	3	9	2%
Peruvian Pepper Tree[i*] (*Schinus molle*)													3		3	1%
Poison Oak (*Toxicodendron diversilobum*)												2	1		3	1%
Bush mallow sp. (*Malacothamnus* sp)													1		1	0%
Black Mustard[i*] (*Brassica nigra*)														1	1	<1%
Tamarisk[i*] (*Tamarix ramosissima*)							2								2	<1%
Big Saltbush (*Atriplex lentiformis*)							2								2	<1%
Ash sp. (*Fraxinus* sp.)		1					1								2	<1%
California Sagebrush (*Artemisia californica*)								1							1	<1%
Douglas' Sagewort (*Artemisia douglasiana*)									1					1	2	<1%
Coyote Brush (*Baccharis pilularis*)		1		1				3							5	1%
Mulefat (*Baccharis salicifolia*)	6	13		1	3		34	1	3	1		6	14	7	89	22%
Spanish False Fleabane[a] (*Pulicaria paludosa*)														1	1	<1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	1	2		1			3	2	1		1	4	3	2	20	5%
Thick-leaved Yerba Santa (*Eriodictyon crassifolium*)														1	1	<1%
Deadfall		1	1		2			2	1						7	2%
Unknown/No Data			1											1	2	<1%
Total	20	79	5	15	21	2	109	41	30	5	1	19	35	30	412	100%

[i] = invasive
[a] = non-native
[r] = endangered, threatened, or sensitive
[1] = Using Jepson eFlora

Table 5. Observations of all species by location, 2021.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other[1]
Avian								
Canada Goose	*Branta canadensis*	X		X	X	X		
Wood Duck	*Aix sponsa*	X		X	X	X		
Blue-winged Teal	*Spatula discors*						X	
Cinnamon Teal	*Spatula cyanoptera*	X					X	
Northern Shoveler	*Spatula clypeata*	X		X				
Gadwall	*Mareca strepera*			X				
American Wigeon	*Mareca americana*					X		
Mallard	*Anas platyrhynchos*	X	X	X	X	X		
Northern Pintail	*Anas acuta*	X						
Green-winged Teal	*Anas crecca*	X		X				
Ring-necked Duck	*Aythya collaris*	X		X				
Lesser Scaup	*Aythya affinis*	X						
Bufflehead	*Bucephala albeola*	X						
Common Merganser	*Mergus merganser*			X				
Ruddy Duck	*Oxyura jamaicensis*	X		X			X	
California Quail	*Callipepla californica*	X	X	X		X	X	
Pied-billed Grebe	*Podilymbus podiceps*				X	X	X	
Western Grebe	*Aechmophorus occidentalis*						X	
Rock Pigeon[i]	*Columba livia*		X	X		X		
Band-tailed Pigeon	*Patagioenas fasciata*		X	X				
Eurasian Collared-Dove[i]	*Streptopelia decaocto*	X		X		X	X	
Common Ground-Dove	*Columbina passerina*			X	X			
Mourning Dove	*Zenaida macroura*	X	X	X	X	X	X	
Greater Roadrunner	*Geococcyx californianus*	X	X	X	X	X	X	
Vaux's Swift	*Chaetura vauxi*			X		X		
White-throated Swift	*Aeronautes saxatalis*			X	X	X		
Black-chinned Hummingbird	*Archilochus alexandri*		X	X		X		
Anna's Hummingbird	*Calypte anna*	X	X	X	X	X	X	
Costa's Hummingbird	*Calypte costae*		X	X		X		
Rufous Hummingbird	*Selasphorus rufus*			X	X			
Allen's Hummingbird	*Selasphorus sasin*		X	X	X	X		
Sora	*Porzana carolina*	X			X			
American Coot	*Fulica americana*	X	X	X			X	
Black-necked Stilt	*Himantopus mexicanus*	X		X				
American Avocet	*Recurvirostra americana*	X						
Killdeer	*Charadrius vociferus*	X	X	X	X	X	X	
Long-billed Curlew	*Numenius americanus*	X						
Least Sandpiper	*Calidris minutilla*	X				X		
Long-billed Dowitcher	*Limnodromus scolopaceus*	X		X				
Wilson's Snipe	*Gallinago delicata*						X	
Greater Yellowlegs	*Tringa melanoleuca*	X					X	
Gull spp.	*Larus spp.*			X				

Table 5 continued. Observations of all species by location, 2021.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other[1]
Avian								
Double-crested Cormorant[r]	*Phalacrocorax auritus*	X	X	X		X	X	X
American White Pelican	*Pelecanus erythrorhynchos*	X	X			X	X	
Great Blue Heron[r]	*Ardea herodias*	X	X	X	X	X	X	X
Great Egret	*Ardea alba*	X	X	X	X	X		
Snowy Egret	*Egretta thula*	X	X	X		X		
Green Heron	*Butorides virescens*	X		X		X		
Black-crowned Night-Heron[r]	*Nycticorax nycticorax*	X	X				X	X
White-faced Ibis[r]	*Plegadis chihi*	X					X	
Turkey Vulture[r]	*Cathartes aura*	X		X		X	X	X
Osprey	*Pandion haliaetus*		X	X		X		
White-tailed Kite[r]	*Elanus leucurus*		X	X			X	
Northern Harrier[r]	*Circus hudsonius*	X		X				
Cooper's Hawk[r]	*Accipiter cooperii*	X	X	X	X	X	X	X
Bald Eagle[r]	*Haliaeetus leucocephalus*	X						
Red-shouldered Hawk	*Buteo lineatus*	X	X	X	X	X		
Swainson's Hawk[r]	*Buteo swainsoni*	X				X		
Red-tailed Hawk	*Buteo jamaicensis*	X	X	X	X	X	X	
Ferruginous Hawk[r]	*Buteo regalis*	X						
Barn Owl	*Tyto alba*	X	X	X		X	X	
Great Horned Owl	*Bubo virginianus*	X	X	X			X	
Burrowing Owl[r]	*Athene cunicularia*							X
Belted Kingfisher	*Megaceryle alcyon*						X	
Acorn Woodpecker	*Melanerpes formicivorus*		X	X		X		
Downy Woodpecker[r]	*Dryobates pubescens*	X	X	X	X	X		X
Nuttall's Woodpecker	*Dryobates nuttallii*	X	X	X	X	X	X	
Hairy Woodpecker	*Dryobates villosus*			X				
Northern Flicker	*Colaptes auratus*	X	X	X	X			
American Kestrel	*Falco sparverius*	X	X	X	X	X	X	
Red-crowned Amazon[i]	*Amazona viridigenalis*					X		
Ash-throated Flycatcher	*Myiarchus cinerascens*	X	X	X		X	X	
Cassin's Kingbird	*Tyrannus vociferans*	X	X	X	X	X		
Western Kingbird	*Tyrannus verticalis*	X	X	X	X	X	X	
Olive-sided Flycatcher	*Contopus cooperi*			X				
Western Wood-Pewee	*Contopus sordidulus*		X	X		X		
Willow Flycatcher[r]	*Empidonax traillii*	X		X		X		
Dusky Flycatcher	*Empidonax oberholseri*	X						
Pacific-slope Flycatcher	*Empidonax difficilis*	X	X	X	X	X		
Black Phoebe	*Sayornis nigricans*	X	X	X	X	X	X	
Say's Phoebe	*Sayornis saya*	X	X	X	X	X		
Vermilion Flycatcher	*Pyrocephalus rubinus*	X				X		
Loggerhead Shrike[r]	*Lanius ludovicianus*	X						
Hutton's Vireo	*Vireo huttoni*	X	X	X	X	X		
Cassin's Vireo	*Vireo cassinii*		X					
Warbling Vireo	*Vireo gilvus*	X		X		X		
California Scrub-Jay	*Aphelocoma californica*	X	X	X	X	X	X	

Table 5 continued. Observations of all species by location, 2021.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other[1]
Avian								
American Crow	*Corvus brachyrhynchos*		X	X	X	X		
Common Raven	*Corvus corax*	X	X	X	X	X	X	
Horned Lark[r]	*Eremophila alpestris*			X				X
Tree Swallow[r]	*Tachycineta bicolor*	X		X	X	X	X	
Violet-green Swallow	*Tachycineta thalassina*	X		X				
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	X	X	X	X	X	X	
Cliff Swallow	*Petrochelidon pyrrhonota*	X		X	X	X	X	
Barn Swallow	*Hirundo rustica*	X		X	X			
Bushtit	*Psaltriparus minimus*	X	X	X	X	X	X	
White-breasted Nuthatch	*Sitta carolinensis*			X		X		
Rock Wren	*Salpinctes obsoletus*						X	
House Wren	*Troglodytes aedon*	X	X	X	X	X	X	
Marsh Wren	*Cistothorus palustris*	X		X	X			
Bewick's Wren	*Thryomanes bewickii*	X	X	X	X	X	X	
Blue-gray Gnatcatcher	*Polioptila caerulea*	X		X	X	X	X	
California Gnatcatcher[r]	*Polioptila californica*					X	X	X
Ruby-crowned Kinglet	*Regulus calendula*	X	X	X	X	X		
Wrentit	*Chamaea fasciata*		X	X	X	X		
Western Bluebird	*Sialia mexicana*	X	X	X		X		
Swainson's Thrush	*Catharus ustulatus*	X			X	X		
Hermit Thrush	*Catharus guttatus*		X	X	X	X	X	
American Robin	*Turdus migratorius*			X	X	X		
California Thrasher	*Toxostoma redivivum*		X	X	X	X	X	
Northern Mockingbird	*Mimus polyglottos*	X		X	X	X	X	
European Starling[i]	*Sturnus vulgaris*	X	X	X		X		
Cedar Waxwing	*Bombycilla cedrorum*			X		X		
Phainopepla	*Phainopepla nitens*	X	X	X		X	X	
Scaly-breasted Munia[i]	*Lonchura punctulata*			X				
House Sparrow[i]	*Passer domesticus*	X	X	X		X		
American Pipit	*Anthus rubescens*	X		X	X			
House Finch	*Haemorhous mexicanus*	X	X	X	X	X	X	
Pine Siskin	*Spinus pinus*					X	X	
Lesser Goldfinch	*Spinus psaltria*	X	X	X	X	X	X	
Lawrence's Goldfinch	*Spinus lawrencei*	X	X	X		X		
American Goldfinch	*Spinus tristis*	X	X	X	X	X		
Grasshopper Sparrow[r]	*Ammodramus savannarum*							X
Lark Sparrow	*Chondestes grammacus*	X	X			X		
Chipping Sparrow	*Spizella passerina*					X		
Brewer's Sparrow	*Spizella breweri*	X						
White-crowned Sparrow	*Zonotrichia leucophrys*	X	X	X	X	X		
Golden-crowned Sparrow	*Zonotrichia atricapilla*					X		
Bell's Sparrow[r]	*Artemisiospiza belli*							X
Savannah Sparrow	*Passerculus sandwichensis*	X		X				
Song Sparrow	*Melospiza melodia*	X	X	X	X	X	X	
Lincoln's Sparrow[r]	*Melospiza lincolnii*			X	X	X		

Table 5 continued. Observations of all species by location, 2021.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other[1]
Avian								
California Towhee	*Melozone crissalis*	X	X	X	X	X	X	
Rufous-crowned Sparrow[r]	*Aimophila ruficeps canescens*	X				X	X	X
Spotted Towhee	*Pipilo maculatus*	X	X	X	X	X	X	
Yellow-breasted Chat[r]	*Icteria virens*	X	X	X	X	X	X	X
Yellow-headed Blackbird[r]	*Xanthocephalus xanthocephalus*	X		X				X
Western Meadowlark	*Sturnella neglecta*	X		X				
Hooded Oriole	*Icterus cucullatus*	X	X	X	X	X	X	
Bullock's Oriole	*Icterus bullockii*	X	X	X		X		
Red-winged Blackbird	*Agelaius phoeniceus*	X	X	X		X	X	
Tricolored Blackbird[r]	*Agelaius tricolor*	X						X
Brown-headed Cowbird[i]	*Molothrus ater*	X		X	X	X	X	
Great-tailed Grackle	*Quiscalus mexicanus*	X	X				X	
Orange-crowned Warbler	*Oreothlypis celata*	X	X	X	X	X	X	
Nashville Warbler[r]	*Leiothlypis ruficapilla*			X		X		
Common Yellowthroat	*Geothlypis trichas*	X	X	X	X	X	X	
Yellow Warbler[r]	*Setophaga petechia*	X	X	X	X	X	X	X
Yellow-rumped Warbler	*Setophaga coronata*	X	X	X	X	X		
Black-throated Gray Warbler	*Setophaga nigrescens*		X	X	X			
Townsend's Warbler	*Setophaga townsendi*	X		X				
Hermit Warbler	*Setophaga occidentalis*				X			
Wilson's Warbler[r]	*Cardellina pusilla*	X	X	X		X		X
Western Tanager	*Piranga ludoviciana*	X	X	X		X		
Northern Cardinal[i]	*Cardinalis cardinalis*					X		
Black-headed Grosbeak	*Pheucticus melanocephalus*	X	X	X	X	X		
Blue Grosbeak	*Passerina caerulea*	X	X	X	X	X		
Lazuli Bunting	*Passerina amoena*			X		X		
Mammals (tracks/other evidence used)								
Virginia Opossum[i]	*Didelphis virginiana*	X	X	X				
San Diego Black-tailed Jackrabbit[r]	*Lepus californicus bennettii*						X	
Desert Cottontail	*Sylvilagus audubonii*	X	X	X	X	X	X	
Broad-footed Mole	*Scapanus latimanus*			X				
Feral Dog[i]	*Canis familiaris*	X		X				
Coyote[r]	*Canis latrans*	X	X	X	X	X	X	X
Feral Cat[i]	*Felis catus*	X		X				
Bobcat[r]	*Lynx rufus*			X		X		
Striped Skunk	*Mephitis mephitis*	X	X	X				
Long-tailed Weasel[r]	*Mustela frenata*					X		X
Raccoon	*Procyon lotor*	X	X	X	X	X	X	
Mule Deer	*Odocoileus hemionus*		X				X	
Feral Pig[i]	*Sus scrofa*		X	X	X			
Woodrat sp. (nest)	*Neotoma sp.*		X			X	X	
North American Deermouse	*Peromyscus maniculatus*						X	
California Ground Squirrel	*Otospermophilus beecheyi*	X	X	X	X	X	X	
Western Gray Squirrel	*Sciurus griseus*		X					
Eastern Fox Squirrel[i]	*Sciurus niger*			X		X		

Table 5 continued. Observations of all species by location, 2021.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Temescal	Other[1]
Herpetofauna								
Western Toad	*Anaxyrus boreas*				X			
American Bullfrog[i]	*Lithobates catesbeianus*			X	X	X		
Baja California Treefrog	*Pseudacris hypochondriaca*	X	X	X	X	X	X	
Belding's Orange-throated Whiptail[r]	*Aspidoscelis hyperythra beldingi*		X				X	X
San Diegan Tiger Whiptail[r]	*Aspidoscelis tigris stejnegeri*		X	X		X	X	X
Zebra-tailed Lizard	*Callisaurus draconoides*			X				
Southern Alligator Lizard	*Elgaria multicarinata*		X	X		X		
Blainville's Horned Lizard[r]	*Phrynosoma blainvillii*			X				
Western Fence Lizard	*Sceloporus occidentalis*	X	X	X	X	X	X	
Granite Spiny Lizard[r]	*Sceloporus orcutti*						X	X
Side-blotched Lizard	*Uta stansburiana*	X	X	X	X	X	X	
Red Racer/Coachwhip	*Coluber flagellum piceus*		X	X	X	X		
California Striped Racer	*Coluber lateralis lateralis*					X	X	
Southern Pacific Rattlesnake	*Crotalus oreganus helleri*		X			X		
Red Diamond Rattlesnake[r]	*Crotalus ruber*						X	
San Bernardino Ring-necked Snake	*Diadophis punctatus modestus*			X				
California Kingsnake	*Lampropeltis californiae*	X	X	X				
San Diego Gopher Snake	*Pituophis catenifer annectens*		X	X		X	X	
Texas Spiny Softshell[i]	*Apalone spinifera emoryi*			X	X	X		
Red-eared Slider[i]	*Trachemys scripta elegans*	X		X	X	X		
Fish								
Mosquitofish[i]	*Gambusia affinis*			X	X	X	X	
Common Carp[i]	*Cyprinus carpio*				X			
Largemouth Bass[i]	*Micropterus salmoides*			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, 2021 to September 17, 2021.

Table 6. Brown-headed Cowbird trapping results, March-July 2021 (grouped by funding source).

Site Name	Trap/Location	2021 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	3/18-7/29	71	8	4	4	0	0.11	0.11
	SJWA A1	3/18-7/29	123	25	8	17	0	0.20	0.20
	SJWA E1	3/18-7/29	129	84	47	31	6	0.60	0.65
Subtotal			**323**	**117**	**59**	**52**	**6**	**0.34**	**0.36**
Mockingbird Canyon	Reservoir	3/15-7/30	137	59	27	32	0	0.43	0.43
	Estates	3/15-7/18	120	11	10	1	0	0.09	0.09
	Dak	3/16-7/29	135	3	2	1	0	0.02	0.02
	Markham	3/15-7/30	138	11	6	5	0	0.08	0.08
Subtotal			**530**	**84**	**45**	**39**	**0**	**0.16**	0.16
Prado/Chino Hills	Bluff	3/16-7/28	128	2	0	2	0	0.02	0.02
	Cuckoo Pond	3/16-7/27	127	0	0	0	0	0.00	0.00
	Dog Park	3/15-7/26	127	0	0	0	0	0.00	0.00
	IEUA	3/15-7/27	125	17	12	4	1	0.13	0.14
	Prado Regional Park	3/15-7/26	128	3	2	1	0	0.02	0.02
Subtotal			**635**	**22**	**14**	**7**	**1**	**0.03**	**0.03**
Temescal	New Sump	3/15-7/30	136	14	7	7	0	0.10	0.10
	Rockery	3/16-7/29	132	11	6	5	0	0.08	0.08
	Baker	3/16-7/30	133	27	14	12	1	0.20	0.20
	Salt Creek	3/17-7/29	133	7	3	3	1	0.05	0.05
Subtotal			**534**	**59**	**30**	**27**	**2**	**0.11**	**0.11**
San Jacinto, Prado and Lake Elsinore Dairies	Dyt	3/18-7/29	131	27	17	8	2	0.19	0.21
	Tuls 1	3/15-7/29	131	555	444	95	16	4.11	4.24
	Scott Bros	3/15-7/29	134	677	538	120	19	4.91	5.05
	Euclid 1	3/15-7/30	131	247	114	123	10	1.81	1.89
	Euclid 2	3/15-7/30	131	451	254	184	13	3.34	3.44
	Weststeyn 1	3/15-7/30	110	417	188	206	23	3.58	3.79
	Weststeyn 2	3/15-7/30	109	544	226	294	24	4.77	4.99
	Dejongs	3/15-7/30	130	299	155	137	7	2.25	2.30
Subtotal			**1007**	**3217**	**1936**	**1167**	**114**	**3.08**	**3.19**
Santa Ana Canyon	Chino Hills State Park	3/15-7/27	127	8	6	1	1	0.06	0.06
	RV Park	3/15-7/27	126	12	5	6	1	0.09	0.10
	Yorba Park	3/16-7/29	131	10	5	4	1	0.07	0.08
	Green River Golf Maintenance	3/15-7/27	129	3	1	1	1	0.02	0.02
	Green River Golf West	3/15-7/27	128	3	-1	3	1	0.02	0.02
	Savi Ranch	5/27-7/29	61	0	0	0	0	0.00	0.00
Subtotal			**702**	**36**	**16**	**15**	**5**	**0.04**	**0.05**

Table 6 continued. Brown-headed Cowbird trapping results, March-July 2021 (grouped by funding source).

Site Name	Trap/Location	2021 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
Anaheim	Conrock	3/17-7/28	117	48	21	19	8	0.34	0.41
	Huckleberry	3/17-7/28	112	19	9	6	4	0.13	0.17
Subtotal			**229**	**67**	**30**	**25**	**12**	**0.24**	**0.29**
TOTAL (USFWS/USACE/SARM)			**3,960**	**3,602**	**2,130**	**1,332**	**140**	**0.87**	**0.91**
SBVMWD									
Santa Ana River (upstream)	Anza	3/16-7/28	132	13	6	7	0	0.10	0.10
	Bain	3/16-7/30	133	1	1	0	0	0.01	0.01
	Crestmore	3/16-7/29	135	5	3	2	0	0.04	0.04
	Fairmount Park	3/16-7/28	133	23	11	9	3	0.15	0.17
	Flood Office	3/16-7/28	56	0	0	0	0	0.00	0.00
	Goose Creek 2	3/16-7/30	136	8	3	4	1	0.05	0.06
	Hidden Valley South	3/16-7/30	134	1	1	-1	1	0.00	0.01
	Regional Lift Station	3/16-7/29	133	7	4	2	1	0.05	0.05
	Sunnyslope Lift Station	3/16-7/29	135	-2	-1	-1	0	-0.01	-0.01
Subtotal			**1,127**	**56**	**28**	**22**	**6**	**0.04**	**0.05**
NORTH COUNTY BRS PROJECT, LLC									
Santa Ana Canyon	Cielo Vista	3/16-7/29	116	0	0	0	0	0.00	0.00
Subtotal			**116**	**0**	**0**	**0**	**0**	**0.00**	**0.00**
IERCD/SAWA									
San Timoteo	Headlee	3/15 - 7/30	131	42	21	18	3	0.30	0.32
	Harned	3/17 - 7/29	128	4	1	3	0	0.03	0.03
	Fisherman's Retreat	3/18 - 7/30	126	12	6	5	1	0.09	0.10
	Younglove 1	3/18 - 7/30	127	14	8	5	1	0.10	0.11
SBCTA									
San Timoteo	Bees 1	3/15-7/27	118	-1	-2	1	0	-0.01	-0.01
	Bees 2	3/15-7/27	128	5	2	3	0	0.04	0.04
Subtotal			**758**	**76**	**36**	**35**	**5**	**0.09**	**0.10**
Rivers and Lands Conservancy									
	Meridian 1	3/16-7/29	135	21	15	6	0	0.16	0.16
Meridian C.A.	Meridian 2	3/16-7/29	135	1	1	0	0	0.01	0.01
Subtotal			**270**	**22**	**16**	**6**	**0**	**0.08**	**0.08**
GRAND TOTAL			**6,231**	**3,756**	**2,210**	**1,395**	**151**	**0.58**	**0.60**
***TOTAL BHCO FIELD HOURS**		**3,657**							

*hours also include installation and removal of traps from field

Table 7. Non-target avian captures in Brown-headed Cowbird traps, March-July 2021.

2021 Non-target Species*		San Jacinto		Mockingbird Canyon		Prado		Temescal		San Jacinto, Prado, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		SBVMWD Santa Ana River (upstream)		IERCD/SBCTA San Timoteo		Rivers and Lands Conservancy Meridian C.A.		NORTH COUNTY BRS PROJECT, LLC Cielo Vista		2021 Total	
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**
Anna's Hummingbird	*Calypte anna*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	**1**	**1**
American Kestrel	*Falco sparverius*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
Loggerhead Shrike	*Lanius ludovicianus*	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**	**0**
House Wren	*Troglodytes aedon*	0	0	0	0	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**	**2**
Bewick's Wren	*Thryomanes bewickii*	0	0	3	1	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	**7**	**1**
Northern Mockingbird	*Mimus polyglottos*	23	0	3	0	0	0	0	0	0	0	2	1	1	0	8	0	6	0	0	0	0	0	**43**	**1**
House Finch	*Haemorhous mexicanus*	0	0	142	1	133	0	0	0	0	0	38	1	64	2	42	2	2	0	17	1	0	0	**438**	**7**
Lark Sparrow	*Chondestes grammacus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	**7**	**0**
White-crowned Sparrow	*Zonotrichia leucophrys*	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	7	0	0	0	0	0	**9**	**0**
Song Sparrow	*Melospiza melodia*	0	0	1	0	15	0	4	0	0	0	0	0	13	0	1	0	0	0	0	0	5	0	**39**	**0**
California Towhee	*Melozone crissalis*	44	0	917	3	60	0	96	0	0	0	50	1	9	0	174	2	409	3	479	0	110	0	**2,348**	**9**
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	1	0	0	0	0	0	0	0	277	0	0	0	0	0	5	0	1	0	0	0	0	0	**284**	**0**
Hooded Oriole	*Icterus cucullatus*	0	0	4	0	1	0	5	1	0	0	0	0	1	0	3	0	1	0	1	0	0	0	**16**	**1**
Bullock's Oriole	*Icterus bullockii*	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	**2**	**1**
Red-winged Blackbird	*Agelaius phoeniceus*	275	0	10	0	0	0	12	0	102	2	1	0	206	3	11	0	13	0	20	0	0	0	**650**	**5**
Tricolored Blackbird	*Agelaius tricolor*	1	0	0	0	0	0	0	0	3	0	0	0	47	0	0	0	0	0	0	0	0	0	**51**	**0**
Brewer's Blackbird	*Euphagus cyanocephalus*	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**	**0**
Great-tailed Grackle	*Quiscalus mexicanus*	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	**2**	**0**
Black-headed Grosbeak	*Pheucticus melanocephalus*	2	0	0	0	1	0	0	0	1	0	4	0	0	0	1	0	1	0	0	0	0	0	**10**	**0**
Exotic Non-targets																									
Budgerigar	*Melopsittacus undulatus*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
Orange Bishop	*Euplectes franciscanus*	0	0	0	0	0	0	0	0	0	0	**0**	0	5	0	0	0	0	0	0	0	0	0	**5**	**0**
Scaly-breasted Munia	*Lonchura punctulata*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
TOTAL		**350**	**0**	**1,080**	**5**	**213**	**1**	**119**	**2**	**391**	**2**	**97**	**4**	**351**	**6**	**245**	**4**	**449**	**3**	**517**	**1**	**115**	**0**	**3,927**	**28**
#/trap day		1.08		2.04		0.34		0.22		0.39		0.14		1.53		0.22		0.59		1.91		0.99		0.63	
Mortality %			0.00%		0.46%		0.47%		1.68%		0.51%		4.12%		1.71%		1.63%		0.67%		0.19%		0.00%		0.71%

*Number of dead non-targets included in number caught

Table 7 continued. Non-target avian captures in Brown-headed Cowbird traps, March-July 2021.

Exotic Nuisance Species Captures in Brown-headed Cowbird Traps, March-July 2021

2021 Exotic Nuisance Species**		USFWS/USACE/SARM Project														SBVMWD		IERCD/SBCTA		Rivers and Lands Conservancy		NORTH COUNTY BRS PROJECT, LLC		2021 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			
Common Name	Scientific Name	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed
European Starling	*Sturnus vulgaris*	2	5	0	0	0	0	0	1	824	469	4	84	67	26	4	3	0	3	0	0	0	0	**901**	**591**
House Sparrow	*Passer domesticus*	0	5	5	0	7	17	0	0	19	165	0	0	6	106	38	15	0	61	5	0	0	0	**80**	**369**
TOTAL		**2**	**10**	**5**	**0**	**7**	**17**	**0**	**1**	**843**	**634**	**4**	**84**	**73**	**132**	**42**	**18**	**0**	**64**	**5**	**0**	**0**	**0**	**981**	**960**

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

Table 8. Brown-headed Cowbird trapping results, winter 2020-2021.

Site Name	Trap/Location	Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
Prado	Euclid 1	8/3/20-3/12/21	122	1,228	361	496	371	**7.02**	**10.07**
	Euclid 2	8/3/20-3/12/21	121	1,129	343	448	338	**6.54**	**9.33**
	Weststeyn 1	8/3/20-3/12/21	119	1,727	350	503	874	**7.17**	**14.51**
	Weststeyn 2	8/3/20-3/12/21	117	717	113	244	360	**3.05**	**6.13**
Subtotal			**479**	**4,801**	**1167**	**1691**	**1943**	**5.97**	**10.02**
San Jacinto	Tuls 1	8/3/20-3/12/21	126	653	173	237	243	**3.25**	**5.18**
	Scott Bros	8/3/20-3/12/21	124	1,244	496	419	329	**7.38**	**10.03**
Subtotal			**250**	**1,897**	**669**	**656**	**572**	**5.30**	**7.59**
GRAND TOTAL			**729**	**6,698**	**1836**	**2347**	**2515**	**5.74**	**9.19**

Table 9. Non-target avian captures in Brown-headed Cowbird traps, winter 2020-2021.

2020-2021 Winter Non-target Species		Prado		San Jacinto		Total	
Common Name	**Scientific Name**	**caught**	**died**	**caught**	**died**	**caught**	**died**
Northern Mockingbird	*Mimus polyglottos*	0	0	1	0	1	0
Song Sparrow	*Melospiza melodia*	2	0	0	0	2	0
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	2	0	1	0	3	0
Red-winged Blackbird	*Agelaius phoeniceus*	38	1	65	5	103	6
Tricolored Blackbird	*Agelaius tricolor*	6	0	2	0	8	0
Brewer's Blackbird	*Euphagus cyanocephalus*	0	0	2	0	2	0
Great-tailed Grackle	*Quiscalus mexicanus*	1	0	0	0	1	0
TOTAL		**49**	**1**	**71**	**5**	**120**	**6**
#/trap day		**0.10**		**0.28**		**0.16**	
Mortality %			**2.04%**		**7.04%**		**5.00%**

Exotic nuisance species captures in Brown-headed Cowbird traps, winter 2020-2021.

2020-2021 Winter Exotic Nuisance Species		Prado		San Jacinto		Total	
Common Name	**Scientific Name**	**released**	**removed**	**released**	**removed**	**released**	**removed**
House Sparrow	*Passer domesticus*	10	182	0	3	10	185
European Starling	*Sturnus vulgaris*	194	15	176	71	370	86
TOTAL		**204**	**197**	**176**	**74**	**380**	**271**

APPENDIX A – SURVEY SITES, STARTING AND ENDING COORDINATES

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

Monitored Locations

Survey Site	Starting Coordinates	Ending Coordinates
San Jacinto:		
-San Jacinto River	506079, 3738423	493412, 3746014
-San Jacinto Wildlife Area	488055, 3745444	490979, 3750919
San Timoteo Canyon:		
-Riverside County	487217, 3760509	499865, 3753848
-San Bernardino County	481628, 3764975	484320, 3763100
Santa Ana River (SAR):		
-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
Santa Ana Canyon (SAC):		
-Upper Canyon	441121, 3749692	438609, 3749795
-Green River Golf Club	438609, 3749795	436613, 3748409
-Featherly Park	436604, 3748585	429512, 3747922

Sampled Locations and Incidental Sighting Locations

Survey Site	Starting Coordinates	Ending Coordinates
Santa Ana River & Tributaries:		
Alessandro Arroyo/Prenda Arroyo	465500, 3754365	470391, 3751168
	465354, 3752493	468066, 3751913
Box Springs	471086, 3757494	472592, 3756430
Burris Basin[3]	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[2]	422957, 3752929	425648, 3754031
Castleview 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)[2]	435061, 3757365	435376, 3753499

Sampled Locations and Incidental Sighting Locations (cont.)

Survey Site	Starting Coordinates	Ending Coordinates
Chino Hills State Park (Lower Aliso Cyn)[2]	435288, 3753302	438033, 3749528
Chino Hills State Park (Telegraph Cyn)[2]	434818, 3753694	424101, 3753165
Chino Hills State Park (Upper Aliso Cyn)[2]	435111, 3753336	433834, 3755029
Cielo Vista[3]	429825, 3750579	429883, 3750566
City Creek (Highland)[2]	482136, 3775290	482454, 3777612
Conrock Basin (FHQ)[3]	423314, 3746089	423465, 3746370
Fresno Canyon[2]	440631, 3748012	440954, 3749370
Golden Star	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
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)	471761, 3749213	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 to Jurupa) [2]	457145, 3757620	457172, 3757560
Ryan Bonaminio Park[2]	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	473225, 3753435
Talbert Park (Orange County)	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	464548, 3751638	464847, 3751471
Wyle Labs (at El Paso only)	450013, 3751824	451547, 3752543
Yorba Linda (San Antonio Rd)[2]	429199, 3750653	429494, 3751473
Yorba Linda (Starlight Dr.)	431058, 3749142	431153, 3750250
Yorba Linda Lakebed Park	424692, 3749150	425273, 3748223
San Jacinto River Sub-watershed:		
Cottonwood Canyon[2]	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	498156, 3747889	497980, 3747499

Santiago Creek Sub-watershed:

Irvine Lake[3]	432717, 3736629	434691, 3737547

Sampled Locations and Incidental Sighting Locations (cont.)

Survey Site	Starting Coordinates	Ending Coordinates
Irvine Trust Management Area	429808, 3738428	429834, 3738307
Limestone Canyon[2]	434012, 3736548	434897, 3735784
Peter's Canyon	429752, 3738563	428604, 3735584
Santiago Basin[3]	424716, 3740614	425842, 3741365
Santiago Canyon (Irvine Park)	430063, 3740268	428977, 3741769
Santiago Canyon (lower channel)	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 vireos 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, 2000-2021

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, 2000-2021 (sites vary by year).

	Parameter	2000-2016 (n=17)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	983	1,039	1,110	1,293	1,096	n/a
B.	Number of known pairs	4,601	560	565	615	714	630	7,685
C.	Number of known breeding (nesting) pairs	3,869	486	418	528	590	510	6,401
D.	Number of breeding pairs that were well-monitored throughout the season	1,338	135	148	151	247	189	2,208
E.	Number of known fledged young observed	7,245	994	691	1,189	1,202	864	12,185
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	3,630	490	363	581	692	500	6,256
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.9	2.0	1.7	2.3	2.0	1.7	1.9
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.7	3.6	2.5	3.8	2.8	2.6	2.8
I.	Number of nests that were discovered	2,824	316	333	420	520	412	4,825
J.	Number of well-tracked nests	2,339	279	267	364	455	336	4,040
K.	Number of successful well-tracked nests	59% 1,374 / 2,339	62% 172 / 279	52% 140 / 267	62% 225 / 364	53% 241 / 455	52% 174 / 336	58% 2,326 / 4,040
L.	Rate of cowbird parasitism (well-tracked nests)[1]	11% 248 / 2,339	5% 13 / 279	3% 9 / 267	10% 32 / 316	8% 32 / 384	11% 30 / 278	9% 364 / 4,250
	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 109 / 2,339	4% 11 / 279	4% 10 / 267	6% 22 / 364	4% 16 / 455	7% 22 / 336	5% 190 / 4,040
	B. Number of well-tracked nests that failed as a result of parasitism	3% 77 / 2,339	2% 6 / 279	1% 2 / 267	4% 13 / 364	2% 8 / 455	2% 7 / 336	3% 113 / 4,040
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 772 / 2,339	31% 86 / 279	42% 113 / 267	29% 104 / 364	36% 165 / 455	36% 120 / 336	34% 1,360 / 4,040
M.	D. Number of well-tracked nests that failed for unknown reasons	<1% 7 / 2,339	1% 4 / 279	1% 2 / 267	0% 0 / 364	5% 24 / 455	4% 13 / 336	1% 50 / 4,040
N.	Average clutch size	n/a	3.7	3.4	3.7	3.6	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	317	13	12	33	35	39	449
P.	Number of 'manipulated' parasitized nests[2]	202	11	9	26	30	26	304
Q.	Number of successful 'manipulated' nests[2]	47% 95 / 202	9% 1 / 11	44% 4 / 9	46% 12 / 26	33% 10 / 30	62% 16 / 26	45% 138 / 304
R.	Number of vireo fledged from 'manipulated' nests[2]	204	3	9	26	21	35	298
S.	Number of cowbird young fledged by vireo observed	15	2	0	1	0	0	18
T.	Number of repaired nests	34	3	4	6	16	10	73
U.	% of successful repaired nests	74% 25 / 34	33% 1 / 3	50% 2 / 4	67% 4 / 6	63% 10 / 16	40% 4 / 10	63% 46 / 73
V.	Number of vireo fledged from repaired nests	70	4	6	9	27	9	125
W.	Number of cowbirds removed from study area[3]	34,670	1,953	2,637	2,345	2,292	1,988	45,885
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)[3]	81,841	4,061	3,096	3,119	3,581	4,628	100,326
Y.	Average number of cowbirds trapped per day (W/X)	0.42	0.48	0.85	0.75	0.64	0.43	0.46

[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, 2000-2021.

Host Plant Species (listed in taxonomic order)	2001-2016	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Giant Reed[ie] (*Arundo donax*)	1		1	1	1	4	8	<1%
Western Sycamore (*Platanus racemosa*)	6	3	2	2	4	10	27	1%
Coulter's Matilija Poppy[r] (*Romneya coulteri*)	1						1	<1%
Golden Currant (*Ribes aureum*)	5						5	<1%
Desert Wild Grape (*Vitis girdiana*)	126	21	19	27	21	19	233	5%
Fremont Cottonwood (*Populus fremontii*)	110	14	21	17	45	33	240	5%
Dead Fremont Cottonwood (*Populus fremontii*)	2						2	<1%
Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)	3						3	<1%
Narrowleaf Willow (*Salix exigua*)	112	20	26	40	42	28	268	6%
Dead Narrowleaf Willow (*Salix exigua*)	1				1		2	<1%
Goodding's Black Willow (*Salix gooddingii*)	319	28	24	35	35	40	481	10%
Dead Goodding's Black Willlow (*Salix gooddingii*)	1						1	<1%
Dead Goodding's Black Willow covered with living Goodding's Black Willow	1						1	<1%
Red Willow (*Salix laevigata*)	280	30	22	31	35	34	432	9%
Arroyo Willow (*Salix lasiolepis*)	527	73	62	69	98	69	898	19%
Dead Arroyo Willow (*Salix lasiolepis*)	1		1	1			3	<1%
Pacific Willow (*Salix lasiandra*)	19			2	6	3	30	1%
Willow sp. (*Salix* sp.)	8		3		3	5	19	<1%
Dead Willow sp. (*Salix* sp.)	4	1					5	<1%
Castor bean[ie] (*Ricinus communis*)	1	1					2	<1%
Bank Catclaw[e] (*Acacia redolens*)	1						1	<1%
Western False Indigo (*Amorpha fruticosa*)	1			1			2	<1%
Blue Palo Verde (*Parkinsonia florida*)	0			1	1		2	<1%
Asian Pear[e] (*Cydonia oblonga*)	0			1	1		2	<1%
Toyon (*Heteromeles arbutifolia*)	27	1		1			29	1%
Holly Leaf Cherry (*Prunus ilicifolia*)	1				1		2	<1%
California Wild Rose (*Rosa californica*)	7	1	1	1	1	2	13	<1%
California Blackberry (*Rubus ursinus*)	1	2			5	6	14	<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, 2000-2021.

Host Plant Species (listed in taxonomic order)	2001-2016	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Chinese Elm[e] (*Ulmus parvifolia*)	1						1	<1%
Fig[e] (*Ficus* sp.)	1						1	<1%
White Mulberry[e] (*Morus alba*)	1			2	2	2	7	<1%
Hoary Nettle (*Urtica dioica*)	1			1			2	<1%
Wild Cucumber (*Marah macrocarpa*)	0				1		1	<1%
Coast Live Oak (*Quercus agrifolia*)	2					3	5	<1%
California Scrub Oak (*Quercus berberidifolia*)	6		1	1	4	2	14	<1%
Oak sp. (*Quercus* sp.)	1						1	<1%
Southern California Black Walnut[r] (*Juglans californica)*	12	5	1	1	2	1	22	<1%
White Alder (*Alnus rhombifolia*)	1	1					2	<1%
Laurel Sumac (*Malosma laurina*)	14	6	9	8	11	9	57	1%
Fragrant Sumac (*Rhus aromatica*)	1						1	<1%
Sugar Sumac (*Rhus ovata*)	2		1				3	<1%
Peruvian Pepper Tree[ie] (*Schinus molle*)	12	3	4	1	3	3	26	1%
Brazilian Pepper Tree[ie] (*Schinus terebinthifolius*)	1						1	<1%
Poison Oak (*Toxicodendron diversilobum*)	22	2		1	3	3	31	1%
Boxelder (*Acer negundo*)	2						2	<1%
Carrotwood[e] (*Cupaniopsis anacardioides*)	0				1		1	<1%
Orange Tree[e] (*Citrus sinensis*)	3				1		4	<1%
Tree of Heaven[ie] (*Ailanthus altissima*)	1		1	1			3	<1%
Bush mallow sp. (*Malacothamnus* sp.)	0					1	1	<1%
Chaparral Mallow (*Malacothamnus fasciculatus*)	0			1	2		3	<1%
Black Mustard[ie] (*Brassica nigra*)	12			7	3	1	23	<1%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	6			1	2		9	<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, 2000-2021.

Host Plant Species (listed in taxonomic order)	2001-2016	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Dead Perennial Pepperweed[ie] (*Lepidium latifolium*)	1						1	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	9	1	5	6	7	2	30	1%
Cape Leadwort[e] (*Plumbago auriculata*)	2						2	<1%
Fourwing Saltbush (*Atriplex canescens*)	2			2	1		5	<1%
Big Saltbush (*Atriplex lentiformis*)	0					2	2	<1%
Summer Cypress[e] (*Kochia scoparia*)	0				1		1	<1%
Arizona Ash (*Fraxinus velutina*)	0				1		1	<1%
Ash sp. (*Fraxinus* sp.)	1				3	2	6	<1%
Privet sp.[e] (*Ligustrum* sp.)	1			1			2	<1%
Olive[e] (*Olea europaea*)	0			1			1	<1%
Lollypop Tree[ie] (*Myoporum laetum*)	1						1	<1%
Black Sage (*Salvia mellifera*)	1		1				2	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	1		1	2	1		5	<1%
California Sagebrush (*Artemisia californica*)	1		1			1	3	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	24			2	2	2	30	1%
Coyote Brush (*Baccharis pilularis*)	11	2	4	13	5	5	40	1%
Mulefat (*Baccharis salicifolia*)	781	75	93	62	106	89	1,206	25%
Dead Mulefat (*Baccharis salicifolia*)	7	1					8	<1%
Willow Baccharis (*Baccharis salicina*)	3						3	<1%
Desertbroom Baccharis (*Baccharis sarothroides*)	1						1	<1%
Yellowspine Thistle[ie] (*Cirsium ochrocentrum*)	2						2	<1%
Brittlebush (*Encelia farinosa*)	1			2			3	<1%
Common Sunflower (*Helianthus annuus*)	1				1		2	<1%
Arrowweed (*Pluchea sericea*)	3	1	1	2	2		9	<1%
Spanish False Fleabane[e] (*Pulicaria paludosa*)	0					1	1	<1%
Milk Thistle[ie] (*Silybum marianum*)	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, 2000-2021.

Host Plant Species (listed in taxonomic order)	2001-2016	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Rough Cockelburr (*Xanthium strumarium*)	2						2	<1%
Wild Celery[a] (*Apium graveolens*)	1						1	<1%
Poison Hemlock[ie] (*Conium maculatum*)	11			6	12		29	1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	162	13	5	36	30	20	266	6%
Dead Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	0	1					1	<1%
Fiddleneck sp. (*Amsinckia* sp.)	1						1	<1%
Thickleaf Yerba Santa (*Eriodictyon crassifolium*)	3					1	4	<1%
Yerba Santa sp. (*Eriodictyon* sp.)	1						1	<1%
Fresh water reed (*Typha* sp.) and Arroyo Willow (*S. lasiolepis*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Goodding's Black Willow (*S. gooddingii*)	1		1				2	<1%
Desert Wild Grape (*V. girdiana*) and Arroyo Willow (*S. lasiolepis*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and California Wild Rose (*R. californica*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Peruvian Pepper Tree[ie] (*S. molle*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	4	1					5	<1%
Desert Wild Grape (*V. girdiana*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Dead Goodding's Black Willow (*S. gooddingii*) and Hoary Nettle (*U. dioica*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Perennial Pepperweed[ie] (*L. latifolium*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Poison Hemlock[ie] (*C. maculatum*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Red Willow (*S. laevigata*) and Wild Cucumber (*Marah macrocarpa*)	0	1					1	<1%
Arroyo Willow (*S. lasiolepis*) and dead Hoary Nettle (*U. dioica*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and Black Mustard[ie] (*B. nigra*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and Sweet Fennel[ie] (*Foeniculum vulgare*)	1						1	<1%
Willow sp. (*Salix* sp.) and California Blackberry (*Rubus ursinus*)	1						1	<1%
Willow sp. (*Salix* sp.) and Perennial Pepperweed[ie] (*L. latifolium*)	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, 2000-2021.

Host Plant Species (listed in taxonomic order)	2001-2016	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Castor bean[ie] (*R. communis*) and Mulefat (*B. salicifolia*)	1						1	<1%
California Blackberry (*Rubus ursinus*) and dead unknown	0				1		1	<1%
Black Mustard[ie] (*B. nigra*) and Poison Hemlock[ie] (*C. maculatum*)	0			1			1	<1%
Black Mustard[ie] (*B. nigra*) and Mulefat (*B. salicifolia*)	1						1	<1%
Coyote Brush (*B. pilularis*) and Mulefat (*B. salicifolia*)	1						1	<1%
Mulefat (*B. salicifolia*) and Poison Hemlock[ie] (*C. maculatum*)	2						2	<1%
Deadfall	5				6	7	18	<1%
Unknown/No data	23	4	22	29	6	2	86	2%
Total	**2,756**	**312**	**333**	**420**	**520**	**412**	4,753	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive

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

Appendix B-3: Brown-headed Cowbird Trapping Effort and Results, 2000-2021.							
Parameter	2000-2016*	2017	2018	2019	2020	2021	Combined*
Fall/Winter[1]							
Number of Traps	n/a	7	4	4	7	6	n/a
Number of Trap Days	n/a	871	598	666	639	729	n/a
Number of Males Removed	n/a	1,357	853	1,784	1,656	1,836	n/a
Number of Females Removed	n/a	2,322	1,656	2,379	1,506	2,347	n/a
Number of Juveniles Removed	n/a	2,580	1,384	1,842	1,626	2,515	n/a
Total Number of Cowbirds Removed	67,435	6,259	3,893	6,005	4,788	6,698	95,078
Spring/Summer[2]							
Number of Traps	763	43	39	42	44	50	981
Number of Trap Days	83,131	5,209	4,182	4,686	4,925	6,231	108,364
Number of Males Removed	21,281	1,633	2,234	2,035	2,596	2,210	31,989
Number of Females Removed	9,720	742	724	843	1,003	1,395	14,427
Number of Juveniles Removed	3,965	269	90	191	358	151	5,024
Total Number of Cowbirds Removed	34,966	2,644	3,048	3,069	3,957	3,756	51,440
Total							
Number of Trap Days	n/a	6,080	4,780	5,352	5,564	6,960	n/a
Number of Cowbirds Removed	102,401	8,903	6,941	9,074	8,745	10,454	146,518
Average Number of Cowbirds Removed Per Day	n/a	1.46	1.45	1.70	1.57	1.50	n/a

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

[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, 2000-2021

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	2000-2016 (n=17 years)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	45	74	63	108	91	n/a
B.	Number of known pairs	194	27	34	44	83	52	434
C.	Number of known breeding (nesting) pairs	156	25	30	44	72	27	354
D.	Number of breeding pairs that were well-monitored throughout the breeding season	50	8	18	7	29	0	112
E.	Number of known fledged young observed	270	48	60	117	145	24	664
F.	Number of known fledged young produced by pairs monitored	133	22	40	35	77	n/a	307
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.7	1.9	2	2.7	2.0	0.9	1.9
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.7	2.8	2.2	5.0	2.7	n/a	2.7
I.	Number of nests that were discovered	123	17	38	47	69	20	314
J.	Number of well-tracked nests	102	11	30	35	56	0	234
K.	Number of successful well-tracked nests	51% 52 / 102	64% 7 / 11	63% 19 / 30	69% 24 / 35	63% 35 / 56	n/a	59% 137 / 234
L.	Rate of cowbird parasitism (well-tracked nests)[1]	15% 15 / 102	9% 1 / 11	10% 3 / 30	26% 5 / 19	15% 7 / 46	n/a	15% 31 / 208
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 4 / 102	9% 1 / 11	7% 2 / 30	3% 1 / 35	4% 2 / 56	n/a	4% 10 / 234
	B. Number of well-tracked nests that failed as a result of parasitism	7% 7 / 102	9% 1 / 11	7% 2 / 30	3% 1 / 35	4% 2 / 56	n/a	6% 13 / 234
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	38% 39 / 102	18% 2 / 11	23% 7 / 30	26% 9 / 35	27% 15 / 56	n/a	31% 72 / 234
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 102	0% 0 / 11	0% 0 / 30	0% 0 / 35	4% 2 / 56	n/a	1% 2 / 234
N.	Average clutch size	n/a	3.8	3	3.5	3.5	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	20	1	3	6	9	6	45
P.	Number of 'manipulated' parasitized nests[2]	11	0	3	6	7	n/a	27
Q.	Number of successful 'manipulated' nests[2]	45% 5 / 11	n/a	33% 1 / 3	67% 4 / 6	29% 2 / 7	n/a	44% 12 / 27
R.	Number of vireo fledged from 'manipulated' nests[2]	13	n/a	1	11	4	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	0	2	0	5
U.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	50% 1 / 2	n/a	80% 4 / 5
V.	Number of vireo fledged from repaired nests	10	n/a	n/a	n/a	1	n/a	11
W.	Numbers of cowbirds removed from study area	21,182	1,405	2,099	1,774	1,674	1,376	29,510
X..	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	11,764	589	659	480	586	719	14,797
Y.	Average number of cowbirds trapped per trap day (W/X)	1.80	2.39	3.19	3.70	2.86	1.91	1.99

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

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	2000-2016 (n=17)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	172	156	124	139	118	n/a
B.	Number of known pairs	1,099	109	104	92	105	83	1,592
C.	Number of known breeding (nesting) pairs	928	99	85	75	86	69	1,342
D.	Number of breeding pairs that were well-monitored throughout the season	448	48	30	39	58	43	666
E.	Number of known fledged young observed	2,013	272	161	170	207	149	2,972
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	1,306	202	86	123	173	117	2,007
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.2	2.7	1.9	2.3	2.4	2.2	2.2
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.9	4.2	2.9	3.2	3.0	2.7	3.0
I.	Number of nests that were discovered	948	94	75	96	104	79	1,396
J.	Number of well-tracked nests	844	91	63	90	99	77	1,264
K.	Number of successful well-tracked nests	56% 476 / 844	63% 57 / 91	44% 28 / 63	44% 40 / 90	52% 51 / 99	49% 38 / 77	55% 690 / 1,264
L.	Rate of cowbird parasitism (well-tracked nests)[1]	14% 114 / 844	1% 1 / 91	0% 0 / 63	15% 12 / 80	0% 0 / 85	0% 0 / 62	10% 127 / 1,225
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 42 / 844	2% 2 / 91	8% 5 / 63	4% 4 / 90	6% 6 / 99	9% 7 / 77	5% 66 / 1,264
	B. Number of well-tracked nests that failed as a result of parasitism	3% 28 / 844	0% 0 / 91	0% 0 / 63	8% 7 / 90	0% 0 / 99	0% 0 / 77	3% 35 / 1,264
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	35% 295 / 844	35% 32 / 91	48% 30 / 63	43% 39 / 90	34% 34 / 99	36% 28 / 77	36% 458 / 1,264
	D. Number of well-tracked nests that failed for unknown reasons	<1% 3 / 844	0% 0 / 91	0% 0 / 63	0% 0 / 90	8% 8 / 99	5% 4 / 77	1% 15 / 1,264
N.	Average clutch size	n/a	3.8	3.4	3.7	3.6	3.6	n/a
O.	Number of cowbird eggs found in or near vireo nests	135	1	2	12	0	0	150
P.	Number of 'manipulated' parasitized nests	93	1	n/a	8	n/a	n/a	102
Q.	Number of successful 'manipulated' nests	51% 47 / 93	0% 0 / 1	n/a	38% 3 / 8	n/a	n/a	49% 50 / 102
R.	Number of vireo fledged from 'manipulated' nests	102	0	n/a	4	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	8	1	1	3	4	3	20
U.	% of successful repaired nests	75% 6 / 8	0% 0 / 1	0 0 / 1	33% 1 / 3	75% 3 / 4	33% 1 / 3	55% 11 / 20
V.	Number of vireo fledged from repaired nests	18	0	0	3	11	3	35
W.	Numbers of cowbirds removed from study area	2,475	93	88	72	139	76	2,943
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	13,833	794	574	500	700	758	17,159
Y.	Average number of cowbirds trapped per trap day (W/X)	0.18	0.12	0.15	0.14	0.20	0.10	0.17

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

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	2004-2016 (n=13)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	16	20	14	14	13	n/a
B.	Number of known pairs	102	9	2	2	9	8	132
C.	Number of known breeding (nesting) pairs	81	8	2	2	7	6	106
D.	Number of breeding pairs that were well-monitored throughout the season	13	3	0	0	6	0	22
E.	Number of known fledged young observed	163	23	2	2	24	4	218
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	60	9	n/a	n/a	22	n/a	91
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.0	2.9	n/a	n/a	3.4	0.7	2.1
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	4.6	3.0	n/a	n/a	3.7	n/a	4.1
I.	Number of nests that were discovered	26	5	0	0	8	3	42
J.	Number of well-tracked nests	25	5	n/a	0	8	0	38
K.	Number of successful well-tracked nests	72% 18 / 25	100% 5 / 5	n/a	n/a	88% 7 / 8	n/a	79% 30 / 38
L.	Rate of cowbird parasitism (well-tracked nests)[1]	0% 0 / 25	0% 0 / 5	n/a	n/a	0% 0 / 8	n/a	0% 0 / 38
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 25	0% 0 / 5	n/a	n/a	13% 1 / 8	n/a	3% 1 / 38
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 25	0% 0 / 5	n/a	n/a	0% 0 / 8	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	28% 7 / 25	0% 0 / 5	n/a	n/a	0% 0 / 8	n/a	18% 7 / 38
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 25	0% 0 / 5	n/a	n/a	0% 0 / 8	n/a	0% 0% / 38
N.	Average clutch size	n/a	3.8	n/a	n/a	3.8	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	1	0	n/a	n/a	0	0	1
P.	Number of 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	0	0	n/a	n/a	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	219	18	6	5	10	22	280
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,854	260	221	248	238	270	4,091
Y.	Average number of cowbirds trapped per trap day W/X)	0.08	0.07	0.03	0.02	0.04	0.08	0.07

*Former March SKR Preserve

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

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	2003-2016 (n=14)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	29	43	43	45	37	n/a
B.	Number of known pairs	273	15	15	19	17	16	355
C.	Number of known breeding (nesting) pairs	234	13	10	12	14	12	295
D.	Number of breeding pairs that were well-monitored throughout the season	65	0	0	3	9	0	77
E.	Number of known fledged young observed	426	15	10	24	26	8	509
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	197	n/a	n/a	3	20	n/a	220
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	1.2	n/a	2.0	1.9	0.7	1.7
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	3.0	n/a	n/a	1.0	2.2	n/a	2.9
I.	Number of nests that were discovered	183	2	0	12	18	5	220
J.	Number of well-tracked nests	156	2	n/a	11	17	0	186
K.	Number of successful well-tracked nests	53% 83 / 156	50% 1 / 2	n/a	36% 4 / 11	35% 6 / 17	n/a	51% 94 / 186
L.	Rate of cowbird parasitism (well-tracked nests)[1]	10% 16 / 156	0% 0 / 2	n/a	22% 2 / 9	6% 1 / 17	n/a	10% 19 / 184
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 11 / 156	0% 0 / 2	n/a	9% 1 / 11	6% 1 / 17	n/a	7% 13 / 186
	B. Number of well-tracked nests that failed as a result of parasitism	4% 6 / 156	0% 0 / 2	n/a	9% 1 / 11	0% 0 / 17	n/a	4% 7 / 186
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	35% 54 / 156	50% 1 / 2	n/a	45% 5 / 11	53% 9 / 17	n/a	37% 69 / 186
	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 156	0% 0 / 2	n/a	0 0 / 11	6% 1 / 17	n/a	2% 3 / 186
N.	Average clutch size	n/a	3.5	n/a	3.8	3.6	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	29	0	n/a	2	1	0	32
P.	Number of 'manipulated' parasitized nests[2]	13	n/a	n/a	1	1	n/a	15
Q.	Number of successful 'manipulated' nests[2]	31% 4 / 13	n/a	n/a	0% 0 / 1	0% 0 / 1	n/a	27% 4 / 15
R.	Number of vireo fledged from 'manipulated' nests[2]	8	n/a	n/a	0	0	n/a	8
S.	Number of cowbird young fledged by vireo observed	1	0	n/a	0	0	0	1
T.	Number of repaired nests	3	0	n/a	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	1,967	84	52	73	89	84	2,349
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	9,842	451	295	383	500	530	12,001
Y.	Average number of cowbirds trapped per trap day (W/X)	0.20	0.19	0.18	0.19	0.18	0.16	0.20

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

* Correction made after the release of the 2020 report

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	2002-2016 (n=15)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	155	164	166	128	154	n/a
B.	Number of known pairs	350	95	96	72	54	78	745
C.	Number of known breeding (nesting) pairs	280	87	68	58	43	55	591
D.	Number of breeding pairs that were well-monitored throughout the season	79	27	12	8	0	8	134
E.	Number of known fledged young observed	488	169	95	82	55	58	947
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	207	78	24	11	n/a	6	326
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.7	1.9	1.4	1.4	1.3	1.1	1.6
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.6	2.9	2	1.4	n/a	0.8	2.4
I.	Number of nests that were discovered	156	58	32	24	18	15	303
J.	Number of well-tracked nests	114	46	24	18	3	13	218
K.	Number of successful well-tracked nests	67% 76 / 114	59% 27 / 46	63% 15 / 24	39% 7 / 18	0% 0 / 3	15% 2 / 13	58% 127 / 218
L.	Rate of cowbird parasitism (well-tracked nests)[1]	14% 16 / 114	13% 6 / 46	21% 5 / 24	41% 7 / 17	n/a	20% 2 / 10	17% 36 / 211
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 3 / 114	7% 3 / 46	0% 0 / 24	22% 4 / 18	0% 0 / 3	15% 2 / 13	6% 12 / 218
	B. Number of well-tracked nests that failed as a result of parasitism	6% 7 / 114	9% 4 / 46	0% 0 / 24	17% 3 / 18	0% 0 / 3	0% 0 / 13	6% 14 / 218
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	25% 28 / 114	26% 12 / 46	38% 9 / 24	22% 4 / 18	100% 3 / 3	54% 7 / 13	29% 63 / 218
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 114	0% 0 / 46	0% 0 / 24	0% 0 / 18	0% 0 / 3	15% 2 / 13	1% 2 / 218
N.	Average clutch size	n/a	3.7	3.2	4.0	n/a	3.2	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	21	6	6	7	0	2	42
P.	Number of 'manipulated' parasitized nests[2]	14	6	5	5	n/a	2	32
Q.	Number of successful 'manipulated' nests[2]	21% 3 / 14	0% 0 / 6	60% 3 / 5	20% 1 / 5	n/a	0% 0 / 2	22% 7 / 32
R.	Number of vireo fledged from 'manipulated' nests[2]	7	0	8	3	n/a	0	18
S.	Number of cowbird young fledged by vireo observed	3	1	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	n/a	n/a	n/a	n/a	n/a	n/a	0
W.	Numbers of cowbirds removed from study area	719	46	14	43	25	46	893
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	6,880	513	266	401	359	724	9,143
Y.	Average number of cowbirds trapped per trap day (W/X)	0.10	0.09	0.05	0.11	0.07	0.06	0.10

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

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	2009-2016 (n=8)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	36	62	78	94	61	n/a
B.	Number of known pairs	88	17	38	37	61	38	279
C.	Number of known breeding (nesting) pairs	56	16	35	31	42	35	215
D.	Number of breeding pairs that were well-monitored throughout the season	13	6	11	0	0	0	30
E.	Number of known fledged young observed	99	34	65	41	74	39	352
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	33	24	35	n/a	n/a	n/a	92
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	2.1	1.9	n/a	1.7	1.1	1.6
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.5	4.0	3.2	n/a	n/a	n/a	3.1
I.	Number of nests that were discovered	21	11	25	1	13	21	92
J.	Number of well-tracked nests	17	10	25	0	0	0	52
K.	Number of successful well-tracked nests	59% 10 / 17	70% 7 / 10	56% 14 / 25	n/a	n/a	n/a	60% 31 / 52
L.	Rate of cowbird parasitism (well-tracked nests)[1]	18% 3 / 17	20% 2 / 10	0% 0 / 25	n/a	n/a	n/a	10% 5 / 52
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 17	0% 0 / 10	0% 0 / 25	n/a	n/a	n/a	0% 0 / 52
	B. Number of well-tracked nests that failed as a result of parasitism	18% 3 / 17	10% 1 / 10	0% 0 / 25	n/a	n/a	n/a	8% 4 / 52
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	18% 3 / 17	20% 2 / 10	44% 11 / 25	n/a	n/a	n/a	31% 16 / 52
	D. Number of well-tracked nests that failed for unknown reasons	6% 1 / 17	0% 0 / 10	0% 0 / 25	n/a	n/a	n/a	2% 1 / 52
N.	Average clutch size	n/a	4.0	3.7	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	4	2	0	n/a	0	0	6
P.	Number of 'manipulated' parasitized nests[2]	2	2	n/a	n/a	n/a	n/a	4
Q.	Number of successful 'manipulated' nests [2]	0% 0 / 2	50% 1 / 2	n/a	n/a	n/a	n/a	25% 1 / 4
R.	Number of vireo fledged from 'manipulated' nests[2]	0	3	n/a	n/a	n/a	n/a	3
S.	Number of cowbird young fledged by vireo observed	0	0	0	n/a	0	0	0
T.	Number of repaired nests	0	0	0	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	n/a	n/a	19	0	13	1	33
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	113	2	68	133	316
Y.	Average number of cowbirds trapped per trap day (W/X)	n/a	n/a	0.2	0	0.19	0.01	0.1

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

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	Combined
A.	Number of territorial males	3	2	3	n/a
B.	Number of known pairs	1	1	3	5
C.	Number of known breeding (nesting) pairs	1	1	2	4
D.	Number of breeding pairs that were well-monitored throughout the breeding season	1	0	1	2
E.	Number of known fledged young observed	0	1	3	4
F.	Number of known fledged young produced by pairs monitored	0	n/a	2	2
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	0	1.0	1.5	1.0
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	0	n/a	2.0	1.0
I.	Number of nests that were discovered	1	0	2	3
J.	Number of well-tracked nests	1	n/a	2	3
K.	Number of successful well-tracked nests	0% 0 / 1	n/a	100% 2 / 2	67% 2 / 3
L.	Rate of cowbird parasitism (well-tracked nests)[1]	0% 0 / 1	n/a	0% 0 / 2	0% 0 / 3
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 / 3
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 1	n/a	0% 0 / 2	0% 0 / 3
	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	33% 1 / 3
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 1	n/a	0% 0 / 2	0% 0 / 3
N.	Average clutch size	4.0	n/a	3.0	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	0	n/a	0	0
P.	Number of 'manipulated' parasitized nests[2]	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests[2]	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests[2]	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	0	0	0
T.	Number of repaired nests	0	n/a	0	0
U.	% of successful repaired nests	n/a	n/a	n/a	n/a
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a
W.	Numbers of cowbirds removed from study area	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
Y.	Average number of cowbirds trapped per trap day (W/X)	n/a	n/a	n/a	n/a

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

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	2000-2016 (n=17)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	871	123	141	140	176	159	n/a
B.	Number of known pairs	513	67	60	79	102	118	939
C.	Number of known breeding (nesting) pairs	449	54	46	77	91	97	814
D.	Number of breeding pairs that were well-monitored throughout the season	92	4	28	39	51	53	267
E.	Number of known fledged young observed	759	87	88	209	187	200	1,530
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	238	19	67	148	126	156	754
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.7	1.6	1.9	2.7	2.1	2.1	1.9
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.6	4.8	2.4	3.8	2.5	2.9	2.8
I.	Number of nests that were discovered	189	18	47	78	113	109	554
J.	Number of well-tracked nests	147	16	45	76	109	102	495
K.	Number of successful well-tracked nests	66% 97 / 147	44% 7 / 16	49% 22 / 45	63% 48 / 76	46% 50 / 109	54% 55 / 102	56% 279 / 495
L.	Rate of cowbird parasitism (well-tracked nests)[1]	6% 9 / 147	0% 0 / 16	0% 0 / 45	9% 6 / 64	21% 18 / 86	22% 18 / 83	12% 51 / 441
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 4 / 147	0% 0 / 16	4% 2 / 45	3% 2 / 76	0% 0 / 109	3% 3 / 102	2% 11 / 495
	B. Number of well-tracked nests that failed as a result of parasitism	4% 6 / 147	0% 0 / 16	0% 0 / 45	1% 1 / 76	5% 5 / 109	5% 5 / 102	3% 17 / 495
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	27% 40 / 147	44% 7 / 16	47% 21 / 45	33% 25 / 76	43% 47 / 109	34% 35 / 102	35% 175 / 495
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 147	13% 2 / 16	0% 0 / 45	0% 0 / 76	6% 7 / 109	4% 4 / 102	3% 13 / 495
N.	Average clutch size	n/a	3.6	3.5	3.8	3.7	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	10	0	0	6	18	19	53
P.	Number of 'manipulated' parasitized nests[2]	3	n/a	n/a	6	17	14	40
Q.	Number of successful 'manipulated' nests[2]	100% 3 / 3	n/a	n/a	67% 4 / 6	35% 6 / 17	71% 10 / 14	58% 23 / 40
R.	Number of vireo fledged from 'manipulated' nests[2]	8	n/a	n/a	8	11	21	48
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	0	0	1	0	1	2	4
U.	% of successful repaired nests	n/a	n/a	100% 1 / 1	n/a	0% 0 / 1	50% 1 / 2	50% 2 / 4
V.	Number of vireo fledged from repaired nests	n/a	n/a	3	n/a	0	2	5
W.	Number of cowbirds removed from study area	708	n/a	n/a	n/a	1	1	710
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	5,215	n/a	n/a	n/a	61	134	5,410
Y.	Average number of cowbirds trapped per day (W/X)	0.14	n/a	n/a	n/a	0.02	0.01	0.13

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

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

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	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	73	91	90	88	73	n/a
B.	Number of known pairs	558	34	56	58	58	47	811
C.	Number of known breeding (nesting) pairs	523	32	46	52	47	42	742
D.	Number of breeding pairs that were well-monitored throughout the season	179	7	16	10	22	21	255
E.	Number of known fledged young observed	1,032	54	86	110	114	73	1,469
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	541	20	43	41	78	43	766
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.0	1.7	1.9	2.1	2.4	1.7	2.0
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	3.0	2.9	2.7	4.1	3.5	2.0	3.0
I.	Number of nests that were discovered	362	19	28	25	36	41	511
J.	Number of well-tracked nests	306	19	25	24	34	34	442
K.	Number of successful well-tracked nests	66% 201 / 306	68% 13 / 19	64% 16 / 25	71% 17 / 24	68% 23 / 34	44% 15 / 34	64% 285 / 442
L.	Rate of cowbird parasitism (well-tracked nests)[1]	6% 17 / 306	0% 0 / 19	0% 0 / 25	0% 0 / 23	3% 1 / 30	21% 6 / 29	6% 24 / 432
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 13 / 306	0% 0 / 19	0% 0 / 25	8% 2 / 24	6% 2 / 34	3% 1 / 34	4% 18 / 442
	B. Number of well-tracked nests that failed as a result of parasitism	1% 4 / 306	0% 0 / 19	0% 0 / 25	0% 0 / 24	3% 1 / 34	6% 2 / 34	2% 7 / 442
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	28% 87 / 306	32% 6 / 19	36% 9 / 25	21% 5 / 24	24% 8 / 34	44% 15 / 34	29% 130 / 442
	D. Number of well-tracked nests that failed for unknown reasons	0% 1 / 306	0% 0 / 19	0% 0 / 25	0% 0 / 24	0% 0 / 34	3% 1 / 34	0% 2 / 442
N.	Average clutch size	n/a	3.5	3.8	3.6	3.8	3.6	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	23	0	0	0	1	8	32
P.	Number of 'manipulated' parasitized nests[2]	16	n/a	n/a	n/a	0	6	22
Q.	Number of successful 'manipulated' nests[2]	69% 11 / 16	n/a	n/a	n/a	n/a	67% 4 / 6	68% 15 / 22
R.	Number of vireo fledged from 'manipulated' nests[2]	18	n/a	n/a	n/a	n/a	10	28
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	2	1	1	0	1	1	6
U.	% of successful repaired nests	50% 1 / 2	100% 1 / 1	100% 1 / 1	n/a	100% 1 / 1	0% 0 / 1	67% 4 / 6
V.	Number of vireo fledged from repaired nests	4	4	3	n/a	4	0	15
W.	Number of cowbirds removed from study area	568	7	11	2	0	8	596
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,679	129	110	96	4	136	3,154
Y.	Average number of cowbirds trapped per day (W/X)	0.21	0.05	0.10	0.02	0.00	0.06	0.19

*Starting in 2015 Goose Creek Golf Club to I-15 only. Formerly monitored as Goose Creek Golf Club to River Rd. Includes Goose Creek mitigation funded by IERCD.

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

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	2015-2016 (n=2)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	69	36	101	133	113	n/a
B.	Number of known pairs	45	31	17	50	65	48	256
C.	Number of known breeding (nesting) pairs	45	30	17	48	65	47	252
D.	Number of breeding pairs that were well-monitored throughout the season	8	12	13	16	25	22	96
E.	Number of known fledged young observed	88	76	39	139	159	125	626
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	26	42	35	87	81	85	356
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.0	2.5	2.3	2.9	2.4	2.6	2.5
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	3.3	3.5	2.7	5.4	3.2	3.9	3.7
I.	Number of nests that were discovered	26	25	16	35	47	30	179
J.	Number of well-tracked nests	25	22	15	35	43	30	170
K.	Number of successful well-tracked nests	64% 16 / 25	77% 17 / 22	73% 11 / 15	89% 31 / 35	70% 30 / 43	90% 27 / 30	78% 132 / 170
L.	Rate of cowbird parasitism (well-tracked nests)[1]	0% 0 / 25	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 41	0% 0 / 28	0% 0 / 166
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	12% 3 / 25	5% 1 / 22	7% 1 / 15	6% 2 / 35	2% 1 / 43	0% 0 / 30	5% 8 / 170
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 25	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 43	0% 0 / 30	0% 0 / 170
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	24% 6 / 25	18% 4 / 22	20% 3 / 15	6% 2 / 35	26% 11 / 43	10% 3 / 30	17% 29 / 170
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 25	0% 0 / 22	0% 0 / 15	0% 0 / 35	2% 1 / 43	0% 0 / 30	1% 1 / 170
N.	Average clutch size	n/a	3.6	3.6	3.8	3.7	3.8	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	0	0	0	0	0	0	0
P.	Number of 'manipulated' parasitized nests[2]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests[2]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests[2]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	0	0	0	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.	Number of cowbirds removed from study area	n/a	n/a	n/a	2	3	2	7
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	n/a	113	130	128	371
Y.	Average number of cowbirds trapped per day (W/X)	n/a	n/a	n/a	0.02	0.02	0.02	0.02

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

[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

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

Temescal Canyon

	Parameter	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	109	106	127	147	103	n/a
B.	Number of known pairs	445	59	48	56	30	35	673
C.	Number of known breeding (nesting) pairs	355	39	21	40	17	26	498
D.	Number of breeding pairs that were well-monitored throughout the season	118	1	0	0	0	0	119
E.	Number of known fledged young observed	688	48	16	48	20	24	844
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	327	3	n/a	n/a	n/a	n/a	330
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.9	1.2	n/a	n/a	n/a	0.9	1.7
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.8	3.0	n/a	n/a	n/a	n/a	2.8
I.	Number of nests that were discovered	246	16	19	16	0	5	302
J.	Number of well-tracked nests	192	13	0	0	n/a	0	205
K.	Number of successful well-tracked nests	65% 124 / 192	38% 5 / 13	n/a	n/a	n/a	n/a	63% 129 / 205
L.	Rate of cowbird parasitism (well-tracked nests)[1]	16% 31 / 192	23% 3 / 13	n/a	n/a	n/a	n/a	17% 34 / 205
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 5 / 192	15% 2 / 13	n/a	n/a	n/a	n/a	3% 7 / 205
	B. Number of well-tracked nests that failed as a result of parasitism	3% 6 / 192	0% 0 / 13	n/a	n/a	n/a	n/a	3% 6 / 205
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	30% 57 / 192	31% 4 / 13	n/a	n/a	n/a	n/a	30% 61 / 205
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 192	15% 2 / 13	n/a	n/a	n/a	n/a	1% 2 / 205
N.	Average clutch size	n/a	3.3	n/a	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	41	3	n/a	0	n/a	0	44
P.	Number of 'manipulated' parasitized nests[2]	32	2	n/a	n/a	n/a	n/a	34
Q.	Number of successful 'manipulated' nests[2]	47% 15 / 32	0% 0 / 2	n/a	n/a	n/a	n/a	44% 15 / 34
R.	Number of vireo fledged from 'manipulated' nests[2]	34	0	n/a	n/a	n/a	n/a	34
S.	Number of cowbird young fledged by vireo observed	2	1	0	1	0	0	4
T.	Number of repaired nests	3	0	0	0	0	0	3
U.	% of successful repaired nests	67% 2 / 3	n/a	n/a	n/a	n/a	n/a	67% 2 / 3
V.	Number of vireo fledged from repaired nests	3	n/a	n/a	n/a	n/a	n/a	3
W.	Number of cowbirds removed from study area	3,560	240	212	338	324	358	5,032
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	12,159	652	547	579	562	664	15,163
Y.	Average number of cowbirds trapped per day (W/X)	0.29	0.37	0.39	0.58	0.58	0.54	0.33

[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

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

Chino Hills

	Parameter	2003-2016* (14 years)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	25	26	29	36	30	n/a
B.	Number of known pairs	81	7	9	17	10	9	133
C.	Number of known breeding (nesting) pairs	59	3	5	12	6	5	90
D.	Number of breeding pairs that were well-monitored throughout the season	23	0	0	0	0	0	23
E.	Number of known fledged young observed	87	3	3	19	10	5	127
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	32	n/a	n/a	n/a	n/a	n/a	32
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.5	1.0	n/a	n/a	n/a	1.0	1.4
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	1.4	n/a	n/a	n/a	n/a	n/a	1.4
I.	Number of nests that were discovered	40	0	2	1	0	1	44
J.	Number of well-tracked nests	31	n/a	2	0	n/a	0	33
K.	Number of successful well-tracked nests	35% 11 / 31	n/a	0% 0 / 2	n/a	n/a	n/a	33% 11 / 33
L.	Rate of cowbird parasitism (well-tracked nests)[1]	23% 7 / 31	n/a	50% 1 / 2	n/a	n/a	n/a	24% 8 / 33
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	10% 3 / 31	n/a	0% 0 / 2	n/a	n/a	n/a	9% 3 / 33
	B. Number of well-tracked nests that failed as a result of parasitism	6% 2 / 31	n/a	0% 0 / 2	n/a	n/a	n/a	6% 2 / 33
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	48% 15 / 31	n/a	100% 2 / 2	n/a	n/a	n/a	52% 17 / 33
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 31	n/a	0% 0 / 2	n/a	n/a	n/a	0% 0 / 33
N.	Average clutch size	n/a	n/a	n/a	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	10	n/a	1	0	n/a	0	11
P.	Number of 'manipulated' parasitized nests[2]	7	n/a	1	n/a	n/a	n/a	8
Q.	Number of successful 'manipulated' nests[2]	0% 0 / 7	n/a	0% 0 / 1	n/a	n/a	n/a	0% 0 / 8
R.	Number of vireo fledged from 'manipulated' nests[2]	0	n/a	0	n/a	n/a	n/a	0
S.	Number of cowbird young fledged by vireo observed	0	0	0	n/a	0	0	0
T.	Number of repaired nests	0	n/a	1	0	n/a	0	1
U.	% of successful repaired nests	n/a	n/a	0% 0 / 1	n/a	n/a	n/a	0% 0 / 1
V.	Number of vireo fledged from repaired nests	n/a	n/a	0	n/a	n/a	n/a	0
W.	Number of cowbirds removed from study area	194	22	23	-3	n/a	n/a	236
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	1,314	113	92	101	n/a	n/a	1,620
Y.	Average number of cowbirds trapped per day (W/X)	0.15	0.19	0.25	0.00	n/a	n/a	0.15

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

*2016 includes former assessment sites

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) - Upper Canyon

	Parameter	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	30	32	35	45	43	n/a
B.	Number of known pairs	192	21	25	24	30	34	326
C.	Number of known breeding (nesting) pairs	167	18	15	19	27	33	279
D.	Number of breeding pairs that were well-monitored throughout the season	59	1	7	9	8	9	93
E.	Number of known fledged young observed	304	32	23	58	52	50	519
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	154	2	13	37	26	25	257
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	1.8	1.5	3.1	1.9	1.5	1.9
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.6	2.0	1.9	4.1	3.3	2.8	2.8
I.	Number of nests that were discovered	121	6	13	22	14	19	195
J.	Number of well-tracked nests	81	5	10	19	12	17	144
K.	Number of successful well-tracked nests	69% 56 / 81	40% 2 / 5	50% 5 / 10	74% 14 / 19	67% 8 / 12	47% 8 / 17	65% 93 / 144
L.	Rate of cowbird parasitism (well-tracked nests)[1]	5% 4 / 81	0% 0 / 5	0% 0 / 10	0% 0 / 17	0% 0 / 11	0% 0 / 17	3% 4 / 141
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 3 / 81	0% 0 / 5	0% 0 / 10	0% 0 / 19	0% 0 / 12	6% 1 / 17	3% 4 / 144
	B. Number of well-tracked nests that failed as a result of parasitism	2% 2 / 81	0% 0 / 5	0% 0 / 10	0% 0 / 19	0% 0 / 12	0% 0 / 17	1% 2 / 144
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	25% 20 / 81	60% 3 / 5	50% 5 / 10	26% 5 / 19	25% 3 / 12	47% 8 / 17	31% 44 / 144
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 81	0% 0 / 5	0% 0 / 10	0% 0 / 19	8% 1 / 12	0% 0 / 17	1% 1 / 144
N.	Average clutch size	n/a	3.7	3.1	3.7	3.7	3.4	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	4	0	0	0	0	0	4
P.	Number of 'manipulated' parasitized nests[2]	1	n/a	n/a	n/a	n/a	n/a	1
Q.	Number of successful 'manipulated' nests[2]	100% 1 / 1	n/a	n/a	n/a	n/a	n/a	100% 1 / 1
R.	Number of vireo fledged from 'manipulated' nests[2]	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	0	1	0	1	4
U.	% of successful repaired nests	0% 0 / 2	n/a	n/a	100% 1 / 1	n/a	0% 0 / 1	25% 1 / 4
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	3	n/a	0	3
W.	Number of cowbirds removed from study area	706	1	94	41	-1	8	849
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,274	47	118	113	128	127	3,807
Y.	Average number of cowbirds trapped per day (W/X)	0.22	0.02	0.80	0.36	0.00	0.06	0.22

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

Appendix C-1-N. 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	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	42	42	45	61	47	n/a
B.	Number of known pairs	230	33	38	34	42	35	412
C.	Number of known breeding (nesting) pairs	200	30	22	32	31	33	348
D.	Number of breeding pairs that were well-monitored throughout the season	81	7	5	12	22	19	146
E.	Number of known fledged young observed	351	76	20	96	63	63	669
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	180	31	3	51	49	43	357
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.8	2.5	0.9	3.0	2.0	1.9	1.9
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.2	4.4	0.6	4.3	2.2	2.3	2.4
I.	Number of nests that were discovered	145	21	20	33	34	35	288
J.	Number of well-tracked nests	124	17	16	28	33	33	251
K.	Number of successful well-tracked nests	58% 72 / 124	76% 13 / 17	25% 4 / 16	79% 22 / 28	48% 16 / 33	48% 16 / 33	57% 143 / 251
L.	Rate of cowbird parasitism (well-tracked nests)[1]	6% 4 / 124	0% 0 / 17	0% 0 / 16	0% 0 / 26	17% 5 / 29	0% 0 / 28	4% 9 / 240
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 9 / 124	0% 0 / 17	0% 0 / 16	7% 2 / 28	0% 0 / 33	18% 6 / 33	7% 17 / 251
	B. Number of well-tracked nests that failed as a result of parasitism	1% 1 / 124	0% 0 / 17	0% 0 / 16	0% 0 / 28	0% 0 / 33	0% 0 / 33	0% 1 / 251
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	34% 42 / 124	24% 4 / 17	69% 11 / 16	14% 4 / 28	45% 15 / 33	33% 11 / 33	35% 87 / 251
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 124	0% 0 / 17	6% 1 / 16	0% 0 / 28	6% 2 / 33	0% 0 / 33	1% 3 / 251
N.	Average clutch size	n/a	3.5	3.4	3.7	3.9	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	4	0	0	0	6	0	10
P.	Number of 'manipulated' parasitized nests	2	n/a	n/a	n/a	5	n/a	7
Q.	Number of successful 'manipulated' nests	100% 2 / 2	n/a	n/a	n/a	40% 2 / 5	n/a	57% 4 / 7
R.	Number of vireo fledged from 'manipulated' nests	6	n/a	n/a	n/a	6	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	0	2	5	2	14
U.	% of successful repaired nests	80% 4 / 5	n/a	n/a	100% 2 / 2	60% 3 / 5	100% 2 / 2	79% 11 / 14
V.	Number of vireo fledged from repaired nests	10	n/a	n/a	3	8	4	25
W.	Number of cowbirds removed from study area	1,040	27	-1	4	n/a	6	1,076
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,509	130	83	114	n/a	257	5,093
Y.	Average number of cowbirds trapped per day (W/X)	0.23	0.21	0.00	0.04	n/a	0.02	0.21

[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

Appendix C-1-O. 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	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined
A.	Number of territorial males	n/a	59	66	69	79	64	n/a
B.	Number of known pairs	350	36	25	33	48	34	526
C.	Number of known breeding (nesting) pairs	282	32	18	28	42	27	429
D.	Number of breeding pairs that were well-monitored throughout the season	85	11	8	8	17	13	142
E.	Number of known fledged young observed	382	57	25	76	66	43	649
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	141	38	17	45	40	23	304
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.4	1.8	1.4	2.7	1.6	1.6	1.5
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	1.7	3.5	2.1	5.6	2.4	1.8	2.1
I.	Number of nests that were discovered	193	24	18	30	46	30	341
J.	Number of well-tracked nests	140	22	12	28	41	28	271
K.	Number of successful well-tracked nests	42% 59 / 140	50% 11 / 22	50% 6 / 12	64% 18 / 28	37% 15 / 41	39% 11 / 28	44% 120 / 271
L.	Rate of cowbird parasitism (well-tracked nests)[1]	4% 5 / 140	0% 0 / 22	0% 0 / 12	0% 0 / 26	0% 0 / 31	21% 4 / 19	4% 9 / 250
	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 6 / 140	9% 2 / 22	0% 0 / 12	14% 4 / 28	10% 4 / 41	7% 2 / 28	7% 18 / 271
	B. Number of well-tracked nests that failed as a result of parasitism	1% 2 / 140	0% 0 / 22	0% 0 / 12	0% 0 / 28	0% 0 / 41	0% 0 / 28	1% 2 / 271
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	52% 73 / 140	41% 9 / 22	42% 5 / 12	21% 6 / 28	49% 20 / 41	46% 13 / 28	46% 126 / 271
M.	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 140	0% 0 / 22	8% 1 / 12	0% 0 / 28	5% 2 / 41	7% 2 / 28	2% 5 / 271
N.	Average clutch size	n/a	3.8	3	3.6	3.5	3.4	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo	5	0	0	0	0	4	9
P.	Number of 'manipulated' parasitized nests[2]	3	n/a	n/a	n/a	n/a	4	7
Q.	Number of successful 'manipulated' nests[2]	33% 1 / 3	n/a	n/a	n/a	n/a	50% 2 / 4	43% 3 / 7
R.	Number of vireo fledged from 'manipulated' nests[2]	2	n/a	n/a	n/a	n/a	4	6
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests	7	1	0	0	3	1	12
U.	% of successful repaired nests	86% 6 / 7	0% 0 / 1	n/a	n/a	67% 2 / 3	0% 0 / 1	67% 8 / 12
V.	Number of vireo fledged from repaired nests	18	0	n/a	n/a	3	0	21
W.	Number of cowbirds removed from study area	460	10	26	-1	15	22	532
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,076	383	239	237	245	318	5,498
Y.	Average number of cowbirds trapped per day (W/X)	0.11	0.03	0.11	0.00	0.06	0.07	0.10

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

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

San Jacinto

Host Plant Species (listed in taxonomic order[1])	2004-2016 (n=12)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Desert Wild Grape (*Vitis girdiana*)	0					1	1	<1%
Fremont Cottonwood (*Populus fremontii*)	0		1	1	3		5	2%
Narrowleaf Willow (*Salix exigua*)	56	5	23	24	22	3	133	44%
Dead Narrowleaf Willow (*Salix exigua*)	1						1	<1%
Goodding's Black Willow (*Salix gooddingii*)	9	3	5	4	13	9	43	14%
Red Willow (*Salix laevigata*)	2	1					3	1%
Arroyo Willow (*Salix lasiolepis*)	0				1		1	<1%
Western False Indigo (*Amorpha fruticosa*)	0			1			1	<1%
Blue Palo Verde (*Parkinsonia florida*)	0				1		1	<1%
California Scrub Oak (*Quercus berberidifolia*)	0				1		1	<1%
Black Mustard[ie] (*Brassica nigra*)	1				1		2	1%
Tamarisk[ie] (*Tamarix ramosissima*)	2		3	4	5		14	5%
Coyote Brush (*Baccharis pilularis*)	4	2	3	9			18	6%
Mulefat (*Baccharis salicifolia*)	35	1	1	1	17	6	61	20%
Arrowweed (*Pluchea sericea*)	0	1	1	2	2		6	2%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	0				3	1	4	1%
Unknown/No data	4	3	1	1			9	3%
Total	114	**16**	**38**	**47**	**69**	**20**	304	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

San Timoteo Canyon

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)	1					1	2	<1%
Golden Currant (*Ribes aureum)*	5						5	<1%
Desert Wild Grape (*Vitis girdiana*)	64	13	8	5	9	9	108	8%
Fremont Cottonwood (*Populus fremontii*)	40	3	8	6	13	4	74	5%
Dead Fremont Cottonwood (*Populus fremontii*)	1						1	<1%
Narrowleaf Willow (*Salix exigua*)	23	6	1	4			34	2%
Goodding's Black Willow (*Salix gooddingii*)	73	3	3	9	3	4	95	7%
Red Willow (*Salix laevigata*)	150	14	6	23	22	27	242	18%
Arroyo Willow (*Salix lasiolepis*)	196	33	26	18	33	13	319	23%
Pacific Willow (*Salix lasiandra)*	12				4	1	17	1%
Willow sp. (*Salix* sp.)	1						1	<1%
Dead Willow sp. (*Salix* sp.)	1						1	<1%
Asian Pear[a] (*Cydonia oblonga*)	0			1	1		2	<1%
Toyon (*Heteromeles arbutifolia*)	21	1		1			23	2%
California Wild Rose (*Rubus californica*)	1	1					2	<1%
White Mulberry[a] (*Morus alba*)	1			2	2	2	7	1%
Hoary Nettle (*Urtica dioica*)	0			1			1	<1%
California Scrub Oak (*Quercus berberidifolia*)	1		1	1	1		4	<1%
Oak sp. (*Quercus* sp.)	1						1	<1%
Southern California Black Walnut[r] (*Juglans californica)*	1	1	1				3	<1%
Fragrant Sumac (*Rhus aromatica*)	1						1	<1%
Sugar Sumac (*Rhus ovata*)	0		1				1	<1%
Boxelder (*Acer negundo*)	2						2	<1%
Orange Tree[a] (*Citrus sinensis*)	0				1		1	<1%

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

Host Plant Species (listed in taxonomic order[‡])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Tree of Heaven[i e] (*Ailanthus altissima*)	1						1	<1%
Chaparral Mallow (*Malacothamnus fasciculatus*)	0			1	2		3	<1%
Black Mustard[i e] (*Brassica nigra*)	1			1			2	<1%
Mustard sp.[i e] (*Brassica* sp.)	4						4	<1%
Perennial Pepperweed[i e] (*Lepidium latifolium*)	1						1	<1%
Tamarisk[i e] (*Tamarix ramosissima*)	2						2	<1%
Fourwing Saltbush (*Atriplex canescens*)	1			1	1		3	<1%
Ash sp. (*Fraxinus* sp.)	0					1	1	<1%
Olive[e] (*Olea europaea*)	0			1			1	<1%
Tree Tobacco[i e] (*Nicotiana glauca*)	0			1			1	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	19			1	1		21	2%
Coyote Brush (*Baccharis pilularis*)	0					1	1	<1%
Mulefat (*Baccharis salicifolia*)	258	14	19	8	6	13	318	23%
Willow Baccharis (*Baccharis salicina*)	1						1	<1%
Brittlebush (*Encelia farinosa*)	0			2			2	<1%
Poison Hemlock[e] (*Conium maculatum*)	0			1			1	<1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	39	5	1	7	5	2	59	4%
Desert Wild Grape (*V. girdiana*) and Arroyo Willow (*S. lasiolepis*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and Sweet Fennel[i e] (*Foeniculum vulgare*)	1						1	<1%
Deadfall	2					1	3	<1%
Unknown/No data	2			1			3	<1%
Total	**929**	**94**	**75**	**96**	**104**	**79**	1,377	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[‡] Using Jepson eFlora

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

Meridian Conservation Area*

Host Plant Species (listed in taxonomic order[1])	2004-2016 (n=6)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Goodding's Black Willow (*Salix gooddingii*)	10				1	1	12	29%
Red Willow (*Salix laevigata*)	7	2			1		10	24%
Arroyo Willow (*Salix lasiolepis*)	8	1			5	1	15	36%
Dead Willow sp. (*Salix* sp.)	0	1					1	2%
Mulefat (*Baccharis salicifolia*)	1	1				1	3	7%
Deadfall	0				1		1	2%
Total	**26**	**5**	**0**	**0**	**8**	**3**	42	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
*Former March SKR Preserve
[1] Using Jepson eFlora

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

Mockingbird Canyon

Host Plant Species (listed in taxonomic order[1])	2003-2016 (n=14)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)	1						1	<1%
Desert Wild Grape (*Vitis girdiana*)	7						7	3%
Fremont Cottonwood (*Populus fremontii*)	2			1	2		5	2%
Narrowleaf Willow (*Salix exigua*)	1						1	<1%
Goodding's Black Willow (*Salix gooddingii*)	31			2		1	34	16%
Red Willow (*Salix laevigata*)	56				4	2	62	29%
Arroyo Willow (*Salix lasiolepis*)	16			1	3		20	9%
Willow sp. (*Salix* sp.)	1						1	<1%
Dead Willow sp. (*Salix* sp.)	1						1	<1%

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

Mockingbird Canyon

Host Plant Species (listed in taxonomic order[1])	2003-2016 (n=14)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Hollyleaf Cherry (*Prunus ilicifolia*)	1						1	<1%
Southern California Black Walnut[r] (*Juglans californica)*	1						1	<1%
Peruvian Pepper Tree[ie] (*Schinus molle*)	4						4	2%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	3				1		4	2%
Dead Perennial Pepperweed[ie] (*Lepidium latifolium*)	2						2	1%
Tamarisk[ie] (*Tamarix ramosissima*)	0			1	1		2	1%
Fourwing Saltbush (*Atriplex canescens*)	1			1			2	1%
Coyote Brush (*Baccharis pilularis*)	0			1	3		4	2%
Mulefat (*Baccharis salicifolia*)	15				1		16	7%
Willow Baccharis (*Baccharis salicina*)	2						2	1%
Arrowweed (*Pluchea sericea*)	1						1	<1%
Wild Celery[e] (*Apium graveolens*)	1						1	<1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	29			5	1		35	16%
Desert Wild Grape (*V. girdiana*) and Goodding's Black Willow (*S. gooddingii*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Perennial Pepperweed[ie] (*L. latifolium*)	1						1	<1%
Willow sp. (*Salix* sp.) and Perennial Pepperweed[ie] (*L. latifolium*)	1						1	<1%
Coyote Brush (*B. pilularis*) and Mulefat (*B. salicifolia*)	1						1	<1%
Deadfall	0				2	1	3	1%
Unknown/No data	2					1	3	1%
Total	**182**	**0**	**0**	**12**	**18**	**5**	217	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

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

Host Plant Species (listed in taxonomic order[1])	2002-2016 (n=13)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)	0	3					3	1%
Desert Wild Grape (*Vitis girdiana*)	8	4	4	5	1	2	24	8%
Fremont Cottonwood (*Populus fremontii*)	8	4		2	3	4	21	7%
Narrowleaf Willow (*Salix exigua*)	5	5			3		13	4%
Dead Narrowleaf Willow (*Salix exigua*)	0				1		1	<1%
Goodding's Black Willow (*Salix gooddingii*)	13	7	5	1		2	28	10%
Dead Goodding's Black Willlow (*Salix gooddingii*)	1						1	<1%
Red Willow (*Salix laevigata*)	9	5	6	1	2		23	8%
Arroyo Willow (*Salix lasiolepis*)	40	9	3	3	1	2	58	20%
Pacific Willow (*Salix lasiandra)*	1						1	<1%
Willow sp. (*Salix* sp.)	1		1		1		3	1%
Holly Leaf Cherry (*Prunus ilicifolia*)	0				1		1	<1%
California Wild Rose (*Rosa californica*)	2						2	1%
California Blackberry (*Rubus ursinus*)	0	1			1		2	1%
Hoary Nettle (*Urtica dioica*)	1						1	<1%
California Scrub Oak (*Quercus berberidifolia*)	2					2	4	1%
White Alder (*Alnus rhombifolia*)	0	1					1	<1%
Poison Oak (*Toxicodendron diversilobum*)	1						1	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	1	1					2	1%
Ash sp. (*Fraxinus* sp.)	0				3		3	1%
Tree Tobacco[ie] (*Nicotiana glauca*)	1			1			2	1%
Coyote Brush (*Baccharis pilularis*)	0			1		1	2	1%
Mulefat (*Baccharis salicifolia*)	42	16	10	3	1	1	73	25%

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

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

Host Plant Species (listed in taxonomic order[1])	2002-2016 (n=13)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Poison Hemlock[ie] (*Conium maculatum*)	0			1			1	<1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	5	2				1	8	3%
Desert Wild Grape (*V. girdiana*) and Goodding's Black Willow (*S. gooddingii*)	0		1				1	<1%
Dead Goodding's Black Willow (*S. gooddingii*) and Hoary Nettle (*U. dioica*)	1						1	<1%
Deadfall	0						0	0%
Unknown/No Data	0		2	6			8	3%
Total	**142**	**58**	**32**	**24**	**18**	**15**	289	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

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

Host Plant Species (listed in taxonomic order[1])	2010-2016 (n=4)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Arundo[i] (*Arundo donax*)	0		1			1	2	2%
Western Sycamore (*Platanus racemosa*)	0		1				1	1%
Desert Wild Grape (*Vitis girdiana*)	3						3	3%
Fremont Cottonwood (*Populus fremontii*)	1	3	1		1	1	7	8%
Narrowleaf Willow (*Salix exigua*)	1				4	4	9	10%
Goodding's Black Willow (*Salix gooddingii*)	0		2			3	5	5%
Red Willow (*Salix laevigata*)	2	1				1	4	4%
Arroyo Willow (*Salix lasiolepis*)	3	2	5		3	6	19	21%
California Blackberry (*Rubus ursinus*)	0	1					1	1%
Mulefat (*Baccharis salicifolia*)	8	4	15		5	3	35	38%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	3						3	3%
Deadfall	0					2	2	2%
Unknown/No Data	0			1			1	1%
Total	**21**	**11**	**25**	**1**	**13**	**21**	92	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

Lower Hole Creek

Host Plant Species (listed in taxonomic order[1])	2019	2020	2021	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)			2	2	67%
Mulefat (*Baccharis salicifolia*)	1			1	33%
Total	**1**	**0**	**2**	3	**100%**

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

[1] Using Jepson eFlora

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

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

Host Plant Species (listed in taxonomic order[1])	2000-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)	0			1	1		2	<1%
Desert Wild Grape (*Vitis girdiana*)	12		4	4	6	5	31	6%
Fremont Cottonwood (*Populus fremontii*)	1			3	9	8	21	4%
Narrowleaf Willow (*Salix exigua*)	4		1	3	7	9	24	4%
Goodding's Black Willow (*Salix gooddingii*)	19	2	5	8	10	13	57	10%
Red Willow (*Salix laevigata*)	13	5	2	5	3		28	5%
Arroyo Willow (*Salix lasiolepis*)	58	4	17	30	28	30	167	31%
Pacific Willow (*Salix lasiandra)*	1						1	<1%
Willow sp. (*Salix* sp.)	2						2	<1%
California Wild Rose (*Rosa californica*)	1			1	1		3	1%
California Blackberry (*Rubus ursinus*)	0					2	2	<1%
Poison Oak (*Toxicodendron diversilobum*)	1				2		3	1%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	0			1	1		2	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	0		1		1	2	4	1%
Big Saltbush (*Atriplex lentiformis*)	0					2	2	<1%
Summer Cypress[e] (*Kochia scoparia*)	0				1		1	<1%
Ash sp. (*Fraxinus* sp.)	0					1	1	<1%
Arizona Ash (*Fraxinus velutina*)	0				1		1	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	0				1		1	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	0				1		1	<1%
Coyote Brush (*Baccharis pilularis*)	1			1			2	<1%
Mulefat (*Baccharis salicifolia*)	50	2	17	16	24	34	143	26%

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

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

Host Plant Species (listed in taxonomic order[1])	2000-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Dead Mulefat (*Baccharis salicifolia*)	0	1					1	<1%
Common Sunflower (*Helianthus annuus*)	0				1		1	<1%
Poison Hemlock[i e] (*Conium maculatum)*	0				5		5	1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	4	1		3	7	3	18	3%
Dead Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	0	1					1	<1%
Fresh water reed (Typha sp.) and Arroyo Willow (S. *lasiolepis*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and California Wild Rose (*R. californica*)	1						1	<1%
Red Willow (*S. laevigata*) and Wild Cucumber (*Marah macrocarpa*)	0	1					1	<1%
Willow sp. (*Salix* sp.) and California Blackberry (*Rubus ursinus*)	1						1	<1%
Mulefat (*B. salicifolia*) and Poison Hemlock[i e] (*C. maculatum*)	1						1	<1%
Unknown/No data	8	1		2	3		14	3%
Total	**179**	**18**	**47**	**78**	**113**	**109**	544	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
*As of 2010, reported as south side of the river
[1] Using Jepson eFlora

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

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

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Giant Reed[ie] (*Arundo donax*)	0				1	3	4	1%
Desert Wild Grape (*Vitis girdiana*)	19	1	1	3	2	1	27	5%
Fremont Cottonwood (*Populus fremontii*)	14	1	3	1	5	9	33	6%
Dead Fremont Cottonwood (*Populus fremontii*)	1						1	<1%
Narrowleaf Willow (*Salix exigua*)	12	1	1	1	3	3	21	4%
Goodding's Black Willow (*Salix gooddingii*)	53			5	1	1	60	12%
Red Willow (*Salix laevigata*)	8	2	6	1	2	3	22	4%
Arroyo Willow (*Salix lasiolepis*)	109	6	5	7	8	5	140	28%
Dead Arroyo Willow (*Salix lasiolepis*)	2						2	<1%
Pacific Willow (*Salix lasiandra*)	1				1	1	3	1%
Willow sp. (*Salix* sp.)	1		2				3	1%
Dead Willow sp. (*Salix* sp.)	1						1	<1%
California Wild Rose (*Rosa californica*)	0					2	2	<1%
California Blackberry (*Rubus ursinus*)	0				3	4	7	1%
Southern California Black Walnut[r] (*Juglans californica*)	1						1	<1%
Tree of Heaven[ie] (*Ailanthus altissima*)	0			1			1	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	0			1			1	<1%
Ash sp. (*Fraxinus* sp.)	1						1	<1%
California Sagebrush (*Artemisia californica*)	0		1			1	2	<1%
Coyote Brush (*Baccharis pilularis*)	0					3	3	1%
Mulefat (*Baccharis salicifolia*)	120	7	9	4	2	1	143	28%
Dead Mulefat (*Baccharis salicifolia*)	6						6	1%

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

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

Host Plant Species (listed in taxonomic order[‡])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Poison Hemlock[ie] *(Conium maculatum)*	4				1		5	1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	3	1		1	3	2	10	2%
Goodding's Black Willow (*S. gooddingii*) and Poison Hemlock[ie] (*C. maculatum*)	1						1	<1%
Deadfall	0				3	2	5	1%
Unknown/No data	3				1		4	1%
Total	**360**	**19**	**28**	**25**	**36**	**41**	509	**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
[‡]Using Jepson eFlora

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

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

Host Plant Species (listed in taxonomic order[1])	2015-2016 (n=2)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Desert Wild Grape (*Vitis girdiana*)	3	2	2	6	3	1	17	9%
Narrowleaf Willow (*Salix exigua*)	1	1		2	3	6	13	7%
Goodding's Black Willow (*Salix gooddingii*)	5	5	3	2	7	4	26	15%
Red Willow (*Salix laevigata*)	0				1		1	1%
Arroyo Willow (*Salix lasiolepis*)	10	10	5	10	15	12	62	35%
Dead Arroyo Willow (*Salix lasiolepis*)	0		1	1			2	1%
Pacific Willow (*Salix lasiandra)*	0			2	1	1	4	2%
California Wild Rose (*Rosa californica*)	0		1				1	1%
California Blackberry (*Rubus ursinus*)	0				1		1	1%
Douglas' Sagewort (*Artemisia douglasiana*)	0					1	1	1%
Coyote Brush (*Baccharis pilularis*)	0			1			1	1%
Mulefat (*Baccharis salicifolia*)	6	6	4	8	15	3	42	23%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea)*	0			2		1	3	2%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	1	1					2	1%
California Blackberry (*Rubus ursinus*) and dead unknown	0				1		1	1%
Deadfall	0					1	1	1%
Unknown/No Data	0			1			1	1%
Total	**26**	**25**	**16**	**35**	**47**	**30**	179	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
*Formerly monitored as part of Goose Creek Golf Club to River Rd.
[1]Using Jepson eFlora

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

Temescal Canyon

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=14)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)	1						1	<1%
Fremont Cottonwood (*Populus fremontii*)	4	1					5	2%
Narrowleaf Willow (*Salix exigua*)	1	1					2	1%
Goodding's Black Willow (*Salix gooddingii*)	31	4					35	12%
Red Willow (*Salix laevigata*)	14						14	5%
Arroyo Willow (*Salix lasiolepis*)	72	5					77	26%
Yellow Willow (*Salix lasiandra*)	4						4	1%
Willow sp. (*Salix* sp.)	0					4	4	1%
Dead Willow sp. (*Salix* sp.)	1						1	<1%
Toyon (*Heteromeles arbutifolia*)	1						1	<1%
California Blackberry (*Rubus ursinus*)	1						1	<1%
Sugar Sumac (*Rhus ovata*)	2						2	1%
Poison Oak (*Toxicodendron diversilobum*)	1						1	<1%
Mustard sp.[ie] (*Brassica* sp.)	1						1	<1%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	1						1	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	4						4	1%
Douglas' Sagewort (*Artemisia douglasiana*)	1						1	<1%
Coyote Brush (*Baccharis pilularis*)	2						2	1%
Mulefat (*Baccharis salicifolia*)	80	5				1	86	29%
Dead Mulefat (*Baccharis salicifolia*)	4						4	1%
Brittlebush (*Encelia farinosa*)	1						1	<1%
Common Sunflower (*Helianthus annuus*)	1						1	<1%

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

Temescal Canyon

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=14)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Arrowweed (*Pluchea sericea*)	2						2	1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	8						8	3%
Arroyo Willow (*S. lasiolepis* and dead Hoary Nettle (*U. dioica*)	1						1	<1%
Deadfall	3						3	1%
Unknown/No data	0		19	16			35	12%
Total	**242**	**16**	**19**	**16**	**0**	**5**	298	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

Chino Hills

Host Plant Species (listed in taxonomic order[1])	2003-2016 (n=11)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Desert Wild Grape (*Vitis girdiana*)	1						1	2%
Goodding's Black Willow (*Salix gooddingii*)	15						15	31%
Red Willow (*Salix laevigata*)	7						7	15%
Arroyo Willow (*Salix lasiolepis*)	1						1	2%
Bank Catclaw[e] (*Acacia redolens*)	1						1	2%
Toyon (*Heteromeles arbutifolia*)	1						1	2%
Chinese Elm[e] (*Ulmus parvifolia*)	1						1	2%
Coast Live Oak (*Quercus agrifolia*)	1						1	2%
California Scrub Oak (*Quercus berberidifolia*)	1						1	2%
Peruvian Pepper Tree[i,e] (*Schinus molle*)	0		1				1	2%
Privet sp.[e] (*Ligustrum* sp.)	0			1			1	2%
Douglas' Sagewort (*Artemisia douglasiana*)	3						3	6%
Mulefat (*Baccharis salicifolia*)	10						10	21%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	2		1			1	4	8%
Unknown/No Data	0						0	0%
Total	**44**	**0**	**2**	**1**	**0**	**1**	48	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

Santa Ana Canyon (SAC) - Upper Canyon

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)	1				1		2	1%
Desert Wild Grape (*Vitis girdiana*)	4			2			6	3%
Fremont Cottonwood (*Populus fremontii*)	8		1	1		4	14	7%
Narrowleaf Willow (*Salix exigua*)	1						1	1%
Goodding's Black Willow (*Salix gooddingii*)	11	1		3			15	8%
Red Willow (*Salix laevigata*)	3		1				4	2%
Arroyo Willow (*Salix lasiolepis*)	3				1		4	2%
Willow sp. (*Salix* sp.)	1						1	1%
Castorbean[ie] (*Ricinus communis*)	1						1	1%
Toyon (*Heteromeles arbutifolia*)	1						1	1%
California Wild Rose (*Rosa californica*)	3						3	2%
Coast Live Oak (*Quercus agrifolia*)	1					2	3	2%
California Scrub Oak (*Quercus berberidifolia*)	2				1		3	2%
Southern California Black Walnut[r] (*Juglans californica*)	0					1	1	1%
Laurel Sumac (*Malosma laurina*)	0		1	1			2	1%
Peruvian Pepper Tree[ie] (*Schinus molle*)	2		1				3	2%
Poison Oak (*Toxicodendron diversilobum*)	5			1		2	8	4%
Mustard sp.[ie] (*Brassica* sp.)	2						2	1%
Coyote Brush (*Baccharis pilularis*)	1				1		2	1%
Mulefat (*Baccharis salicifolia*)	45	2	7	8	7	6	75	39%
Desertbroom Baccharis (*Baccharis sarothroides*)	1						1	1%
Milk Thistle[ie] (*Silybum marianum*)	1						1	1%

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

Santa Ana Canyon (SAC) - Upper Canyon

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Rough Cockelburr (*Xanthium strumarium*)	1						1	1%
Poison Hemlock[ie] (*Conium maculatum*)	2						2	1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	19	1	2	6	2	4	34	18%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	1						1	1%
Black Mustard[ie] (*B.nigra*) and Mulefat (*B. salicifolia*)	1						1	1%
Unknown/No Data	0				1		1	1%
Total	**121**	**4**	**13**	**22**	**14**	**19**	193	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Giant Reed[ie] (*Arundo donax*)	1			1			2	1%
Desert Wild Grape (*Vitis girdiana*)	3	1		2			6	2%
Fremont Cottonwood (*Populus fremontii*)	7	2	4	1	4	1	19	7%
Narrowleaf Willow (*Salix exigua*)	2					1	3	1%
Goodding's Black Willow (*Salix gooddingii*)	14	2	1	1		2	20	7%
Red Willow (*Salix laevigata*)	6					1	7	2%
Arroyo Willow (*Salix lasiolepis*)	5	1				1	7	2%
Toyon (*Heteromeles arbutifolia*)	2						2	1%
Coast Live Oak (*Quercus agrifolia*)	0					1	1	<1%
California Scrub Oak (*Quercus berberidifolia*)	0				1		1	<1%
Southern California Black Walnut[r] (*Juglans californica)*	1	3		1			5	2%
Laurel Sumac (*Malosma laurina*)	5	2	3	4	5	6	25	9%
Peruvian Pepper Tree[ie] (*Schinus molle*)	6	3	2	1	3	3	18	6%
Brazilian Pepper Tree[ie] (*Schinus terebinthifolius*)	1						1	<1%
Poison Oak (*Toxicodendron diversilobum*)	5				1	1	7	2%
Carrotwood[e] *(Cupaniopsis anacardioides)*	0				1		1	<1%
Tree of Heaven[ie] (*Ailanthus altissima*)	0		1				1	<1%
Bush mallow sp. (*Malacothamnus* sp)	0					1	1	<1%
Black Mustard[ie] (*Brassica nigra*)	0			4			4	1%
Cape Leadwort[e] (*Plumbago auriculata*)	2						2	1%
Privet sp.[e] (*Ligustrum* sp.)	1						1	<1%
Lollypop Tree[ie] (*Myoporum laetum*)	1						1	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	0		1				1	<1%
California Sagebrush (*Artemisia californica*)	1						1	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	1						1	<1%

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

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed in taxonomic order[1])	2001-2016 (n=16)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Coyote Brush (*Baccharis pilularis*)	3		1				4	1%
Mulefat (*Baccharis salicifolia*)	55	7	6	7	11	14	100	35%
Poison Hemlock[i e] (*Conium maculatum*)	2						2	1%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	15	1	1	10	7	3	37	13%
Yerba Santa sp. (*Eriodictyon* sp.)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Peruvian Pepper Tree[i e] (*S. molle*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Unknown/No data	1			1	1		3	1%
Total	**144**	**22**	**20**	**33**	**34**	**35**	288	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

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

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed in taxonomic order[1])	2002-2016 (n=15)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Coulter's Matilija Poppy[r] (*Romneya coulteri*)	1						1	<1%
Western Sycamore (*Platanus racemosa*)	3		1	1	2	7	14	4%
Desert Wild Grape (*Vitis girdiana*)	1						1	<1%
Fremont Cottonwood (*Populus fremontii*)	24		3	1	5	2	35	10%
Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)	3						3	1%
Narrowleaf Willow (*Salix exigua*)	5	1		6		2	14	4%
Goodding's Black Willow (*Salix gooddingii*)	21	1				1	23	7%
Dead Goodding's Black Willow covered with living Goodding's Black Willow (*Salix gooddingii*)	1						1	<1%
Red Willow (*Salix laevigata*)	4		1	1			6	2%
Arroyo Willow (*Salix lasiolepis*)	6	2	1				9	3%
Willow sp. (*Salix* sp.)	1				2	1	4	1%
Castor bean[ie] (*Ricinus communis*)	0	1					1	<1%
Blue Palo Verde (*Parkinsonia florida*)	0			1			1	<1%
Toyon (*Heteromeles arbutifolia*)	1						1	<1%
Wild Cucumber (*Marah macrocarpa*)	0				1		1	<1%
Southern California Black Walnut[r] (*Juglans californica*)	8	1			2		11	3%
White Alder (*Alnus rhombifolia*)	1						1	<1%
Laurel Sumac (*Malosma laurina*)	9	4	5	3	6	3	30	9%
Poison Oak (*Toxicodendron diversilobum*)	9	2					11	3%
Orange Tree[e] (*Citrus sinensis*)	3						3	1%
Black Mustard[ie] (*Brassica nigra*)	3	2		2	2	1	10	3%
Tamarisk[ie] (*Tamarix ramosissima*)	0		1				1	<1%
Black Sage (*Salvia mellifera*)	1		1				2	1%
Douglas' Sagewort (*Artemisia douglasiana*)	0			1		1	2	1%
Coyote Brush (*Baccharis pilularis*)	0				1		1	<1%

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

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed in taxonomic order[1])	2002-2016 (n=15)	2017	2018	2019	2020	2021	Combined	Percentage of Combined
Mulefat (*Baccharis salicifolia*)	42	8	5	7	17	7	86	25%
Yellowspine Thistle[ie] (*Cirsium ochrocentrum*)	2						2	1%
Spanish False Fleabane[e] (*Pulicaria paludosa*)	0					1	1	<1%
Rough Cockelburr (*Xanthium strumarium*)	1						1	<1%
Poison Hemlock[ie] (*Conium maculatum*)	3			4	6		13	4%
Blue Elderberry (*Sambucus nigra* ssp. *caerulea*)	29	2		2	2	2	37	11%
Fiddleneck sp. (*Amsinckia* sp.)	1						1	<1%
Thickleaf Yerba Santa (*Eriodictyon crassifolium*)	3					1	4	1%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	2						2	1%
Arroyo Willow (*S. lasiolepis*) and Black Mustard[ie] (*B. nigra*)	1						1	<1%
Castorbean[ie] (*R. communis*) and Mulefat (*B. salicifolia*)	1						1	<1%
Black Mustard (*B. nigra*) and Poison Hemlock (*C. maculatum*)	0			1			1	<1%
Unknown/No data	3					1	4	1%
Total	**193**	**24**	**18**	**30**	**46**	**30**	341	**100%**

[i] = invasive
[e] = non-native
[r] = endangered, threatened, or sensitive
[1] Using Jepson eFlora

APPENDIX D: SUMMARY TABLES BY MANAGED SITE, 2000-2021

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 *2020 Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2020, and Summary Data by Site and Watershed-wide, 2000-2020* report.

Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2016-2020. Numbers of territories, pairs, and fledglings detected.

Column	Row	Page Number	Data Listed in the 2020 Report	Corrected Data
2020	Chino Hills	56	36 / 10 / 9	36 / 10 / 10
2020	Featherly Regional Park	56	79 / 47 / 66	79 / 48 / 66
2020	Subtotal	59	1,574 / 827 / 1,291	1,574 / 828 / 1,292
2020	Total for Santa Ana Watershed Excluding Prado Basin	59	1,574 / 827 / 1,291	1,574 / 828 / 1,292
2020	Total for Santa Ana Watershed	59	2,293 / 1,200 / 1,868	2,293 / 1,201 / 1,869

Appendix B-1: Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana Watershed, 2000-2020 (sites vary by year).

Page Number	Row	Parameter	Data Listed in the 2020 Report		Corrected Data	
			2020 Column	Combined Column	2020 Column	Combined Column
B-2	B	Number of known pairs	713	7,054	714	7,055
	C	Number of known breeding (nesting) pairs	592	5,893	590	5,891
	E	Number of known fledged young observed	1,201	11,320	1,202	11,321
	F	Number of known fledged young produced by pairs monitored throughout the breeding season	696	5,760	692	5,756
	I	Number of nests that were discovered	519	4,412	520	4,413
	J	Number of well-tracked nests	454	3,703	455	3,704
	K	Number of successful well-tracked nests	53% 241 / 454	58% 2,152 / 3,703	53% 241 / 455	58% 2,152 / 3,704
	L	Rate of cowbird parasitism (well-tracked nests)	8% 32 / 386	9% 334 / 3,587	8% 32 / 384	9% 334 / 3,555
	M.A.	Number of well-tracked nests that failed as a result of reproductive failure	4% 16 / 454	5% 168 / 3,703	4% 16 / 455	5% 168 / 3,704
	M.B.	Number of well-tracked nests that failed as a result of parasitism	2% 8 / 454	3% 106 / 3,703	2% 8 / 455	3% 106 / 3,704
	M.C.	Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	36% 164 / 454	33% 1,239 / 3,703	36% 165 / 455	33% 1,240 / 3,704
	M.D.	Number of well-tracked nests that failed for unknown reasons	5% 24 / 454	1% 37 / 3,703	5% 24 / 455	1% 37 / 3,704
	O	Number of cowbird eggs or nestlings found in or near vireo nests	34	409	35	410
	P	Number of 'manipulated' parasitized nests	29	277	30	278
	Q	Number of successful 'manipulated' nests	34% 10 / 29	44% 122 / 277	33% 10 / 30	44% 122 / 278
	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,583	91,148	3,581	95,698

Appendix B-2: Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2020.

Appendix Number	Page Number	Row	Data Listed in the 2020 Report			Corrected Data		
			2020 Column	Combined Column	Percentage of Combined Column	2020 Column	Combined Column	Percentage of Combined Column
B-2	B-4	California Blackberry (*Rubus ursinus*)	4	7	<1%	5	8	<1%
	B-4	California Scrub Oak (*Quercus berberidifolia*)	3	11	<1%	4	12	<1%
	B-7	Deadfall	7	12	<1%	6	11	<1%
	B-7	Total	519	4,338	100%	520	4,341	100%

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 2020 Report		Corrected Data	
				2020 Column	Combined Column	2020 Column	Combined Column
C-1-A	C-2	L	Rate of cowbird parasitism (well-tracked nests)	14% 7 / 49	15% 31 / 211	15% 7 / 46	15% 31 / 208
		P	Number of 'manipulated' parasitized nests	6	26	7	27
		Q	Number of successful 'manipulated' nests	33% 2 / 6	46% 12 / 26	29% 2 / 7	44% 12 / 27
C-1-D	C-5	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	503	11,474	500	11,471
C-1-H	C-9	N	Average clutch size	3.7	n/a	3.8	n/a
C-1-I	C-10	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	131	244	130	243
C-1-J	C-11	X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	561	14,498	562	14, 499
C-1-K	C-12	C	Number of known breeding (nesting) pairs	5	84	6	85
		E	Number of known fledged young observed	9	121	10	122
C-1-L	C-13	I	Number of nests that were discovered	13	175	14	176
		J	Number of well-tracked nests	11	126	12	127
		K	Number of successful well-tracked nests	73% 8 / 11	67% 85 / 126	67% 8 / 12	67% 85 / 127
		L	Rate of cowbird parasitism (well-tracked nests)	0% 0 / 10	3% 4 / 123	0% 0 / 11	3% 4 / 124
		M.A.	Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 11	2% 3 / 126	0% 0 / 12	2% 3 / 127
		M.B.	Number of well-tracked nests that failed as a result of parasitism	0% 0 / 11	2% 2 / 126	0% 0 / 12	2% 2 / 127
		M.C.	Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	18% 2 / 11	28% 35 / 126	25% 3 / 12	28% 36 / 127
		M.D.	Number of well-tracked nests that failed for unknown reasons	9% 1 / 11	1% 1 / 126	8% 1 / 12	1% 1 / 127
		X	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	127	3,679	128	3,680
C-1-M	C-14	C	Number of known breeding (nesting) pairs	34	318	31	315
		N	Average clutch size	3.8	n/a	3.9	n/a
		O	Number of cowbird eggs or nestlings found in or near vireo nests	5	9	6	10
C-1-N	C-15	B	Number of known pairs	47	491	48	492
		F	Number of known fledged young produced by pairs monitored throughout the breeding season	44	285	40	281

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 2020 Report			Corrected Data		
			2020 Column	Combined Column	Percentage of Combined Column	2020 Column	Combined Column	Percentage of Combined Column
C-2-E	C-21	California Blackberry (*Rubus ursinus*)	0	1	1%	1	2	<1%
C-2-E	C-22	Deadfall	1	1	<1%	n/a	n/a	0%
C-2-L	n/a	Unknown/No data	n/a	n/a	0%	1	1	1%
	C-33	Total	13	172	100%	14	173	100%
C-2-M	n/a	California Scrub Oak (*Quercus berberidifolia*)	n/a	n/a	n/a	1	1	<1%
	C-35	Unknown/No data	2	4	2%	1	3	1%