

Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2019, and Summary Data by Site and Watershed-wide, 2000-2019

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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 protection of endangered, threatened and other sensitive species. Since 2000, populations of endangered Least Bell's Vireo (*Vireo bellii pusillus*) have been studied 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 winter at four dairies in Prado Basin. In 2019, SAWA biologists documented 1,361 Least Bell's Vireo territories in the Santa Ana Watershed (excluding Prado Basin), of which 686 were known to be paired. This represents a 1% increase in territories from 2018, and the highest number documented to date. One thousand two hundred forty-seven fledglings were also documented. Prado Basin reported another 606 vireo in 2019, a 9% decrease from the 665 documented in 2018. Nesting success was 62% overall and 151 well-monitored pairs had a 3.8 reproductive success rate. Ninety-three percent of 420 vireo nests were placed native vegetation.

In 2019, the watershed-wide cowbird parasitism rate of vireo nests was 10%, up from 3% in 2018. San Jacinto, San Timoteo, Mockingbird Canyon, and SAR – Upstream (Riverside Ave. to Van Buren Blvd. and Hidden Valley-South) were sites in which parasitism was documented in 2019. During the nesting season, 3,069 cowbirds were removed from 42 traps in the watershed. Additionally, 6,005 cowbirds were removed from the watershed during the fall and winter of 2018-2019. Over 127,000 cowbirds have been removed from the watershed by SAWA since cowbird management began.

Southwestern Willow Flycatchers (*Empidonax traillii extimus*) were not detected by SAWA biologists in 2019; however, eight migrant Willow Flycatchers were documented within the watershed. All wildlife species detected (161 avian, 19 mammalian, 21 herpetofauna and two 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 6 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 in 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 flammable nature. SAWA is dedicated to the restoration of the Santa Ana River Watershed in 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*) and Southwestern Willow Flycatcher (*Empidonax traillii extimus*).

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 destruction 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 665 territorial males in 2018 (Bonnie Johnson, personal communication). The watershed-wide population (including Prado Basin and those reported by other agencies) totaled 1,967 territorial males in 2019. The Southwestern Willow Flycatcher (hereafter “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 and throughout the rest of the watershed since 2000.

The work reported herein is an expansion upon the Prado Basin efforts into other portions of the watershed from 2000-2019 through the implementation of the Santa Ana Watershed Program by SAWA and the Orange County Water District (OCWD). Data collected in Prado Basin are reported separately by OCWD. Monitoring is conducted during the avian nesting season to determine the number of vireo and willow flycatchers 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 2019, nest monitoring occurred at several locations discussed here as monitored sites: San Jacinto, San Timoteo Canyon, proposed 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 documented at Temescal Canyon, Mockingbird Canyon and Chino Hills. Thirty-five additional peripheral drainages within the watershed were sampled (≥ 3 visits) and incidental sightings were documented at 12 sites visited on 1-2 occasions.

METHODS

Study Location

The Santa Ana Watershed is located in southern California and includes portions of San Bernardino, Riverside, Orange, and Los Angeles Counties and covers nearly 3,000 square miles (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 (SAR), which includes more than 50 tributaries.

Study sites contained typical southern Californian 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 distributed among 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, 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 (> 8 visits) and regular nest monitoring occurred. Vireo were monitored in the

Santa Ana River from Riverside Avenue in the city of Riverside downstream through the Santa Ana Canyon to Weir Canyon Road, excluding Prado Basin. These sites included San Bernardino Valley Municipal Water District (SBVMWD) restoration sites within Santa Ana River - Upstream (Riverside Ave. to Van Buren Blvd.), Hidden Valley - south side of the river (SBVMWD restoration sites and a control site), Goose Creek mitigation areas - Norco to I-15, Norco Bluffs (I-15 to River Rd.) and the Santa Ana Canyon (Upper Canyon, Green River Golf Course, and Featherly Regional Park). San Timoteo Canyon, a tributary of the Santa Ana River, as well as portions of the San Jacinto River and San Jacinto Wildlife Area were also monitored (Figure 2). See Appendix A for specific restoration area coordinates.

San Jacinto

San Jacinto includes three monitored sections: the San Jacinto River from Lake Park Drive to State Street, the San Jacinto River from Sanderson Avenue to Bridge Street, and the San Jacinto Wildlife Area. These sites are located within the San Jacinto Valley in Riverside County. 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 can be 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. The dominant invasive plant in the riparian zone is tamarisk. The riparian zone in the San Jacinto Wildlife Area can be 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, agricultural land, golf courses, and residential development.

San Timoteo Canyon

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.

Residential development of portions of the uplands continues to occur. San Timoteo Creek is typically 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 vireo did not return in 2018 to the historical territories that were burned in the fire. In 2019, 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 heavily 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 are Russian thistle, mustard (*Brassica* sp.) and perennial pepperweed.

Santa Ana River (SAR) – Upstream

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. These sections are: Riverside Ave. to Van Buren Blvd., Lower Hole Creek, Hidden Valley - North side of river, Hidden Valley - South side of river, and Goose Creek-Norco to I-15. 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 "upstream"; all sites were reported separately. In 2015, the upstream section did not include Goose Creek, Norco to I-15; however, in 2016 a change in funding source now incorporates this area as part of SAR - Upstream. In 2019, a previously unsurveyed site, Lower Hole Creek, was included 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 approximately 87 acres of previously unsurveyed land in and near Fairmount Park in Riverside, a portion of which was monitored in 2019, and approximately 20 acres of previously unsurveyed land was included near the eastern terminus of Rubidoux Ave. in Riverside. The Riverside Ave. to Van Buren Blvd section was analyzed as a whole and by three sub-sections (Non-Restoration, Evans Lake Drain, and Anza/Old Ranch Creeks) to isolate two proposed restoration areas (Evans Lake Drain and Anza/Old Ranch Creeks). Similarly, the Hidden Valley South section was analyzed as a whole and by two sub-sections (Hidden Valley South – Restoration and Hidden Valley South Non-Restoration) to isolate one proposed restoration area.

There are a variety of vegetation types throughout the SAR - Upstream section of the Santa Ana River. The riparian zone can be classified as a *Salix gooddingii* Woodland Alliance with Fremont cottonwood as a co-dominant (Sawyer et al. 2009). The most common invasive plant in

the riparian zone is arundo. 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 commercial and residential, recreational trails, parks, and golf courses. Within the riparian habitat, many homeless encampments occur. SAWA biologists often observe vegetation clearing, trash dumping, and inappropriate disposal of human excreta in this portion of the river. Many new large homeless encampments were documented during the 2019 breeding season.

Norco Bluffs, I-15 to River Rd.

Norco Bluffs is comprised of a 3-mile long riparian zone located along the river between Interstate 15 and River Road. The U.S. Army Corps of Engineers (USACE) considers most of this area to be within the Prado Basin (566-foot elevation and below). In 2019, vireo were monitored in select areas within Norco Bluffs and excluded a 101-acre easement belonging to Riverside-Corona Resource Conservation District. In comparison to areas surveyed from 2015-2018, the area monitored exclusively by SAWA in 2019 (Figure 5) is the largest to date. The on-going changes in the survey area preclude comparability of data across all years; comparable population level data are as follows: 2015 and 2018, 2016 and 2017. The 2019 survey year has no comparable data.

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 re-established arundo were removed then treated with herbicide before nesting season. Additional monthly follow-up treatments were conducted during nesting season with the presence of a vireo biologist. Past construction activities were conducted on the north side of the river by the City of Norco (hereafter “the City”) on the east and west sides of Hamner Ave. In the spring of 2011, the City constructed a large, protective stone levee east of Hamner Ave. in response to damaging floods during the previous winter. Construction of the levee resulted in the removal of riparian habitat and noise disturbance to vireo territories nearby. Additional habitat was removed by the City in the spring of 2012 to allow for the widening of Hamner Ave. In the spring of 2015, the City conducted construction activities at a site located in the riparian area approximately 50 yards beyond the end of Old Hamner Rd; no existing riparian vegetation was removed. 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 nesting season.

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 co-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. Species in the more recently disturbed areas are composed of Goodding's black willow, arroyo willow, Pacific willow (*Salix lasiandra*), and narrowleaf willow.

Santa Ana Canyon (SAC)

The 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 the habitat throughout the canyon, it was divided into three sites: Upper Canyon, Green River Golf Club, and Featherly Regional Park. The Upper Canyon is located from 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. In 2014, Phase 3 of the USACE stabilization project began and subsequently impacted the habitat of ten 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 ten 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, 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 2019. The project located in Green River Golf Club removed vegetation from two territories and partially impacted two additional territories in 2018. No additional vegetation removal occurred in 2019.

There is a variety of habitat types throughout SAC. Vireo 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 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 and arundo. The 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, castor bean, perennial pepperweed, gum tree (*Eucalyptus* sp.) and Peruvian pepper tree (*Schinus molle*).

Upper Canyon

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 what is considered the Santa Ana Canyon. The Upper Canyon has undergone a barrage of habitat disturbances from native vegetation removal, subsequent restoration, additional vegetation removal and a devastating fire in the last decade. Construction on a portion of the Santa Ana River trail began during the winter of 2018 and continued into April 2019. It is not known when construction on the trail will resume or the exact alignment it will take as it proceeds through Upper Canyon and Green River Golf Club to connect to the existing trail located south of the golf course. In early 2019, restoration crews were mowing, treating, and removing non-native vegetation downstream of Prado dam. Restoration activities are scheduled to resume this fall and will be ongoing outside of avian nesting season.

Green River Golf Club

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 what is considered the Santa Ana Canyon.

The USACE Reach 9 bank stabilization project started during the fall/winter of 2011 with several more acres of riparian habitat removed that included mature willow and cottonwood

trees. This area supported 13 vireo territories during the 2011 breeding season. The 2010 project phase was roughly 75% complete at the end of the 2012 season with some replanting underway, but habitat loss and construction activities likely contributed to the 27% decrease in territory numbers between 2011 to 2012. In 2014, no additional habitat was removed; however, construction continued adjacent to occupied habitat upstream of the railroad bridge in the beginning of the nesting season. On May 1 of that season, a vireo nest was found within 100 feet of construction activities that were moving toward the nest. The USACE and the U.S. Fish and Wildlife Service (USFWS) were both notified immediately, but work continued toward the nest. By the next week the nest had been abandoned with two eggs. Subsequently, other vireo nests were found near construction activities and work eventually stopped in this area for the rest of the 2014 season. Most recently, the Burlington Northern Santa Fe (BNSF) rail bridge construction project, which began in 2018, continued in 2019. A total of 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.

Featherly Regional Park

Featherly Regional Park is located along the Santa Ana River, between the west end of the Green River Golf Club and the Yorba Linda Blvd./Weir Canyon Rd. bridge in the County of Orange. This site is the downstream portion of what is considered the Santa Ana Canyon.

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 3 of the USACE Santa Ana River Mainstem (SARM) 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 has been 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. Concurrently, Phase 4 began 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, removing vegetation from another three and a half territories. In 2019, Phase 5a was completed and restoration began before nesting season. Construction activities in Phases 4 and 5b continued throughout the season.

Sampled Sites

A sampled site is considered a site where either three assessment surveys were conducted, or a site surveyed >3 times irregularly across the breeding season, in which no or minimal nest monitoring occurred. The objectives were to document vireo occupancy, quantify a minimum number of territories, and to identify areas in need of restoration. Territorial males were documented, as well as incidental observations of females and fledglings. In 2019, the first assessment surveys were conducted between 4/22-4/29, the second surveys between 5/20-5/24, and the third between 6/24-6/28.

Mockingbird Canyon

Mockingbird Canyon is located in the city of Riverside in Riverside County, and its arroyo serves as a drainage tributary to 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). 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 piluliferum*) is becoming more prevalent.

Although the reservoir and basin are protected from development at this time, residential development remains an issue in Mockingbird Canyon. Damage to the habitat and potential harm to nesting vireo occurs from residents extending their property into the arroyo. Much of the adjacent upland habitat is lost and the arroyo is becoming more fragmented by culverts and bridges. The riparian habitat throughout the entire site is continually threatened by OHV's, paintball activity, trash dumping, and other illegal activities. SAWA manages an 11-acre easement in Mockingbird Canyon at Roosevelt St. and Markham St. and will continue to work with local stakeholders to enhance and protect the canyon's natural resources.

Temescal Canyon

Temescal Canyon is approximately 26 miles (42 km) long and is located along Interstate 15 between Lake Elsinore and Highway 91, where it crosses into Prado Basin. Survey areas 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 monitored vireo in Temescal Canyon since 2001 when it began its arundo removal program. Temescal Wash is currently being managed for arundo regrowth and native vegetation has begun to reestablish. Five biologists covered the canyon over three visits in 2014,

2015, and 2016 with the goal of documenting an accurate territory count and as much data on reproductive status as time allowed. A seasonal biologist was hired to cover the entirety of the canyon and collect the same data in 2017, 2018, and 2019, albeit over several more visits. The additional visits resulted in a more complete dataset than was possible in prior years. However, as in 2017 and 2018, SAWA was again unable to collect a complete dataset from the riparian habitat within the Dos Lagos golf course due to denial of access to the area. This area has contained approximately 15% of vireo territories in Temescal in previous years.

The habitat within Temescal Canyon is characterized by patchy, but dense riparian vegetation. Privately owned sand and gravel mines operate downstream adjacent to the 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 and the most downstream section of the wash. Many sections of the wash are channelized by riprap and berms, but still allow some meandering 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 is dominated by tamarisk. Semi-natural shrubland stands also occur with patches of sparse Goodding's black willow. Although SAWA has been effectively treating arundo since 2000, tamarisk has now become a dominant exotic throughout the wash, especially in areas surrounding Lake Elsinore.

Chino Hills

The fragments of riparian habitat in Chino Hills along Highway 71 have been surveyed annually since 2003. A total of twelve riparian habitat patches were monitored in Chino Hills, including Butterfield Park, Alterra Park, a flood basin at Brookwood Lane, and a patch of habitat at Slate Drive. Formerly considered assessment sites, habitat at Soquel Canyon and the Community Park at English Channel were also monitored in 2019. Most of these assessment sites occur on private property for which access is restricted. The riparian patches in Chino Hills are classified as a *Salix gooddingii* Woodland Alliance (Sawyer et al. 2009).

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.

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 vireo and

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. All vireo encountered were noted as to location, behavior, and reproductive status on each visit or survey. GPS coordinates were taken in the approximate center of the territory, if known. Each point denotes a territory, not just a sighting. Coordinates were not taken at nest locations. Territory size range was estimated at monitored sites. Attributes were associated with each vireo territory location and are as follows: unique ID, notes, survey location, surveyor name, agency, category (monitored/sampled/incidental), breeding status, GPS location, fledged (yes/no/unknown), number fledged, and parasitism (yes/no/unknown). A complete attribute table with detailed metadata is included in the shapefiles submitted to the USACE, CDFW, SBVMWD and USFWS. Banded vireo 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 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-839480-5.2 and a Memorandum of Understanding with the CDFW.

Surveys were conducted five days per week throughout the nesting season (March through July). Occasional visits to determine continued vireo presence occurred through August and September. Biologists watch for nesting behavior from a distance and do 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 or zebra finch egg was used to replace the cowbird egg. Beginning 2019, nests that were predated before it could be determined if they had been parasitized (7-8 days) were excluded from parasitism rate calculations.

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

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 well-monitored pair to build a nest. Includes carrying nesting material though never finding nest.

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

Well-tracked nest: a complete nest observed with vireo egg(s) and/or nestlings 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 eggs or nestlings but produced no known fledged young.

Presumed failure (nest): a complete nest that did not receive an egg; no powder from pin feathers seen in nest; adults seen without fledglings.

Presumed successful (nest): a well-tracked nest with powder from pin feathers seen in the nest.

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

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

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

Unknown failure: classified as such when loss due to unknown reasons.

Manipulated nest: cowbird egg or nestling removed from nest.

Known fledged young: a fledgling seen out of the nest; nestlings from well-tracked nests, 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 were documented in conjunction with visual and auditory searches for vireo. 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 2019, 42 traps were deployed. Thirty-five traps were deployed in or near vireo habitat and the remaining seven were deployed at dairy farms (Figure 5). The USACE and the USFWS funded 29 habitat traps and seven dairy traps. The SAWA/IERCD Reach 3B project funded four traps in San Timoteo Canyon and the remaining two traps, located at the Meridian Conservation Area, were contracted by the Rivers and Lands Conservancy. All but two traps were opened by March 25. All traps were closed by July 31.

Traps are designed after Australian crow traps. The trap is a cubic wood frame covered in wire mesh and fitted with shade 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 followed 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 August 8, 2014, SAWA is required to dispatch all European Starlings and House Sparrows 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 where these birds congregated and may hamper trapping of cowbirds. 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 coloring started to show. 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 four 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 the 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 trap until the falconer could collect the birds. Holding traps contained extra food and water containers and were closed to entry by additional birds. If applicable, banded cowbirds were reported to the U.S. Bird Banding Laboratory, but only banded males were released. At the end of July, birds were removed from all of the traps and food and water was removed. Trap entry was closed and the door locked open to prevent unintended captures. SAWA removed traps from the field after they had been closed.

RESULTS

Vireo Abundance

In 2019, SAWA documented a total of 1,361 vireo territories, including 686 known pairs and 1,247 known fledglings at all monitored, sampled, and incidental sites. This represents a 1% increase in territories from 2018 (n=1,347). OCWD reported 606 territories in Prado Basin in 2019 (Bonnie Johnson, personal communication) for a total of 1,967 vireo territories watershed-wide (Table 1). The number of territories, pairs, and fledglings documented at each monitored site can be found in Table 2. Abundance data over time can be found in Appendix C-1.

In 2019, monitoring efforts at most sites were similar to 2018; notable exceptions were San Jacinto, Hidden Valley – North, and Norco Bluffs. The number of documented territories in San Jacinto decreased 15% from 2018 (n=74) to 63 territories in 2019. This decrease may be due to decreased site monitoring effort this year. For Hidden Valley – North, 78 territories were detected, an increase of 26% from 2018 (n=62). This increase may be attributed to an increased monitoring effort. The number of documented vireo territories in Norco Bluffs in 2019 (n=101) increased by 181% from 2018 (n=36); however, this is due to the addition of 250 acres to the monitoring area (see Results and Discussion by Site).

Chronology of Breeding Activity

Surveys at monitored sites began between March 15 and March 22. Surveys ended between July 31 and September 18. The first vireo was detected on March 15 at Featherly Regional Park. The estimated earliest date for the arrival of 50% of vireo males was on April 3 at

San Jacinto. The estimated earliest date for 50% of males paired was April 11 at San Jacinto and Featherly Regional Park. The first nests were found on April 2 at San Timoteo Canyon and Featherly Regional Park. The first date a nest fledged was May 1 at Green River Golf Club. The last date a nest fledged was August 5 at Hidden Valley – South. The last date vireo were detected was September 13 at Featherly Regional Park (Table 3).

Nesting Site Preferences

Nesting site preferences followed parameters 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. Arroyo willow (16%) and mulefat (15%) were the primary plant species used for nest placement by vireo in 2019 (n = 419). Three other abundantly used species of willow were narrowleaf willow (10%), Goodding's black willow (8%), and red willow (7%). Blue Elderberry (*Sambucus nigra* ssp. *caerulea*), desert wild grape (*Vitis girdiana*), and Fremont cottonwood held another 9%, 6%, and 4% respectively. Thirty-one nests (7%) were placed in non-native vegetation. A complete list of plant species utilized by nesting vireo in 2019 can be found in Table 4. Historical nest site preference data can be found in Appendix C-2.

Other vegetation used by vireo in the watershed in 2019 include coyote brush (*Baccharis pilularis*), laurel sumac (*Malosma laurina*), tamarisk, black mustard (*Brassica nigra*), and poison hemlock (Appendix B-2). This suggests that Least Bell's Vireo 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 vireo supports the need for careful monitoring of all plants during the nesting season.

Reproductive Success

Reproductive success, as measured by productivity of well-monitored pairs watershed-wide, was 3.8 in 2019. This rate represents a substantial increase from 2.5 in 2018. Nest success was 62% (225/364 well-tracked nests), an increase from 52% (140/267) in 2018 (Appendix B-3). Average clutch size was 3.7 based on 337 complete clutches (Table 5). See Appendix C-3 for individual site data over time. Metrics specific to San Bernardino Valley Municipal Water District restoration sites can be found in Table 5B.

Predation Rates

Nests are assumed predated if all eggs or unfledged young were destroyed or removed. In 2019, the watershed-wide predation rate was 29%, a decrease from 42% in 2018 (104/364 well-tracked nests; Table 5; Appendix B-3). Predation rates varied at each site, and can be found

in individual site results. At sites with more than five or more well-tracked nests, predation rates varied between 6% and 45% (Table 5). Historically, nest loss due to predation is 34% (n=1,094/3,249) watershed-wide (Appendix B-3). Nest losses are typically due to unknown predators. In 2019, vegetation containing a vireo nest with three nestlings was removed by homeless in Hidden Valley - South. The vireo pair managed to successfully re-nest nearby and fledge one young. Multiple vireo pairs were observed scolding or chasing California Scrub-jays (*Aphelocoma californica*) at several sites. In Featherly Park, one particular pair was found chasing scrub-jays on most visits but was still able to successfully fledge two broods. At Green River Golf Club, three nests containing nestlings were classified as predated by Argentine ants (*Linepithema humile*), though it is not clear if the ants were the cause of death or just scavengers. Other suspected nest predators include American Crow (*Corvus brachyrhynchos*), Common Raven (*Corvus corax*), long-tailed weasel (*Mustela frenata*), raccoon (*Procyon lotor*), and various snake species. These 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. For the first time, feral pig signs (tracks and scat) were observed downstream of Prado Dam in an active vireo territory. Isolated sightings have been made in other areas throughout the watershed. 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 2019, 10% (32/316) of well-tracked nests were parasitized by cowbirds, up from 3% in 2018 (n = 267; Appendix B-1). San Jacinto, San Timoteo, Mockingbird Canyon, and SAR – Upstream (Riverside Ave. to Van Buren Blvd. and Hidden Valley South) were sites in which parasitism was documented in 2019. The watershed - wide parasitism rate has ranged from 2% to 10% in the last five years, and overall loss of well-monitored nests due to parasitism has ranged from 0% to 4% during that time. The criteria for judging nest failure due to parasitism is the loss or abandonment of vireo eggs in the presence of a cowbird egg or nestling (in well-monitored nests). The low parasitism rates over the last five years are likely attributed to SAWA's extensive cowbird trapping program. Since SAWA began nest monitoring, 248 nests have been manipulated (cowbird egg or nestling removed), 112 of which successfully fledged 242 vireo (Appendix B-3).

Repaired Vireo Nests

Six nests were repaired in 2019 (Table 5). Of these, four were ultimately successful, fledging nine young. Since SAWA has managed vireo in the watershed, 47 nests have been repaired and 89 young have fledged from those nests (Appendix B-3).

Results and Discussion by Site

Monitored Sites

San Jacinto

In 2019, 63 vireo territories were documented in San Jacinto, 12 of which were in the San Jacinto Wildlife Area (SJWA), 16 in the river from Bridge St. to Sanderson Ave., and the remaining 35 territories in the river from State St. to Lake Park Dr. This represents a decrease of 15% from 2018 (n=74). Many historical territories located in the section between Bridge St. and Sanderson Ave. were not documented in 2019. This section was scoured after February rain storms, and much of the understory did not grow back until later in the season. In previous years, this site has been monitored inconsistently due to funding and staff availability. Despite differential monitoring over the years, the population has increased over fifteen-fold from three territories in 2004 when SAWA began monitoring this location (Appendix D). This increase can likely be attributed to nest monitoring and cowbird management in the area. In 2019, the estimated vireo territory size in San Jacinto ranged between 0.97 and 5.2 acres.

Forty-four pairs and 117 fledglings were detected in 2019. Nesting success was 69% based on 35 well-tracked nests. Nest losses in 2019 were due to predation, parasitism and reproductive failure, accounting for 26%, 3% and 3% of total nest outcomes, respectively. Seven well-monitored pairs had a 5.0 reproductive success rate and produced 35 fledglings (Table 5). Nesting success is 57% over 15 years of monitoring (n=178 well-tracked nests). Predation has been the major cause of nest loss in the last 15 years (32%). Reproductive success based on productivity of well-monitored pairs in the last 15 years is 2.8. Narrowleaf willow (50%) and mulefat (18%) have been the primary plant species used for nest placement in San Jacinto since 2004. Goodding's black willow and coyote brush accounted another 10% and 8%, respectively. Ten nests (5%) found from 2004 to 2019 were placed in non-native vegetation (Appendix C-2-A).

Cowbird trapping has occurred in San Jacinto since 2003 (excluding 2015) and a total of 26,460 cowbirds have been removed during the breeding seasons, mostly from local dairies (Appendix C-1-A). Parasitism has occurred consistently over the years, including the 2019 breeding season. During 2019, five well-tracked nests were parasitized by cowbirds. In addition to the parasitized vireo nests, 38 cowbirds were observed in the habitat throughout the breeding season.

Current threats to the riparian habitat primarily involve human encroachment, including the use of OHV's in the riverbed and trash dumping. In the San Jacinto River, approximately 1.5 miles upstream from State St., numerous homeless camps have been established, which have

resulted in refuse in the habitat and vegetation clearing. Rains in February 2019 scoured the riverbed; however, the vegetation recovered well. Many of the previously standing dead trees, suspected to be a result of drought conditions, were washed downstream.

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 (Albert A. Webb and Associates 2015), and 11,350 residential units (The Villages of Lakeview 2017) remain to be seen.

San Timoteo Canyon

In 2019, 124 vireo territories were documented in San Timoteo Canyon, down 21% from the 156 documented in 2018 (Table 1). However, some areas of San Timoteo were inaccessible in 2019 due to landowner restrictions. In addition, some of this decrease may be attributed to 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 were not documented in both 2018 and 2019. Also, a previously occupied section of Younglove Preserve was not surveyed this year. However, the population in San Timoteo has experienced a greater than 30-fold increase in 19 years. This increase can be attributed to the removal of invasive species and subsequent restoration of native vegetation, nest monitoring, and cowbird management. In 2019, estimated territory size of the vireo in San Timoteo ranged between 0.3 to 2.2 acres.

Ninety-two pairs and 170 fledglings were detected in 2019. Nesting success was 44%, the same as in 2018 (Appendix C-3-B). Nesting success is 55% over 19 years of monitoring (n=1,088 well-tracked nests). Thirty-nine well-monitored pairs had a 3.2 reproductive success rate in 2019, up from 2.9 in 2018. Overall reproductive success based on productivity of well-monitored pairs in the last 19 years is 3.0. Nest losses in 2019 were primarily due to predation, accounting for 43% of total nest outcomes. Predation has been the major cause of nest loss in the last 19 years (36%; Appendix C-3-B). Mulefat (25%), arroyo willow (23%) and red willow (16%) have been the primary plant species used for nest placement in San Timoteo since 2001. Desert wild grape and Goodding's black willow held another 8% and 7%, respectively. Only fifteen of 1,194 nests found from 2001-2019 have been placed in non-native vegetation (Appendix C-2-B).

Cowbird trapping has occurred in San Timoteo Canyon since 2001, and a total of 2,728 cowbirds have been removed during this time (Appendix C-1-B). In 2019, 12 nests (15%) were parasitized by Brown-headed cowbirds, and subsequently seven nests (8%) failed as a result (Appendix C-3-B). This parasitism rate remains a marked decrease from a high of 75% in 2001.

Although parasitism by cowbirds still occurs, at a rate of 12% (127/1,078 nests) over 19 years, only 3% of nests have failed due to parasitism (Appendix C-3-B). This low failure rate is primarily a result of intensive nest monitoring efforts which include nest manipulation.

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.

Santa Ana River (SAR) – Upstream

In 2019, 477 vireo territories were documented, an increase of 4% from the 458 documented in 2018. Two hundred and forty-seven pairs and 442 fledglings were also documented. Vireo abundance has increased throughout the upstream section since monitoring began in 2000, and may be attributed to increased monitoring efforts, addition of new survey areas, removal of invasive vegetation, mowing in the Riverside Flood Control channel upstream, as well as cowbird management.

In 2019, estimated territory size of vireo in SAR – Upstream ranged between 0.2 and 3.8 acres. In 2019, apparent nest success was 61% (n = 119), higher than in 2018 (56%; n = 119). The most common cause of nest failure was predation (29%; n = 119). The parasitism rate was 12% (n = 105; Table 5B). Arroyo willow was the most common nest substrate used (34%), followed by mulefat (20%). In 2019, six cowbird traps were located in this section of the river and a total of 45 cowbirds were removed over 497 trap days (Table 2).

SAR - Riverside Ave. to Van Buren Blvd.

Historically, SAR – Riverside Ave to Van Buren Blvd. has been analyzed as one site. Because of two new restoration projects, SAR – Riverside Ave to Van Buren Blvd. has been split into three sections: Non-Restoration, Evans Lake Drain, and Anza/old Ranch Creeks. 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 2019, 166 territories were detected at SAR – Riverside Ave. to Van Buren Blvd., a 1% increase from 164 territories detected in 2018 (note that the survey area was increased in 2019 and could be contributing to the increase in detected territories). Seventy-two males were known to be paired, eight of which were well-monitored. Eighty-two fledglings were observed, 11 of which fledged from well-monitored pairs. An average of 1.4 fledglings were produced by

well-monitored pairs. Nest success was 39% ($n = 18$), less than 2018 (63%; $n = 24$). The parasitism rate was 41% ($n = 17$) in 2019, greater than the 21% ($n=24$) documented in 2018. Information specific to each sub-section can be found in the following sections and Table 5B.

One-hundred ninety homeless camps were documented in this stretch of the Santa Ana River in 2019. This is likely an underestimate of the actual number of camps, as there were areas unsafe for biologists to traverse, which precluded documenting potential camps in those areas. In addition, each documented camp ‘houses’ an unknown number of individuals and it is likely that some camps are inhabited by multiple individuals. Some camps were compounds with multiple structures and vehicles. Observations related to the camps include clearing of whole areas 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. In the habitat near the river at the end of Wilderness Ave., campers have created ‘roads’ using hundreds, if not thousands, of square feet of carpet. Brush fires occur regularly in and near the riverbottom, with areas near Sunnyslope, Mount Rubidoux and the Van Buren Bridge burning in 2019. Further disturbance was created via police activity related to the encampments, including officers on foot, officers driving OHV’s through the riverbottom, and low flying helicopters broadcasting announcements. While homeless camps have been an issue at this site for several years, the level of homeless inundation observed could be becoming detrimental to the habitat and vireo.

Recreational use and human encroachment continues to be a threat to the habitat. Recreational activity was noted near Sunnyslope, where food trash, alcohol containers, latrines, and used diapers were found at the river’s edge. Similar disturbance has been noted near the Van Buren Bridge. Garbage in general, including clothing, tires, tents, and furniture, was abundant in large portions of the survey area, especially early in the spring after winter flooding. This garbage likely originates from multiple sources, including homeless camps, dumping, and improperly secured trash receptacles. Along the mainstem, multiple discarded vehicles, including sedans and pickups, were noted.

SAR - Riverside Ave. to Van Buren Blvd. Non-Restoration

In 2019, 140 vireo territories were documented along the Santa Ana River from Riverside Avenue to Van Buren Boulevard in the Non-Restoration section. Nest searching and monitoring were not conducted in this area in 2019. Six nests were found incidentally, but not revisited. Fifty-four pairs and 49 fledglings were detected in 2019 (Table 5B). 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.

Prior to the start of the 2014, 2016 and 2018 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 vireo shifted to new areas downstream. In the years following mowing, monitoring efforts showed an increase in vireo territories. This suggests as the vireo 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. Research suggests vireo 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 822 cowbirds have been removed during this time (Appendix C-1-E). In 2019, 18 cowbirds were observed within the survey area.

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

Four territories were detected at Evans Lake Drain in 2019. Only a small portion of Evans Lake Drain had been previously surveyed by SAWA, so it is unknown how many vireo occupied the site in prior years. Two males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Both pairs were well-monitored. Four fledglings were detected; all fledged from one well-monitored pair, resulting in an average of 2.0 fledglings produced per well-monitored pair in 2019 (Table 5B). In 2019, estimated territory size of the vireo ranged between 0.5 to 2.0 acres. In 2019, apparent nest success was 33% (n = 3). One of the two nest failures was predated and the other failed due to reproductive failure. Cowbird parasitism was not observed and no cowbirds were incidentally observed onsite in 2019. One nest was placed in Goodding's black willow; the other two nests were placed in exotic species, poison hemlock and tree tobacco.

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

In 2019, 22 territories were detected at Anza/Old Ranch Creeks, a 29% increase from 17 territories detected in 2018. Sixteen males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Six pairs were well-

monitored. Twenty-nine fledglings were detected across all pairs in 2019, seven of which fledged from the six well-monitored pairs, resulting in an average of 1.2 fledglings produced per well-monitored pair in 2019 (Table 5B). In 2019, estimated territory size ranged from 0.2 to 3.8 acres.

Fifteen nests were found in 2019, all of which were well-monitored. In 2019, apparent nest success was 40% (n = 15). Of all nests, three (20%) failed due to predation, three (20%) failed due to parasitism, and three (20%) failed due to reproductive failure/other. Seven nests were parasitized by cowbirds (50%; n = 14), five of which were manipulated (removal of egg(s)/nestlings). It was clear the other two nests had been abandoned prior to removal of cowbird eggs. Of the five manipulated nests, one fledged (20%), two were predated after manipulation (40%), one did not hatch (20%), and one was likely abandoned before manipulation (20%). In addition, three male cowbirds were detected onsite during the course of fieldwork in 2019. The three most common nest substrates used in 2019 were desert wild grape (33%; n = 15), arroyo willow (20%), and mulefat (20%). The remaining nests were found in various native substrates (Table 4).

SAR – Lower Hole Creek

Three territories were detected in 2019. Lower Hole Creek had previously not been surveyed by SAWA, so it is unknown how many vireo occupied the site in prior years. One male was determined to be paired, which was the sole well-monitored pair. No fledglings were detected. In 2019, estimated territory size of the vireo ranged between 0.5 to 2.0 acres.

In 2019, one nest was found and subsequently predated. No cowbirds were incidentally observed at the site in 2019. Although potential effects have not been quantified, homeless encampments and trash dumping may threaten habitat quality at Lower Hole Creek. Approximately five camps were documented over the course of the 2019 season at Lower Hole Creek. A minimum of three were active at seasons end. The exact number of homeless camps is difficult to quantify because homeless often move their camps and it can be difficult to determine if a camp is actively being used. There is an open lot on the southeast edge of the site that is atop a hill. People frequently come to this location to illegally dump refuse, often dumping it down the hill and into the vireo habitat. Several pieces of furniture, a water heater, chemicals, old windows, and numerous other types of refuse were observed at the site in 2019. Monitoring at this site is hazardous. While monitoring a bird, the onsite biologist witnessed an on-foot police chase through the territory. The suspect was not apprehended and a helicopter search ensued, forcing the onsite biologist to leave. The frequency and effect of these types of events is unknown.

SAR - Hidden Valley — North (north side of river)

Seventy-eight territories were detected in 2019, a 26% increase from 62 territories detected in 2018. Thirty-seven males were determined to be paired, though most territories were not monitored sufficiently to determine pairing success. Forty-one fledglings were detected across all pairs in 2019; none of which were well-monitored. The average number of fledglings produced per well-monitored pair has ranged from 2.0 in 2014 (n = 4) to 4.0 in 2017 (n = 6; Appendix C-3-F). Nest monitoring did not occur at Hidden Valley – North in 2019, but did occur in 2010, 2014, and 2016-2018.

Although potential effects have not been quantified, homeless encampments may threaten habitat quality at Hidden Valley – North. Multiple encampments were observed in 2019, many of which were established prior to 2018 and likely involved habitat removal at the time they were established. In addition, several homeless at Hidden Valley – North keep unleashed dogs, which could possibly disturb vireo breeding behavior. Improper garbage and human waste disposal from the sizable homeless population adds pollutants to the environment that could possibly affect vireo, but these potential effects are currently not very well known. Recreationists may pose an additional threat. The City of Jurupa Valley Park located on Downey Street is a popular location for swimming, barbecuing, picnicking and occasionally for live music. The recreational use of Hidden Valley – North results in additional noise and refuse in the vireo habitat.

SAR - Hidden Valley — South (south side of the river)

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 (south side of river) Overall

In 2019, 140 territories were detected at Hidden Valley – South, less than a 1% decrease from 141 territories detected in 2018. Seventy-nine males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Thirty-nine pairs were well-monitored. Two hundred-nine fledglings were detected across all pairs in 2019, 148 of which fledged from 39 well-monitored pairs, resulting in an average of 3.8 fledglings produced per well-monitored pair in 2019. The average number of fledglings produced per well-monitored

pair has ranged from 2.1 in 2010 (n = 9) to 4.8 in 2017 (n = 4; Appendix C-3-G). In 2019, estimated territory size ranged from 0.2 to 3.2 acres.

Nest monitoring has occurred at a Hidden Valley – South every year since 2000 with widely varying numbers of nests monitored (Appendix C-3-G). Seventy-eight nests were found in 2019, 76 of which were well-monitored. In 2019, apparent nest success was 63% (n = 76), higher than in 2018 (49%; n = 45). Predation was the most common cause of nest failure accounting for 25 (33%) nests in 2019. It's noteworthy that one of these predated nests failed when a homeless person broke the branch the nest was in as they were clearing vegetation for a camp; human-caused failures are considered predations. The cause of two (3%) nest failures was classified as 'reproductive failure/other' because they were partially predated and subsequently abandoned. Though six (9%; n = 64) nests were parasitized by cowbirds, only one (1%) failed due to parasitism (Table 5). Predation has been the leading cause of failure every year nests were monitored (Appendix C-3-G).

An attempt was made to manipulate all six parasitized nests. Four of the six (67%) parasitized nests were successful after manipulation, one (17%) was later predated, and one (17%) was abandoned, likely before manipulation and due to the parasitism. Parasitism was down from a high of 44% (n = 9) in 2007; however, parasitism had not been observed at Hidden Valley – South from 2012 to 2018 (Appendix C-1-G). Though it's clear from the observations of parasitism that cowbirds use the site, no incidental observations of free-flying cowbirds were made in 2019.

Arroyo willow (39%) and mulefat (21%) were most frequently used for nest placement in 2019. One nest was found in exotic perennial pepperweed (1%; n = 76) and the remaining nests were found in various native substrates (Table 4). Substrates used in 2019 are comparable to those used in previous years (Appendix C-2-G).

Five homeless camps were found during the course of fieldwork at Hidden Valley – South in 2019. Three were evicted by conservation officers, one was either abandoned or infrequently used, and the last was in the process of being evicted, but still onsite at the close of the season. Hidden Valley – South is used frequently by equestrians and hikers which could plausibly disturb vireo breeding behavior, but the potential effect recreation has on vireo is not well studied. Large swaths of exotic plant monocultures (e.g. arundo) still exist at this location, particularly in the western part of Hidden Valley – South. Areas with high concentrations of arundo tend not to be selected for territory or nest placement (personal observation).

SAR - Hidden Valley – South (south side of river) Restoration

In 2019, 24 territories were detected at Hidden Valley – South Restoration. Twenty-three males were determined to be paired, twenty of which were well-monitored. Seventy-five fledglings were detected across all pairs in 2019, 70 of which fledged from the 20 well-monitored pairs resulting in an average of 3.5 fledglings produced per well-monitored pair. Thirty-seven nests were found in 2019 and all were well-monitored. Apparent nest success was 57% (n = 37). The parasitism rate was 21% (n = 29). Additional information specific to Hidden Valley – South Restoration can be found in Table 5B.

SAR - Hidden Valley – South (south side of river) Non - Restoration

In 2019, 116 territories were detected at Hidden Valley – South Non-Restoration. Fifty-six males were determined to be paired, nineteen of which were well-monitored. One hundred thirty-four fledglings were detected across all pairs in 2019, 78 of which fledged from the 19 well-monitored pairs resulting in an average of 4.1 fledglings produced per well-monitored pair. Forty-one nests were found in 2019, 39 of which were well-monitored. Apparent nest success was 69% (n = 39). The parasitism rate was 0% (n = 35). Additional information specific to Hidden Valley – South Non-Restoration can be found in Table 5B.

SAR - Goose Creek, Norco to I-15

In 2019, 90 vireo territories were documented at SAR - Goose Creek, only a 1% decrease from the 91 vireo documented in 2018. Fifty-eight pairs and 110 fledglings were also documented (Table 2). Nesting success for 24 well-tracked nests was 71%, an increase from 64% in 2018. Nest losses in 2019 were due to predation and reproductive failure, accounting for 21% and 8% of total nest outcomes, respectively. The reproductive success rate of well-monitored pairs was 4.1 in 2019, due to unusually high numbers of successful second broods (Table 5). This is the highest recorded reproductive success rate at this site. The lowest recorded rate is 1.0 in 2002; however, only three pairs were well-monitored that year (Appendix C-3-H). In 2019, nests were primarily placed in arroyo willow (28%), black willow (20%), and mulefat (16%). Overall, since 2000, most nests have been placed in mulefat (32%) and arroyo willow (29%). Less frequently, nests have been placed in Goodding's black willow (13%), desert wild grape (6%), Fremont cottonwood (4%), and red willow (4%; Appendix C-2-H).

Cowbird trapping has occurred at this site since 2004 and data are reported as part of the SAR - Upstream route. Five hundred eighty-eight cowbirds have been removed from this area in over 3,014 trap days (Appendix C-1-I). Parasitism has been documented on the site in seven out of 19 years surveyed; however, parasitism has only been documented in one of the last ten years (2013). Overall parasitism is low, with a rate of 5% (n=374 nests) since 2000 (Appendix C-1-H). In

2019, one male cowbird was detected directly adjacent to the habitat; however, no nest parasitism was documented during the season.

Currently, a housing development is being constructed near the west end of the IERCD Goose Creek mitigation parcels. The development creates dust, noise and easier access to the habitat. Once finished, the development may result in increased human and domestic animal disturbance as the development abuts the habitat. Additionally, construction on the 1-15 bridge over the Santa Ana river has shifted territories on the south side of the site, possibly due to high noise levels. Feral pigs are prevalent in the area and damage the habitat. There is also evidence of feral pig trapping and hunting in the area. 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. On June 21, 2018, it was discovered that an individual (or individuals) accessed one of the IERCD Goose Creek mitigation parcels with a large industrial vehicle, possibly an excavator. Damage from this incident is still evident as it knocked over and crushed shrubs, small cottonwood trees, and prickly pear cactus (*Opuntia* sp.). Other threats to the habitat include unauthorized creation of trails, OHV use, trash dumping, and tree die off due to polyphagous shot hole borer (*Euwallacea* sp.).

Norco Bluffs, I-15 to River Rd.

In 2019, a total of 101 vireo territories were detected in Norco Bluffs, a 10% decrease from the 112 documented in 2018¹. Fifty males were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 139 fledged young were documented (Table 2). A total of 35 nests were found, all of which were well-tracked. Nesting success of well-tracked nests was 89%, a large increase from 73% in 2018. The reproductive success rate also increased from 2.7 in 2018 to 5.4 in 2019, much higher than the previous peak rate of 3.7 in 2015. Average clutch size was 3.8, slightly higher than 3.6 in 2018. Of the 35 well-tracked nests, only 6% (n=2) were lost due to predation, compared to 20% in 2018. Two (6%) nests failed due to reproductive failure in 2019, similar to 2018 at 7% (Appendix C-3-I). In 2019, estimated vireo territory size in Norco Bluffs ranged from approximately 0.5 to 3.25 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 in 2019, SAWA placed a trap at a site previously used by the contractor and removed one male and one female over the course

¹ In 2018, vireos were monitored in select areas within Norco Bluffs and excluded a 250-acre parcel monitored the previous two seasons; vireo within the parcel were surveyed using a different methodology by a USACE consultant as part of a 1-year maintenance contract. Of the 112 vireo territories detected; thirty-six vireo territories were detected in the area monitored by SAWA, and 76 vireo territories were detected by the 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 and 2018, 2016 and 2017. The 2019 survey year has no comparable data.

of 113 trap days (Appendix C-1-I). No cowbirds were detected in vireo habitat over the course of the season. Parasitism was not observed in 2019 or during any of the previous survey years.

As in the past three seasons, the primary sources of habitat degradation in 2019 were invasive plants and the continued negative impacts of the polyphagous shot hole borer (PSHB). This beetle drills into trees and brings with it a pathogenic fungus (*Fusarium* sp.) that can infect, and kill, many different tree species. Fortunately, the large-scale dieback of riparian habitat, as observed in the Tijuana River Valley (Boland 2016), from PSHB infestation has yet to occur; nonetheless, arroyo willow have been significantly impacted by PSHB in Norco Bluffs. The majority of arroyo willows 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 37% (n=13/35 nests) were placed in these two species in 2019 (Table 4). Before the arrival of PSHB, the Norco Bluffs habitat was characterized as healthy where arundo had yet to become dominant, but some large areas are completely dominated by arundo and provide little habitat value to native wildlife. 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. Assuming not all of the trees are eventually killed by PSHB, removal of arundo and palms would allow for natural recruitment of native riparian plant species, thereby dramatically increasing the total area of functional habitat for vireo and other sensitive species.

Santa Ana Canyon (SAC)

These results are compiled from three sites (Upper Canyon, Green River Golf Club, and Featherly Park), collectively known as SAC. One hundred forty-nine vireo territories were detected in the Santa Ana Canyon (SAC) in 2019, a slight increase from the 140 territories detected in 2018 (compiled from Table 1). In 2019, mean clutch size was 3.7 (n=77), an increase of 0.6 from 2018. Nesting success for 75 well-tracked nests in SAC was 72% overall, a substantial increase from 39% in 2018. Fifteen well-tracked nests were lost to predation (20%) and six were lost to reproductive failure or unknown reasons (8%). No parasitism was documented in 2019. The reproductive success rate in SAC in 2019 was 4.6, vastly different from a success rate of 1.7 in 2018. Until 2019, the rate had been decreasing annually in SAC since 2011 when the rate was 2.7 (compiled from C-3-L to C-3-N; Appendix D). For comparison, the watershed-wide rate of reproductive success in 2019 was 3.8 (n= 151 well-monitored pairs) and the watershed-wide rate

of fledglings produced from 2001-2019 was 2.9 (n= 1,772 well-monitored pairs; Appendix B-3). A record 230 fledglings were documented in 2019, a substantial increase from 68 fledglings documented in 2016 and 2018. A total of 1,501 fledglings have been documented in SAC over the last 18 years (compiled from Appendix C-1). Vireo used a variety of plant species (n= 18) for nest substrate in 2019. Of the 85 total nests found, the highest number of nests were found in mulefat (30%), blue elderberry (24%), laurel sumac (11%), black mustard (8%), and narrowleaf willow (8%; compiled from Table 4). Vireo territory size in SAC is estimated to be between 0.5 acre and 9.8 acres.

SAWA began cowbird trapping in SAC in 2001 when parasitism was documented in five of 19 nests (26%). Parasitism was again documented in one of 21 nests (5%) in 2009 after five years of no occurrences (Appendix D). SAWA deployed two traps within a mile of that location and no parasitism has been recorded since. Since 2001, a total of 2,407 cowbirds have been removed from the canyon over 13,300 trap days during the vireo breeding season (compiled from Appendix C-1-L to C-1-N). There were no un-trapped cowbirds detected in vireo habitat in the Santa Ana Canyon in 2019.

In 2019, two different phases of the USACE Reach 9 project were active in Featherly Park and the BNSF bridge project continued in Green River Golf Club. These on-going construction projects will continue for several years and may challenge future vireo recovery in the impact areas. However, proposed mitigation should expand and enhance vireo habitat in the post-construction years. For example, several vireo have already moved into restored areas in Phase 3, only three years after installation and in Phase 4 by the second year.

At this time, riparian habitat in the Santa Ana Canyon 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 the Upper Canyon continue to spread. In the lower section (Featherly Regional Park) the arundo had been treated with Imazapyr, which damaged many of the surrounding native trees. Though most of the arundo at this location is dead, the biomass remains, hampering native regeneration at this site. Additionally, multiple native trees are suffering from Imazapyr over-spray. Trees damaged by Imazapyr continue to suffer and many were found dead in 2016. Additional damage was observed in 2018.

The polyphagous shot-hole borer (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 the last five years. Although the USACE riverbank stabilization (Reach 9) and BNSF bridge projects are expected to continue for several years, as well as the Santa Ana River Trail project set to resume, we hope active management of the canyon will improve to maintain optimum conditions for its native species.

Upper Canyon

In 2019, 35 vireo territories were documented in Upper Canyon, three more than 2018. Twenty-four were known to be paired and 58 fledglings were documented (Table 2). Nesting success for 19 well-tracked nests was 74%, an increase from 50% in 2017 and 2018. Five (26%) well-tracked nests were lost to predation, bringing the overall rate of predation from 2001 through 2019 to 29% (Appendix C-3-M). Nine well-monitored pairs successfully produced a total of 37 fledglings (Table 5). Overall success of well-tracked nests for this site from 2001 to 2019 is 67% and the overall reproductive success rate of well-monitored pairs during this time is 1.9. A total of 417 fledglings have been documented over the last 19 years (Appendix C-3-L). Well-tracked nests were most frequently placed in mulefat (36%), blue elderberry (27%), and black willow (14%; Table 4). One nest was repaired during the early nestling stage. The weight of the nest contents caused the nest to sag and was in danger of falling off the host branch. The repaired nest successfully fledged three vireo. Estimated territory size of the vireo in Upper Canyon ranged between 0.70 to 1.5 acres in 2019.

Cowbird trapping has occurred in Upper Canyon since 2001 when the first vireo was detected on-site. To date, 842 cowbirds have been removed from this area (Appendix C-1-L). Parasitism has only been documented two of the 19 years monitored and reached its highest rate in 2003 (18%). No parasitism has been detected in Upper Canyon since 2003 (Appendix D). No cowbirds were detected in the habitat in 2019.

No construction activities occurred within Upper Canyon in 2019. 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

In 2019, 45 territories were documented, an increase of 7% from 2018 (n= 42; Table 1). The vireo population at Green River Golf Club has more than quadrupled since monitoring began

in 2001 when only ten vireo were detected (Appendix D). Of the 45 males found, 34 were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 96 fledglings were documented (Table 2). Nesting success for 28 well-tracked nests was a record high of 79% compared to the lowest recorded rate of 25% in 2018 (Table 5). The highest previous nest success occurred in 2017 (76%). Overall nest success from 2001 to 2019 is 58%. Four (14%) well-tracked nests were lost to predation and two (7%) nests were lost to reproductive failure (Appendix C-3-M). The reproductive success rate rebounded in 2019 to 4.3 compared to 0.6, the lowest rate documented at this site in 2018. The overall reproductive success rate from 2001-2019 of well-monitored pairs is 2.5. A total of 544 fledglings have been documented over the last 19 years (Appendix C-3-M). Well-tracked nests were most frequently placed in blue elderberry (30%), mulefat (21%), laurel sumac (12%), and black mustard (12%; Table 4). Six nests were placed in non-native vegetation which included black mustard (12%), arundo (3%), and Peruvian pepper tree (3%). In 2019, estimated territory size of the vireo at Green River Golf Club ranged between 0.5 to 9.8 acres.

The BNSF construction project that began in 2018 continued in 2019. The project impacted four vireo territories 2018. Riparian habitat for two territories was completely removed and habitat for two additional territories was partially removed. A pair of vireo located directly upstream from the construction work exhibited signs of reproductive stress in 2018 and 2019. Their first nest contained four eggs; however, the nest only successfully fledged one vireo. Two dead nestlings and an egg remained in the complete nest. In addition, this nest was repaired during the egg stage due to nest instability on the host plant. In 2018, this pair experienced similar reproductive issues and only one nestling successfully fledged from a well-tracked nest.

Cowbird trapping has occurred at the golf club since 2001 when the first vireo was detected on-site and a total of 1,070 cowbirds have been removed from this area (Appendix C-1-M). When SAWA began monitoring this site, the parasitism rate was 44%. No parasitism has been documented since 2001 when cowbird trapping was initiated (Appendix D).

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 vireo and other sensitive species, and enhance habitat.

Featherly Regional Park

In 2019, 69 territorial vireo were detected in Featherly Regional Park, three more than 2018. Thirty-three were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 76 fledglings were detected. A total of 540 fledglings have been observed over the last 19 years (Appendix C-1-N). These numbers emphasize

the vireo population recovery at this site over the last nineteen years given that no vireo were detected in 2001, the first year of monitoring. The population's first major increase 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 2016 (Appendix C-3-N; Appendix D). In 2019, estimated territory size of the vireo in Featherly Park ranged between 1.0 to 3.2 acres. The banded vireo that held the same territory from 2013 to 2018 was not detected in 2019. In his place was an un-banded male.

Nesting success for 28 well-tracked nests in 2019 was 64%, an increase from 2018 and much higher than the overall nesting success from 2002 to 2019 of 47%. Only six (21%) of 28 tracked nests were lost to predation. Although parasitism was not documented at this site in 2019, four well-tracked nest failed due to reproductive failure, three of which were placed in poison hemlock and fell when the branch peeled down. Eight closely monitored pairs had a record high reproductive success rate of 5.6. The overall reproductive success rate of well-monitored pairs over 19 years of monitoring is 2.2 (Appendix C-3-N). Of the 30 nests found in 2019, eight were placed in non-native vegetation (27%), with the highest number of native nest placement in mulefat (23%) and narrowleaf willow (20%; 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 as a scrub-jay took three seven-day old nestlings from one nest in 2015. In 2019, one particular pair was found to be chasing scrub-jays on most visits but was still able to successfully fledge two broods. Another nest invader found in large numbers throughout the site is the Argentine ant, though no ant predation was found in 2019. One nest was found with ants entering a small hole in the eggs on hatch day in 2015. 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, Argentine ants were observed preying on vireo nestlings and hatch-day eggs..

Cowbird trapping has occurred in Featherly Regional Park since 2001 when the first vireo were detected on-site and 495 cowbirds have been removed during this time. Parasitism has been documented three out of the 18 years surveyed, reaching its highest rate in 2002 (67%). No parasitism has been detected in Featherly Regional Park since 2009 (Appendix C-1-N).

Until the abundant winter rains in 2016/2017, 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 at this site was likely due to the decrease in drought stress and resulted in higher recruitment in 2018. Though 2018 was another

severe drought year, higher than normal precipitation occurred during the winter of 2018/19. 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 increasing homeless camps. Invasive plants continue to be a problem at this site. In 2019, with the increased winter/spring precipitation, poison hemlock and mustard were dense throughout most of the site. The highly invasive 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 re-established 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. Trees damaged by Imazapyr continue to suffer and many were found dead in 2016. More damage was observed in 2019. Two different phases of the USACE Reach 9 project were active in Featherly Park in 2019. However, proposed mitigation should expand and enhance vireo habitat in the post-construction years. In fact, vireo ($n=3$) have already begun inhabiting the Phase 4 restoration area this year. 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, those numbers rebounded in 2019 ($n=69$).

Sampled Sites

Thirty-five sites were sampled in 2019 and 420 additional vireo territories were documented. Vireo were not detected at six of the 35 sampled sites. Thirteen sites sampled in 2019 reported an increase in detected vireo territories, while 17 sites reported a decrease in detected vireo territories. Five sites reported the same number of territories in 2018 and 2019 (Table 1).

Cowbirds were reported at six of the sample sites: Alessandro/Prenda Arroyo, Irvine Park, Lake Perris, Meridian CA (formerly March SKR Preserve), Mead Valley, and Poorman Reservoir. Cowbirds at Meridian CA were reported from captures in cowbird traps; cowbirds were not observed in the habitat. Traps operated by another agency were on site at Irvine Park.

Mockingbird Canyon

In 2019, 43 vireo territories, 19 pairs and 24 fledglings were detected in Mockingbird Canyon (Table 2). The number of territories has remained constant since 2018; however, some shifts in territory placement were observed. Measures of reproductive success have varied over the years, due in part to differential monitoring efforts. This year was the lowest recorded

reproductive success (1.0); however, only three pairs were well-monitored. A high of 5.0 was observed in 2009 (Appendix D-3-E) with two well-monitored pairs. Excluding 2009, the highest reported reproductive successes were 3.0 in 2012 and 2016 (Appendices D and C-3-D). Since 2003, overall nesting success of 169 well-tracked nests is 52% (n=88), with a low of 15% in 2003 (n=13) and a high of 83% in 2009 (n=12; Appendices D and C-3-D). Four hundred seventy-five vireo fledglings have been reported over all the survey years (Appendix C-3-D). Nest placement has primarily occurred in red willow (29%), blue elderberry (18%) and Goodding's black willow (16%; Appendix C-2-D).

In 2019, there were two documented cases of nest parasitism. One nest failed due to parasitism, while the other nest was manipulated and eventually failed due to predation. 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. The parasitism rate decreased sharply after this trapping program began, and although parasitism continues to occur episodically, it seems to be controlled. The overall parasitism rate is 11% (n=167), with 4% of nests failing as a result of parasitism (n=169). Since 2003, a total of 2,176 cowbirds have been removed from Mockingbird Canyon (Appendix C-1-D).

Despite SAWA's efforts within its conservation easement, habitat destruction and disturbance still occurs in Mockingbird Canyon. In 2016, a huge portion of habitat was removed along the north strip of land behind the homes off Owl Tree Rd., just west of SAWA's easement site. Although this area is not part of the easement, it historically had vireo nesting activity. In 2017, another portion of riparian habitat was bulldozed at the Markham Street entrance to the site, adjacent to SAWA's easement. These disturbances may have impacted or greatly stressed nesting birds that were on site. In addition, the possibility of Cal Fire beginning a fuel modification project on site may put a number of vireo territories in the area at risk. During the 2019 nesting season, large amounts of vegetation showed signs of heat and drought stress, such as early senescence and desiccation. In some areas, particularly in Mockingbird Canyon Archaeological Site on Harley John Road, dead riparian vegetation has been scoured, resulting in a lack of vireo occupation in 2019.

Temescal Canyon

One hundred twenty-seven territorial male vireo were detected in 2019, compared to 106 in 2018 and 109 in 2017. The 2019 count was slightly less than the count of 131 territorial vireo in 2013, which to date, was the peak year (Appendix D). Unlike the 2013 survey year, the past three survey years (2017-2019) excluded the Dos Lagos Golf Course as SAWA biologists were prohibited from entering the area; thus, the 2019 count likely would have been higher. Without nest monitoring and/or cowbird trapping, vireo will likely begin to decrease in number. Fifty-six

pairs and 16 nests were found incidentally in 2019. Forty-eight fledglings were detected in 2019, as occurred in 2017, making both years the peak years (Appendix C-1-J).

In 2019, a total of 14 adult cowbirds were detected in the riparian habitat of Temescal Canyon: one in the most southern area within the property owned by 3M Corporation, one south of Corona Lake, two at Lake Elsinore, four in the habitat north of the intersection at Highway 74 and Baker Street, and six at Railroad Canyon creek. One parasitized nest containing two cowbird eggs was found incidentally at Railroad Canyon, and one fledgling observed being fed by a vireo at Lake Elsinore was also detected. Five cowbird traps were open for the 2019 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 338 cowbirds over 579 trap days. Cowbird trapping has occurred during the nesting season in Temescal Canyon since 2001 and a total of 4,350 cowbirds have been removed during this time (Appendix C-1-J). Even with on-site cowbird trapping, parasitism has been documented in Temescal in eleven out of the 19 years it has been surveyed, reaching a peak rate of 42% (n=5/12 nests) in 2007 (Appendix D).

Despite the above average annual precipitation received in 2019, much of the habitat throughout Temescal Wash continues to show drought, 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 re-establishing outflow to the creek near Dos Lagos Golf Course.

Chino Hills

In 2019, Chino Hills was not monitored extensively due to inaccessibility to all vireo locations. Even though fewer site visits were conducted and survey effort was reduced, 29 territories, 17 pairs, and 19 fledglings were documented in 2019, representing an increase in territories from 2018 (n=26) and 2017 (n=25) (Appendix C-1-K). One nest was found and successfully fledged four vireo. In 2019, estimated territory size of the vireo in Chino Hills ranged between 0.4 to 3 acres.

One cowbird trap was deployed in Chino Hills in 2019. The trap was located near the Chino Hills Community Center at English Channel and did not capture any cowbirds over a period of 101 trap days. The trap encountered some predator issues due to Cooper's Hawks utilizing it as a prey source. In 2018, 23 cowbirds were captured over 92 trap days. Compared to 2016, 53 cowbirds were removed over 262 trap days, utilizing two cowbird traps. Trapping has occurred in Chino Hills since 2008, and a total of 239 cowbirds have been removed during this time (Appendix C-1-K). Before 2019, parasitism ranged from 0% (0/2 nests) in 2016 to 60% (3/5 nests) in 2007 (Appendix D). Since 2008, when cowbird control began, only two nests were found to be parasitized, in 2015 and 2018, respectively. No vireo were observed with cowbird fledglings and no cowbirds were detected in the habitat during monitoring in 2019. Parasitism, development, human activity, cattle grazing, and small fragmented habitat patches are factors that may threaten vireo and reduce productivity throughout the Chino Hills area.

Incidental Sites

In 2019, 27 additional vireo territories were documented at 10 sites in which no formal surveys were conducted (Table 1). Of those 27 territories, two males were incidentally determined to be paired and to have produced at least one fledgling. Location names and GPS coordinates of incidental vireo detections can be found in Appendix A.

SIGHTINGS OF INTEREST – INCIDENTAL SPECIES OBSERVATIONS

All incidental species sightings were documented at monitored sites and only sensitive species were documented at sampled and incidental sites during vireo monitoring. One hundred sixty-one avian, 19 mammal, 21 herpetofauna and 2 fish species were observed at monitored and sampled sites. Sensitive species were documented by site and a combined total of 42 sensitive species were detected (Table 6). Sensitive species are defined as those listed as endangered, threatened, or a species of concern by resource agencies, and those covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Observations are verified detections and are considered presence at each location, and should not be considered as a complete species list for each site. For example, California Gnatcatcher (*Polioptila californica*) were detected at three sites adjacent to vireo habitat; however, other gnatcatchers likely occur in adjacent areas of other sites where biologists do not frequent and hence there may be many undetected gnatcatchers. 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 (SWFL) 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). There were no detections of SWFL in the Prado Basin in 2019 (James Pike personal communication). In past years, the highest number of detections in the Prado Basin occurred in 2003, with nine individuals present.

In 2019, SAWA biologists detected eight individual migrant Willow Flycatchers (WIFL) within the watershed. No breeding pairs were detected. Two males were counter-singing in Norco Bluffs on 5/20. On 5/21, one male was detected at San Timoteo. On 5/24, one adult was observed at Irvine Regional Park (n=1) and one male singing at Hidden Valley — South). On 5/30, a second male was found at San Timoteo, and a third on 5/31. On 6/3, a second male was singing at Hidden Valley — South.

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 electronically to USGS Riparian Birds Working Group and to the California Natural Diversity Database.

BROWN-HEADED COWBIRD TRAPPING RESULTS

Brown-headed Cowbird Trapping, March-July 2019

Forty-two cowbird traps were deployed during the 2019 vireo season and 3,069 cowbirds were removed from all sites over 4,686 trap days. Of the 42 traps, seven were located at local dairies. The sex and ages of the cowbirds removed in 2019 were 2,035 adult males, 843 adult females, and 191 juveniles. SAWA biologists and field assistants spent 2,114 hours servicing traps during the vireo season, including installation and removal of traps from the field (Table 7).

Cowbird captures increased by less than 1% from 2018 (3,048) despite having three additional traps deployed in 2019. Nine percent fewer males, 17% more females, and 112% more juveniles were trapped during the 2019 breeding season. In 2019, the overall capture rate was 0.65 cowbirds per trap day, a decrease from 0.73 in 2018. Over 43,500 cowbirds have been removed from the watershed by SAWA during the breeding season since cowbird management began in 2001 (Appendix D). In 2019, one trap was shut down after two trap days because a dog at the property bit an assistant. The trap was not replaced.

Non-Target Captures in Cowbird Traps, March-July 2019

Twenty-six non-target native species and six exotic species were captured in 42 traps in 2019. Including all native species and the four non-nuisance exotic species, there were a total of 1,920 trapping occurrences (1,909 native and 11 non-nuisance exotic). It should be noted that many of these trapping occurrences are likely the same individuals returning to the same traps. In order of most frequently captured, the most common species were California Towhee (*Melospiza crissalis*), Song Sparrow (*Melospiza melodia*), Red-winged Blackbird (*Agelaius phoeniceus*), and House Finch (*Haemorhous mexicanus*). The percent of trapping occurrences that resulted in mortality was 2.0% in 2019 (Table 8). Numbers of the two nuisance exotic species released or removed, European Starlings and House Sparrows, are also listed in Table 8.

Fall/Winter 2018-2019 Brown-headed Cowbird Trapping and Non-Target Captures

Four cowbird traps were deployed at dairies during the non-breeding season (fall/winter) of 2018-2019. All four traps were located at two different dairies in the Prado Basin. A total of 6,005 cowbirds were removed (1,784 adult males, 2,379 adult females, and 1,842 juveniles) over 666 trap days (Table 9). In the fall/winter of 2017-2018, 3,893 cowbirds were removed from four dairy traps over 598 trap days (Aimar et al. 2018). In 2018-2019, the capture rate was 9.0 cowbirds per trap day, an increase from 6.5 in 2017-2018. Over 83,000 cowbirds have been removed from the watershed by SAWA during the fall/winter since cowbird management began (combined from SAWA annual reports 2001-2019).

Three non-target native species, consisting of 12 individual trapping occurrences, were captured in the four dairy traps in 2018-2019. The most common species captured was the Red-winged Blackbird. No non-target native species died in traps in 2018-2019. Numbers of European Starlings and House Sparrows either removed or released from cowbird traps are reported in Table 10.

DISCUSSION

With the exception of a few years, vireo abundance has increased annually in the Santa Ana Watershed since monitoring began in 2000. In 2019, 1,967 vireo territories were documented watershed-wide (including data from Prado Basin and other reporting agencies), a 7% decrease from 2018 (n=2,105; Figure 6). The significant population increase over 20 seasons of monitoring at four sites is illustrated in Figure 7. The 1,361 vireo detected by SAWA biologists in 2019 was up 1% from 2018 (n=1,347). Most survey sites throughout the watershed showed similar territory numbers. The two exceptions being San Timoteo, with a 21% decrease, and San

Jacinto, with a 15% decrease. Territories in San Timoteo were lost where a large swath of riparian habitat was removed for a flood control project and another area has yet to recover from a fire in 2017. The decrease in San Jacinto may be the result of reduced effort or continually high parasitism rates decreasing overall recruitment. Survey efforts were similar at most sites with one exception. Though Norco Bluff's had a similar survey effort, over 250 acres of habitat that was previously surveyed by another organization was added to SAWA's survey area this year, resulting in a nearly 3-fold increase in territory numbers (2018 n=36 vs 2019 n=101; Table 1).

Nesting success watershed-wide was 62% in 2019, up from 52% in 2018 and higher than the overall nesting success of 51% (n=3,249 well-tracked nests) in the last 19 years. In 2019, the overall reproductive success rate (average number of fledglings produced by well-monitored pairs) was 3.8, higher than the rate of 2.5 in 2018 and well above the 19-year average of 2.9. Southern California received higher than average precipitation during the 2018/2019 winter-spring season, which likely produced higher prey availability for nesting vireo and potentially contributing to increased reproductive success. Predation remains the primary cause of nest failure, with an overall 29% of nests lost to predation in 2019, lower than the 34% watershed-wide spanning all years of monitoring. The parasitism rate was 10% in 2019, though overall nest loss from cowbird parasitism was 4% (19-year average of 3%). The watershed-wide parasitism rate has ranged from 2% to 10% in the last five years and these low rates can likely be attributed to SAWA's cowbird trapping program and nest monitoring. Kus and Whitfield (2005) showed that cowbird trapping reduces parasitism of vireo nests, thus enhancing productivity of nesting pairs and in turn increasing the population level. Figure 8 shows the increase in vireo territories in relation to the rate of cowbird parasitism in the Santa Ana Watershed from 2001-2019. A comparison of watershed-wide nesting success, predation, and parasitism rates from 2003-2019 are shown in Figure 9. Nest loss due to reproductive failure and other unknown factors in 2019 was 6%. Examples of nest loss due to reproductive failure are failure of the vegetation to support the nest and non-parasitized egg abandonment (Appendix B-3).

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 by SAWA through cowbird trapping and habitat restoration. SAWA biologists have removed over 127,000 cowbirds from the watershed in the last 19 years (Figure 10). SAWA has also removed over 7,700 acres of invasive arundo from the watershed, allowing for almost as many acres of riparian recovery.

The lack of documented nesting Southwestern Willow Flycatchers in the watershed in 2019 is not surprising given the dwindling numbers over the last decade. No breeding activity from this species has been documented in the watershed since 2014. The habitat in the higher elevations of the watershed has had willow flycatcher territories in the past, and should be

surveyed to ascertain the status of this imperiled species in the mountains. SAWA and OCWD have plans to survey these areas in 2020.

MANAGEMENT RECOMMENDATIONS

Parasitism by Brown-headed Cowbirds continues to occur episodically throughout the watershed. Vireo monitoring and cowbird trapping should continue along with the removal of non-native vegetation and long-term maintenance of non-native vegetation re-growth. 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 over 7,700 acres of arundo and other invasive plants to date and an additional 600 acres to be removed this winter, SAWA continues to have extraordinary success with riparian habitat restoration along the Santa Ana River and its tributaries.

In recent years, large homeless encampments have become increasingly prevalent throughout the Santa Ana River. These encampments have a strong 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 land, there needs to be increased protection of lands for wildlife values. Specifically, enforcement of current laws that restrict illegal activities in sensitive riparian areas. Local landscapes are scarred with off-highway vehicle (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 must be enforced. A positive development in this area is the County of Riverside's code enforcement program that targets illegal dumping. 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.

Although existing laws are meant to protect these resources, even on private land, we must strive to invest the public in these resources and identify effective ways to ensure that floodplains are protected for future generations of humans and wildlife. Priorities for SAWA's vireo recovery program in the near future will continue to be based primarily on cowbird trapping and nest monitoring, which we believe provides the most immediate support for the recovering vireo population, the availability of ample invasive-free riparian habitat notwithstanding. SAWA will continue to provide accurate annual data on vireo status, distribution and reproductive productivity as funding allows.

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Figure 1. Map of the Santa Ana Watershed.



Figure 2. Least Bell's Vireo survey sites in the Santa Ana Watershed, 2019.

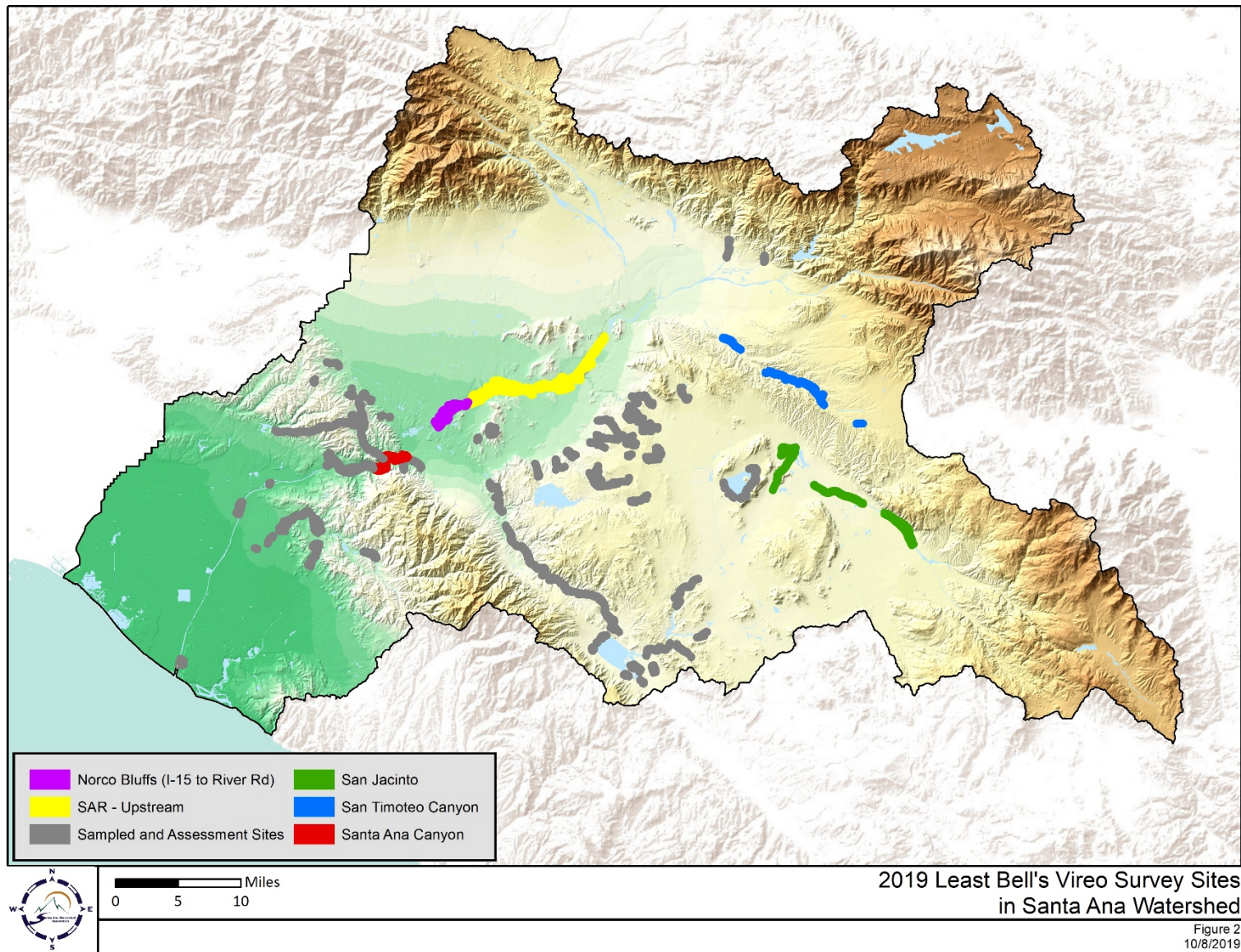


Figure 3. Norco Bluffs Vireo Survey Area, 2019.

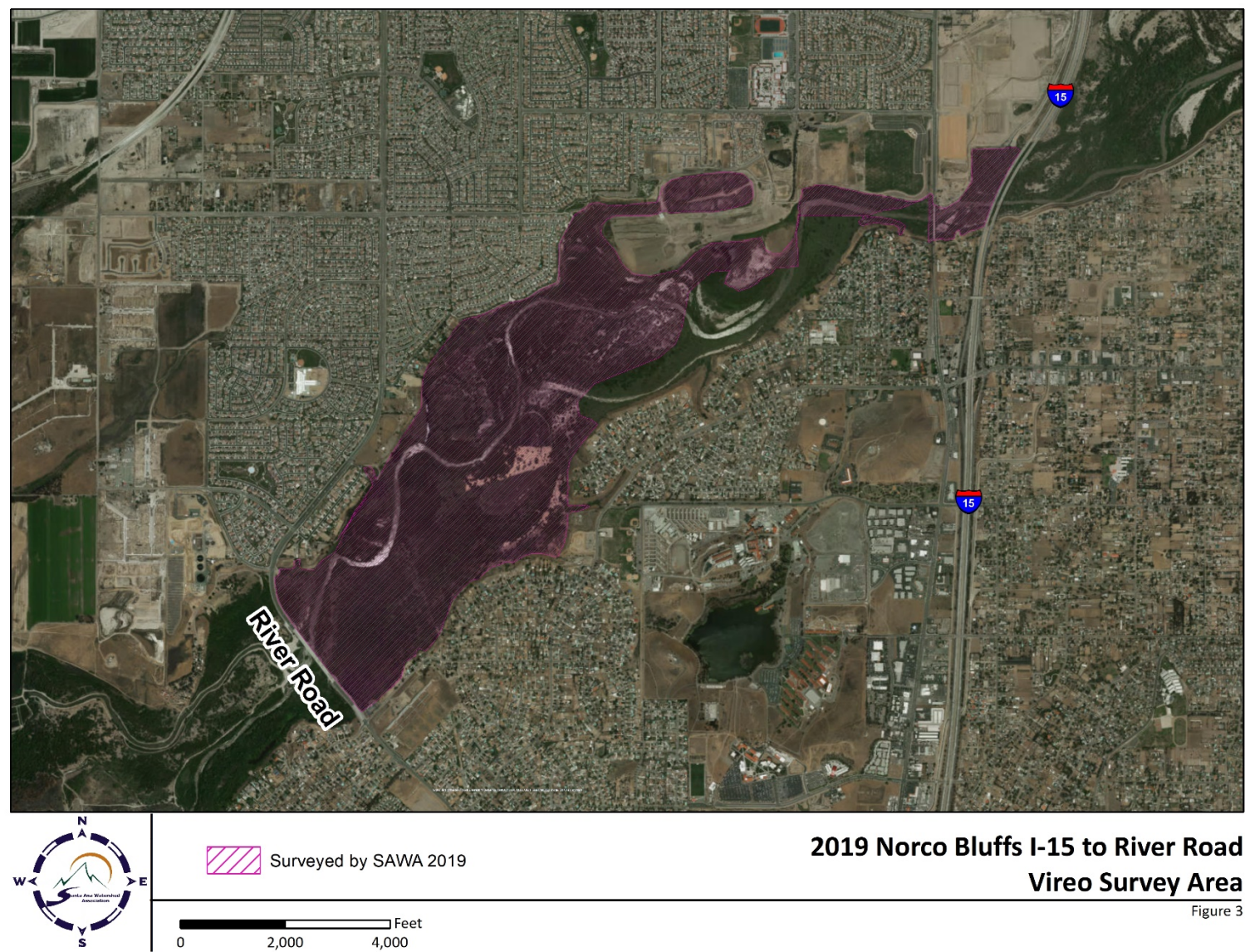


Figure 4. Upper Santa Ana River Least Bell's Vireo Sites, 2019.

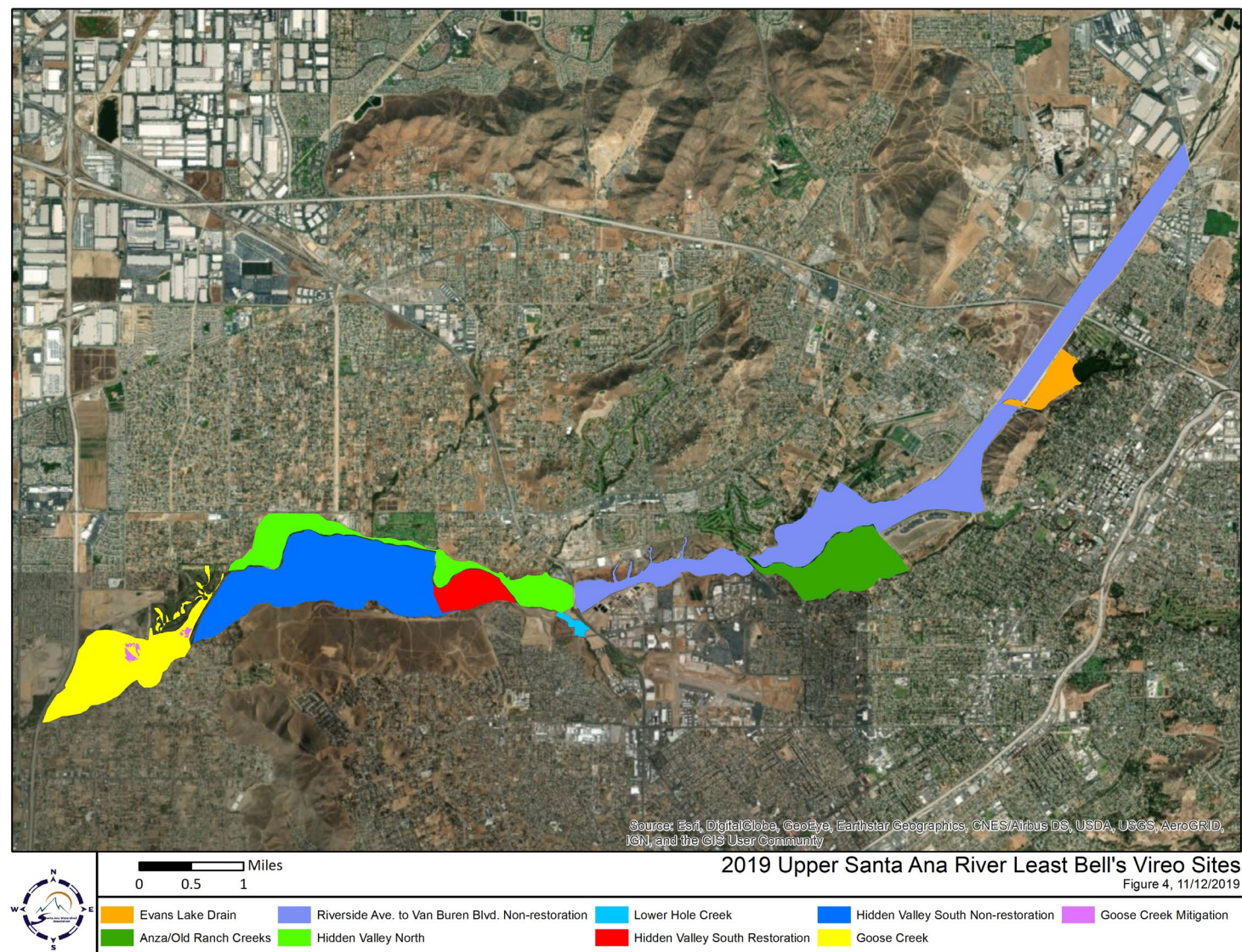


Figure 5. Brown-headed Cowbird trap locations in the Santa Ana Watershed, 2019.

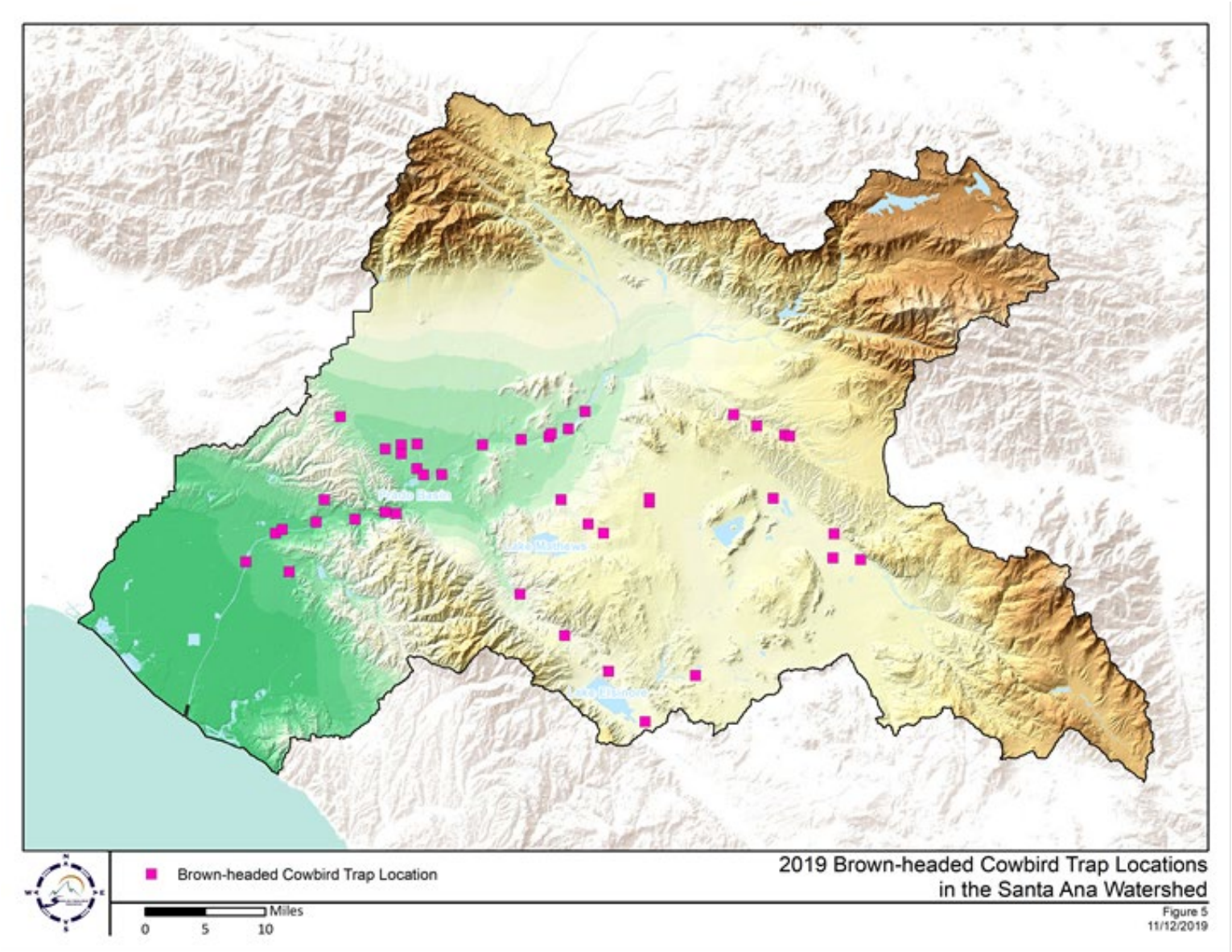


Figure 6. Least Bell’s Vireo abundance in the Santa Ana Watershed, including Prado Basin, 2000-2019.

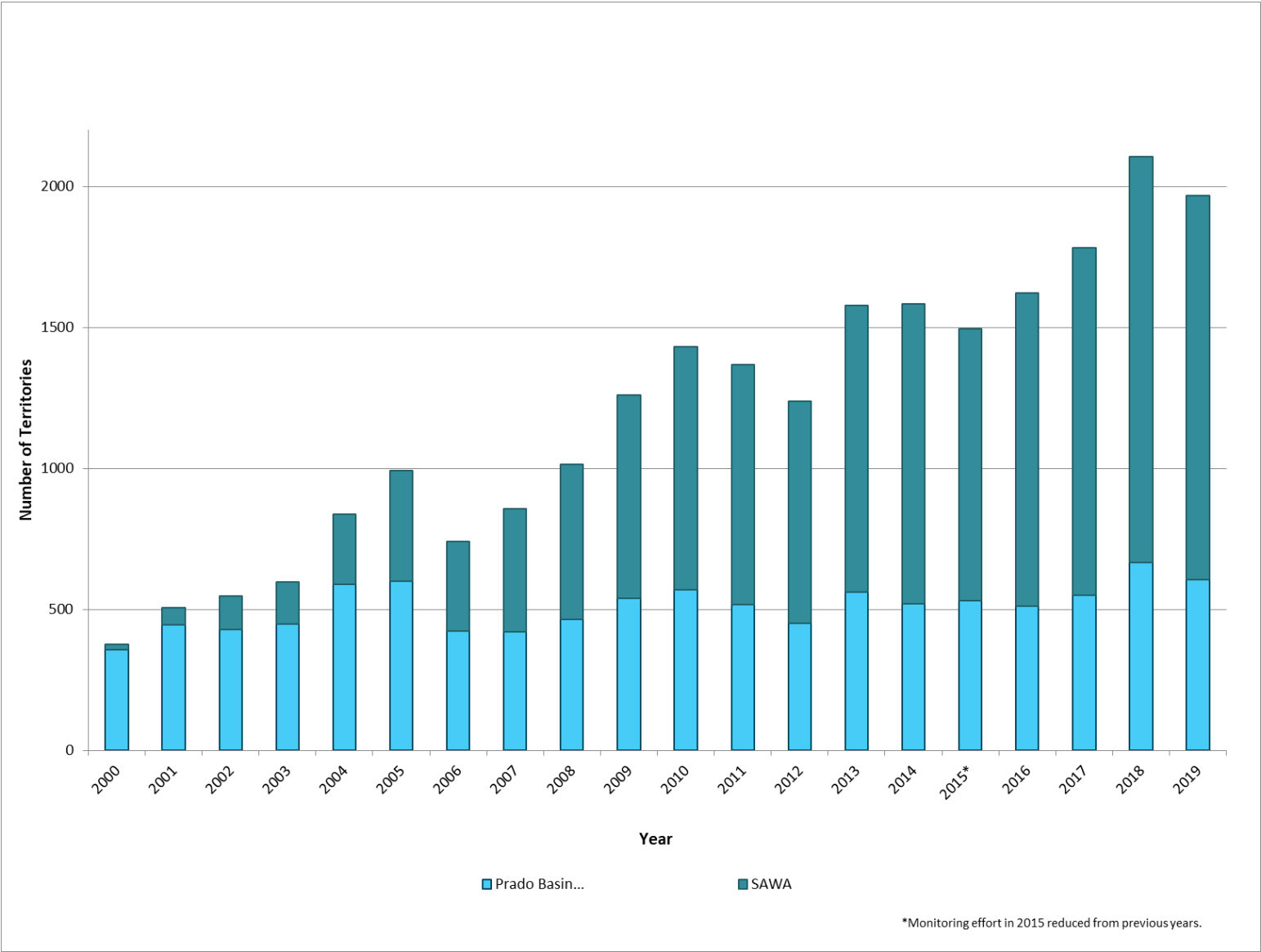


Figure 7. Least Bell's Vireo territories at four sites in the Santa Ana Watershed, 2000-2019.

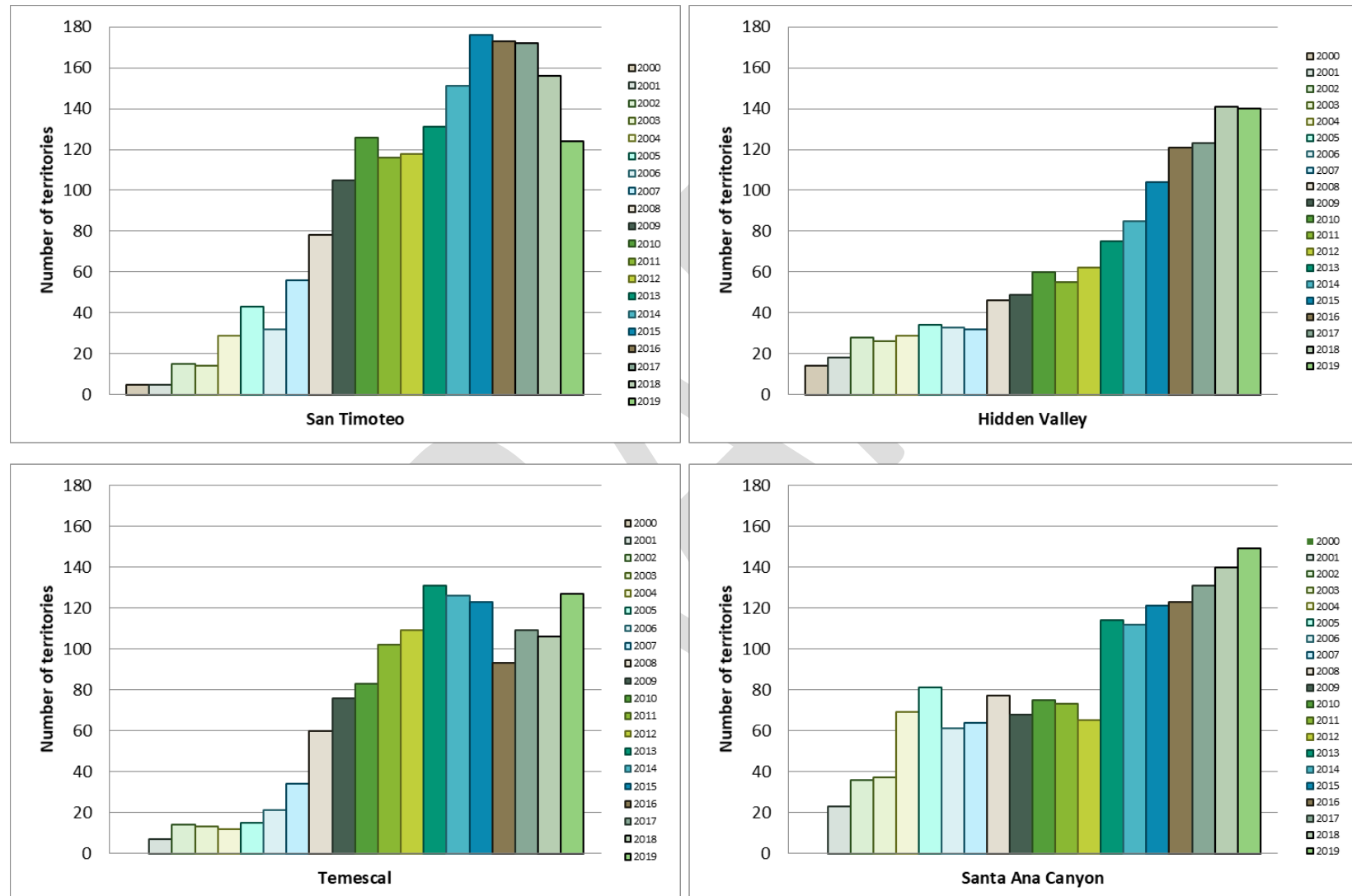


Figure 8. Vireo Territories vs. Parasitism Rates in the Santa Ana Watershed, 2001-2019.

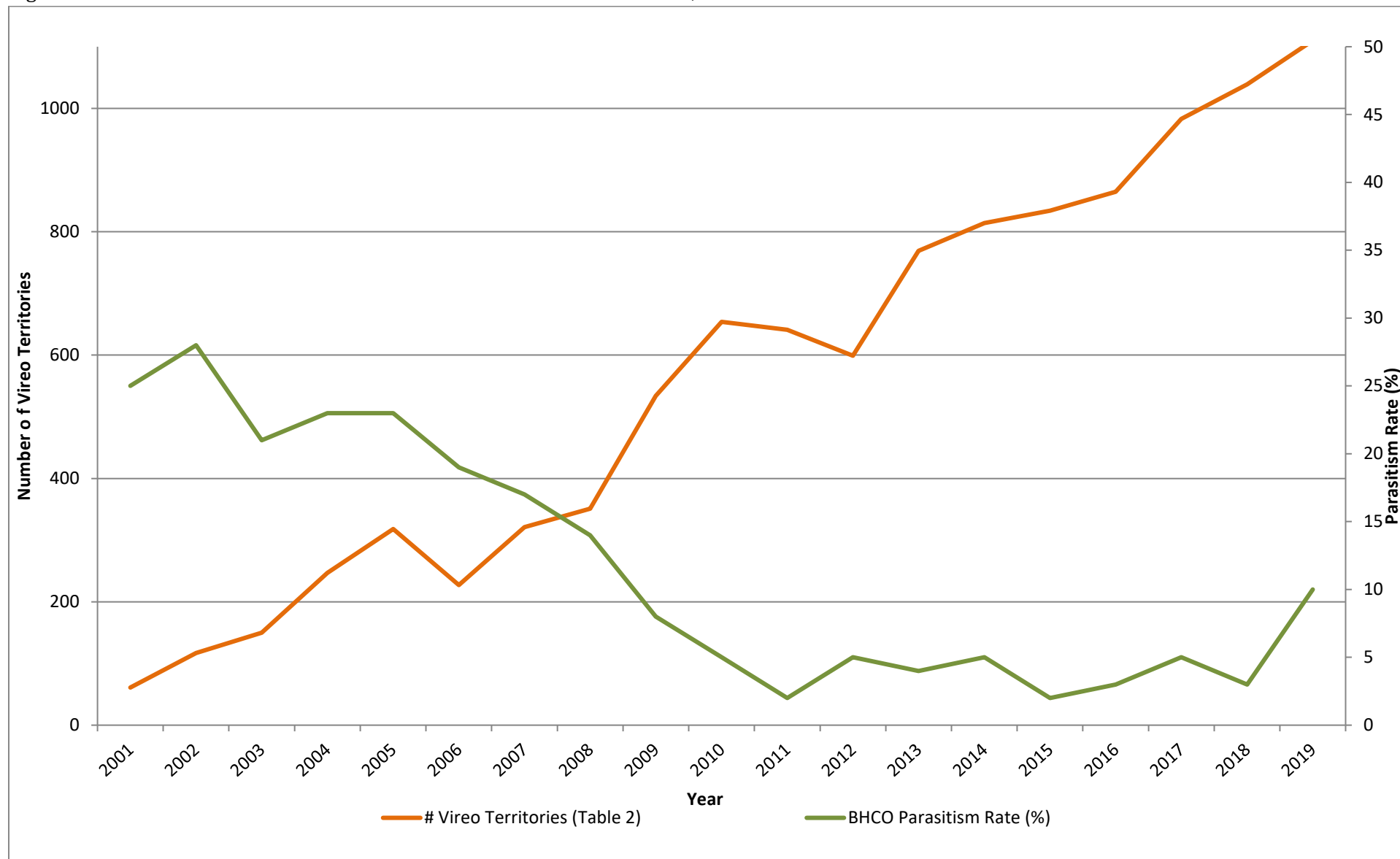


Figure 9. Least Bell's Vireo nesting success, predation rates, and parasitism rates in the Santa Ana Watershed, 2001-2019.

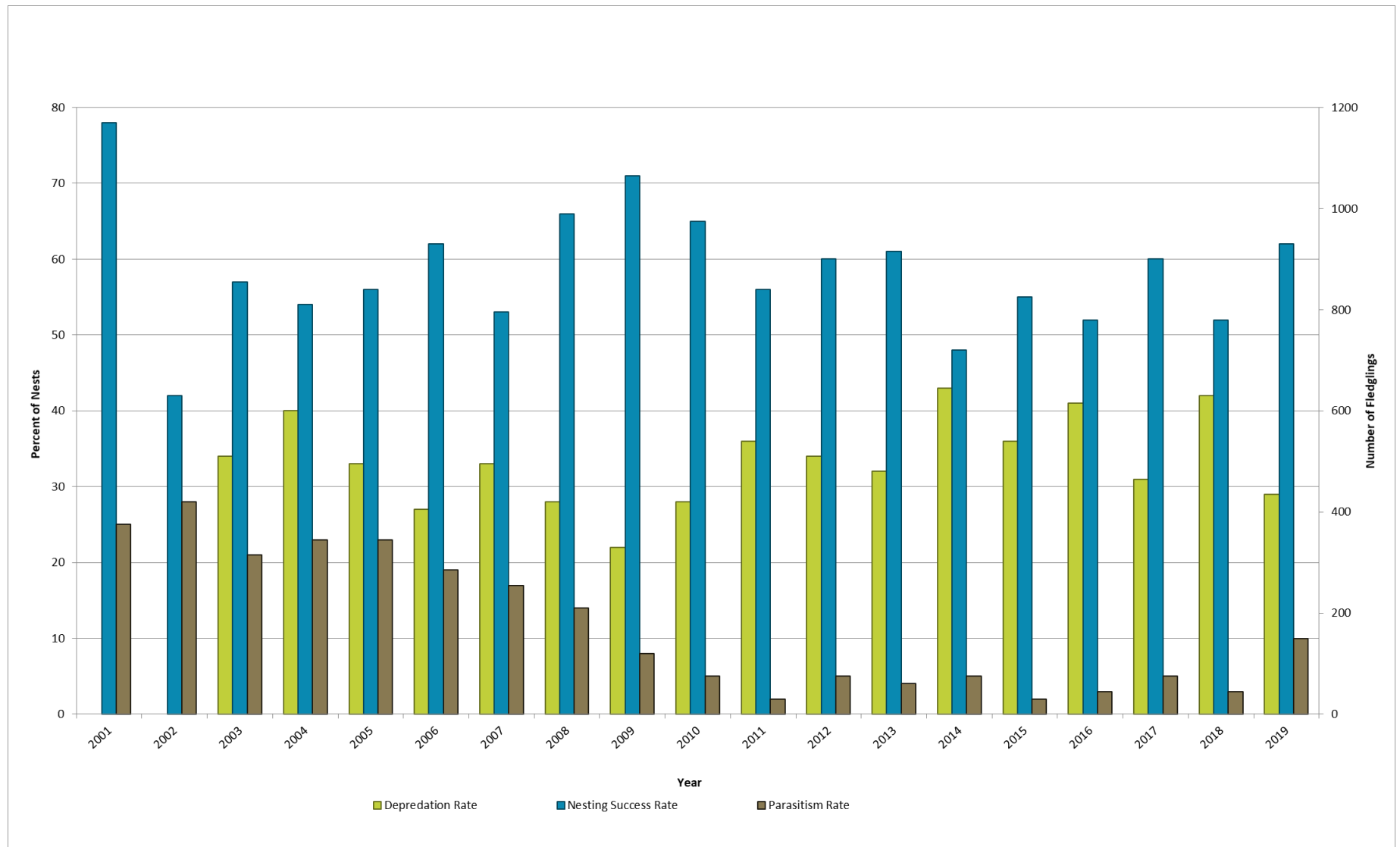


Figure 10. Brown-headed Cowbirds removed from sites in the Santa Ana Watershed, 2000-2019.

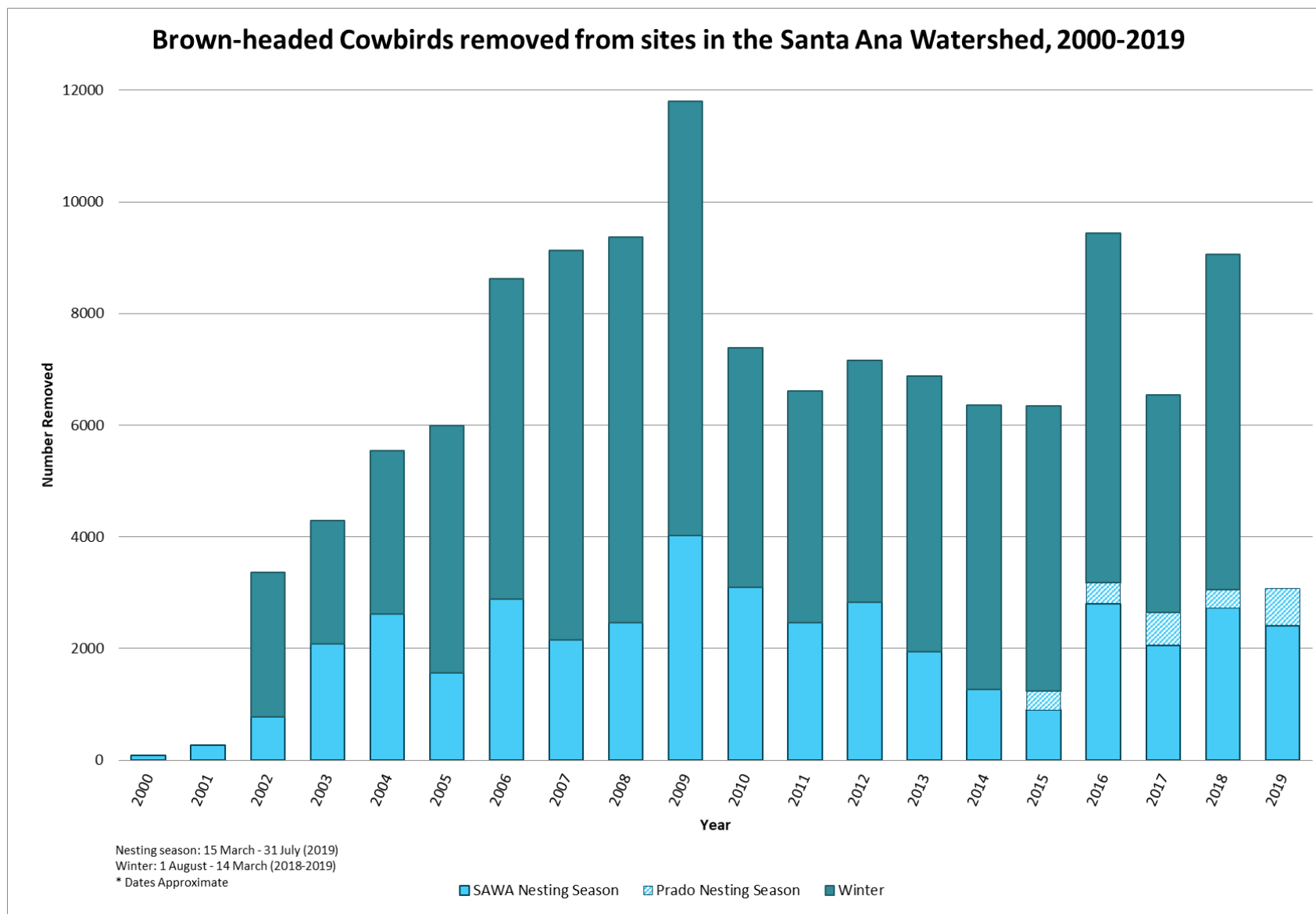


Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2015-2019. Numbers of territories, pairs, and fledglings detected.

Site Name	2015	2016	2017	2018	2019
Monitored Locations					
San Jacinto	29 / 7 / 8	37 / 17 / 12	45 / 27 / 48	74 / 34 / 60	63 / 44 / 117
San Timoteo Canyon	176 / 141 / 287	173 / 124 / 222	172 / 109 / 272	156 / 104 / 161	124 / 92 / 170
Santa Ana River (SAR) - Upstream					
Riverside Ave. to Van Buren Blvd.	109 / 37 / 33	109 / 43 / 62	155 / 95 / 169	164 / 96 / 95	166 / 72 / 82
Lower Hole Creek	n/s	n/s	n/s	n/s	3 / 1 / 0
Hidden Valley, north side of river	39 / 23 / 15	40 / 27 / 33	36 / 17 / 34	62 / 38 / 65	78 / 37 / 41
Hidden Valley, south side of river	104 / 27 / 22	121 / 66 / 97	123 / 67 / 87	141 / 60 / 88	140 / 79 / 209
Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD) ¹	71 / 36 / 63	63 / 31 / 45	73 / 34 / 54	91 / 56 / 86	90 / 58 / 110
Norco Bluffs (I-15 to River Rd., non-mitigation) ¹	30 / 17 / 43	63 / 28 / 45	69 / 31 / 76	36 / 17 / 39	101 / 50 / 139
Santa Ana Canyon (SAC)					
Upper Canyon	25 / 9 / 10	26 / 12 / 18	30 / 21 / 32	32 / 25 / 23	35 / 24 / 58
Green River Golf Club	31 / 23 / 35	33 / 26 / 27	42 / 33 / 76	42 / 38 / 20	45 / 34 / 96
Featherly Regional Park	65 / 38 / 37	64 / 39 / 23	59 / 36 / 57	66 / 25 / 25	69 / 33 / 76
Sampled Locations					
Santa Ana River & Tributaries:					
Alessandro Arroyo/Prenda Arroyo	n/s	19 / 4 / 3	23 / 7 / 10	20 / 5 / 3	18 / 2 / 0
Arlington Falls	n/s	n/s	n/s	n/s	n/s
Box Springs	n/s	4 / 3 / 4	7 / 1 / 0	3 / 0 / 0	1 / 0 / 0
Cajon Wash	n/s	0 / 0 / 0	n/s	n/s	n/s
Canyon Crest	n/s	1 / 0 / 0	0 / 0 / 0	n/s	n/s
Carbon Canyon (Chino Hills Pkwy.)	n/s	0 / 0 / 0	n/s	n/s	n/s
Carbon Canyon Regional Park	12 / 4 / 4	10 / 2 / 0	14 / 5 / 2	26 / 9 / 5	n/s
Castleview Park	n/s	n/s	0 / 0 / 0	n/s	n/s
Chino Hills	24 / 6 / 4	18 / 11 / 10	25 / 7 / 3	26 / 9 / 3	29 / 17 / 19
Chino Hills State Park (CHSP)	n/s	15 / 4 / 4	20 / 4 / 4	32 / 9 / 0	37 / 17 / 13

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2015-2019. Numbers of territories, pairs, and fledglings detected.

Site Name	2015	2016	2017	2018	2019
Sampled Locations					
Santa Ana River & Tributaries:					
Clearwater Pkwy. @ Glen Helen	0	2 / 0 / 0	0 / 0 / 0	n/s	n/s
Corona Ave. at Gilmore	n/s	1 / 0 / 0	1 / 0 / 0	n/s	n/s
Fontana Power Plant	0	0 / 0 / 0	n/s	n/s	n/s
Fresno Canyon	2 / 0 / 0	2 / 1 / 0	2 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Goldenstar	0 / 0 / 0	1 / 0 / 0	2 / 1 / 2	2 / 0 / 0	0 / 0 / 0
Harrison Reservoir (aka McAllister Creek)	3 / 1 / 0	3 / 2 / 2	5 / 2 / 3	5 / 4 / 1	7 / 1 / 1
Hidden Valley Golf Club	5 / 2 / 2	7 / 2 / 0	9 / 1 / 0	9 / 1 / 1	8 / 2 / 1
La Sierra	n/s	3 / 0 / 0	5 / 2 / 1	2 / 1 / 1	4 / 0 / 0
Little Sand Basin	n/s	0 / 0 / 0	n/s	n/s	n/s
Mead Valley (Cajalco/Aqueduct)	4 / 0 / 0	7 / 3 / 3	13 / 8 / 7	9 / 4 / 0	7 / 3 / 1
Meridian Conservation Area (former March SKR Preserve)	7 / 3 / 3	14 / 5 / 6	16 / 9 / 23	20 / 2 / 2	14 / 2 / 2
Mockingbird Canyon	37 / 23 / 19	25 / 7 / 11	29 / 15 / 15	43 / 15 / 10	43 / 19 / 24
Norco Hills Park Mitigation	n/s	0 / 0 / 0	0 / 0 / 0	n/s	n/s
Plunge Creek	n/s	1 / 1 / 2	2 / 0 / 0	5 / 0 / 0	2 / 0 / 0
Poorman Reservoir	n/s	8 / 2 / 1	9 / 4 / 5	6 / 2 / 0	6 / 1 / 0
Pyrite Channel	n/s	1 / 0 / 0	0 / 0 / 0	n/s	n/s
Quail Run	n/s	1 / 0 / 0	0 / 0 / 0	3 / 1 / 2	2 / 1 / 1
Ryan Bonaminio Park	n/s	n/s	0 / 0 / 0	n/s	n/s
Sun Canyon Park	n/s	0 / 0 / 0	n/s	n/s	n/s
Sycamore Canyon	4 / 1 / 1	13 / 4 / 6	18 / 9 / 9	20 / 8 / 5	22 / 5 / 3
Talbert Park (Orange County)	1 / 0 / 0	7 / 1 / 0	8 / 0 / 0	6 / 0 / 0	3 / 0 / 0
Temescal Canyon	123 / 21 / 22	93 / 9 / 5	109 / 59 / 48	106 / 48 / 16	127 / 56 / 48
Tequesquite Arroyo	n/s	0 / 0 / 0	0 / 0 / 0	n/s	n/s
Van Buren Blvd. (Bountiful)	2 / 0 / 0	2 / 0 / 0	1 / 0 / 0	0 / 0 / 0	2 / 0 / 0

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2015-2019. Numbers of territories, pairs, and fledglings detected.

Site Name	2015	2016	2017	2018	2019
Sampled Locations					
Santa Ana River & Tributaries:					
Van Buren Blvd. (Porter Rd.)	n/s	0 / 0 / 0	0 / 0 / 0	n/s	n/s
Wardlow Wash	n/s	n/s	n/s	2 / 1 / 0	0 / 0 / 0
Woodcrest	1 / 1 / 3	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0	0 / 0 / 0
Wyle Labs	0 / 0 / 0	1 / 0 / 0	1 / 0 / 0	3 / 1 / 1	3 / 3 / 3
Yorba Linda (San Antonio Rd.)	1 / 1 / 2	n/s	0 / 0 / 0	n/s	n/s
Yorba Linda (Starlight Dr.)	4 / 1 / 1	1 / 1 / 0	4 / 0 / 0	5 / 0 / 0	9 / 1 / 1
Yorba Linda Lakebed Park	0	1 / 0 / 0	0 / 0 / 0	n/s	n/s
San Jacinto River Sub-watershed:					
Cottonwood Canyon	n/s	2 / 1 / 1	2 / 0 / 0	2 / 1 / 1	1 / 0 / 0
Kabian Park	n/s	9 / 4 / 3	8 / 3 / 3	7 / 5 / 2	2 / 2 / 1
Lake Perris	n/s	n/s	n/s	8 / 3 / 0	6 / 2 / 1
Meniffee (Salt Creek)	6 / 1 / 1	9 / 3 / 3	9 / 4 / 3	10 / 5 / 2	11 / 7 / 11
Santiago Creek Sub-watershed:					
Irvine Trust Management Area	1 / 0 / 0	n/s	0 / 0 / 0	n/s	1 / 0 / 0
Limestone Canyon		n/s	1 / 0 / 0	n/s	n/s
Peter's Canyon	18 / 4 / 6	25 / 11 / 6	27 / 8 / 9	23 / 7 / 1	22 / 8 / 9
Santiago Canyon (Irvine Park)	24 / 1 / 2	17 / 1 / 0	14 / 1 / 0	18 / 5 / 2	20 / 10 / 8
Santiago Creek (above Irvine Lake)	n/s	2 / 0 / 0	5 / 0 / 0	12 / 2 / 1	5 / 0 / 0
Santiago Creek (Cambridge Road)	0 / 0 / 0	0 / 0 / 0	1 / 0 / 0	1 / 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 Oaks Regional Park (to Cannon Rd.)	n/s	n/s	2 / 0 / 0	1 / 0 / 0	2 / 0 / 0
Silverado Canyon	n/s	0 / 0 / 0	n/s	n/s	n/s
Smith Basin	2 / 1 / 0	4 / 0 / 0	3 / 1 / 0	3 / 0 / 0	4 / 1 / 0

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2015-2019. Numbers of territories, pairs, and fledglings detected.

Site Name	2015	2016	2017	2018	2019
Incidental Sightings					
Burris Basin	n/s	2 / 1 / 4	1 / 1 / 0	0 / 0 / 0	0 / 0 / 0
Chino Creek Wetlands Park	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0	4 / 1 / 1	n/s
Cielo Vista	n/s	n/s	n/s	n/s	1 / 0 / 0
Conrock Basin FHQ	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0
Hwy 71	n/s	n/s	n/s	1 / 0 / 0	n/s
Irvine Lake	n/s	2 / 1 / 1	2 / 0 / 0	1 / 0 / 0	1 / 0 / 0
Moreno Valley (near Pigeon Pass Rd.)	n/s	n/s	n/s	n/s	1 / 0 / 0
Raceway Ford	n/s	n/s	n/s	1 / 0 / 0	n/s
Rancho La Sierra West, Riverside	0 / 0 / 0	1 / 0 / 0	See Hidden Valley, south side of river	See Hidden Valley, south side of river	See Hidden Valley, south side of river
Riverside (near Goldenstar)	n/s	n/s	n/s	n/s	1 / 0 / 0
Riverside (Van Buren & Jurupa)	n/s	n/s	n/s	n/s	1 / 0 / 0
RLC Alessandro Arroyo - 1.52 ac	See Alessandro Arroyo/Prenda Arroyo	1 / 0 / 0	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo	2 / 1 / 1
Santiago Basin	1 / 0 / 0	1 / 0 / 0	3 / 0 / 0	3 / 0 / 0	5 / 0 / 0
Santa Ana River - San Bernardino County Flood Control	See Santa Ana River - San Bernardino County ⁷	See Santa Ana River - San Bernardino County ⁷	See Santa Ana River - San Bernardino County ⁷	30 / 3 / 5	8 / 0 / 0
Tin Mine Rd. (Temescal)	n/s	n/s	n/s	n/s	4 / 0 / 0
Wolfskill	n/s	n/s	n/s	2 / 1 / 1	3 / 1 / 1
SUBTOTAL	962 / 429 / 623	1,070 / 497 / 659	1,208 / 623 / 1,052	1,347 / 646 / 728	1,361 / 686 / 1,247
Reported by other agencies					
Lake Perris ²	Not reported	14 / 0 / 0	10 / 0 / 0	See Lake Perris	See Lake Perris
SAR - Norco Bluffs ACOE Mitigation Areas ^{3/4/5/6}	Not reported	14 / 0 / 0	14 / n/a / n/a	76 / n/a / n/a	See Norco Bluffs
Santa Ana River - San Bernardino County ⁷	Not reported	14 / 0 / 0	Not reported	17 / 0 / 0	Not Reported

Table 1 continued with footnotes. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2015-2019. Numbers of territories, pairs, and fledglings detected.

Site Name	2015	2016	2017	2018	2019
TOTAL FOR SANTA ANA WATERSHED EXCLUDING PRADO BASIN	962 / 429 / 623	1,112 / 497 / 659	1,232 / 623 / 1,052	1,440 / 646 / 728	1,361 / 686 / 1,247
PRADO BASIN ⁸	532 / 186 / 225	511 / 208 / 328	549 / 218 / 409	665 / n/a / n/a	606 / n/a / n/a
TOTAL FOR SANTA ANA WATERSHED	1,494 / 615 / 848	1,623 / 705 / 987	1,781 / 841 / 1,461	2,105 / 646 / 728	1,967 / 686 / 1,247
Outside Watershed					
French Valley, Benton Channel ⁹	n/s	n/s	n/s	1 / 0 / 0	n/s
French Valley, Warm Springs ⁹	n/s	n/s	n/s	1 / 0 / 0	n/s
Temecula, Santa Gertrudis ⁹	n/s	n/s	n/s	6 / 1 / 0	n/s
Wildomar, Helash Mitigation ⁹	n/s	n/s	n/s	4 / 0 / 0	n/s

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

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

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

¹2010-2014 data combined with data previously reported as "Hidden Valley to River Rd." In 2015 and 2018, USACE mitigation areas excluded from SAWA surveys included 250-acre site; In 2016-2017, SAWA surveys included the 250-acre mitigation area.

²Reported by California State Parks.

³AECOM personal communication.

⁴Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2016."

⁵Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2017."

⁶Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2018."

⁷Reported by San Bernardino County Flood Control biologist Theresa Sims.

⁸Preliminary data. Bonnie Johnson personal communication.

⁹Outside Santa Ana Watershed, not included in totals.

Table 2. Least Bell's Vireo status and management data, at monitored and select sampled sites in the Santa Ana Watershed, California, 2019.

	Parameter	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
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park	
A.	Number of territorial males	63	124	43	166	78	140	90	101	127	29	35	45	69	1,110
B.	Number of known pairs (breeding and non-breeding)	44	92	19	72	37	79	58	50	56	17	24	34	33	615
C.	Number of fledged young observed	117	170	24	82	41	209	110	139	48	19	58	96	76	1,189
D.	Projected total of recruitment of vireo young ¹	220	294	19	101	n/a	300	238	270	n/a	n/a	98	146	185	2,337
E.	Average number of fledglings per pair (C/B)	2.7	1.8	1.3	1.1	n/a	2.6	1.9	2.8	n/a	n/a	2.4	2.8	2.3	1.9
F.	Projected number of fledglings per pair (D/B)	5.0	3.2	1.0	1.4	n/a	3.8	4.1	5.4	n/a	n/a	4.1	4.3	5.6	3.8
G.	This row purposefully omitted.														
H.	Rate of cowbird nest parasitism (well-tracked nests) ³	26% 5 / 19	15% 12 / 80	22% 2 / 9	41% 7 / 17	n/a	9% 6 / 64	0% 0 / 23	0% 0 / 35	n/a	n/a	0% 0 / 17	0% 0 / 26	0% 0 / 26	10% 32 / 316
I.	Number of cowbirds removed from study area ²	1,774	72	73	43	0	n/a	2	2	338	-3	41	4	-1	2,345
J.	This row purposefully omitted.														
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) ²	480	500	383	401	2	n/a	96	113	579	101	113	114	237	3,119
L.	Average number of cowbirds trapped per trap day (I/K)	3.70	0.14	0.19	0.11	0.00	n/a	0.02	0.02	0.58	0.00	0.36	0.04	0.00	0.75
M.	Number of field hours - LBVI	340	504	116	359	56	373	312	226	181	38	170	226	239	3,140
N.	Number of field hours - BHCO	379	171	209	240				38	372	34	273			1,716

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

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

³Twelve of the 145 "tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these 12 nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

Table 3. Least Bell's Vireo survey dates and breeding chronology, monitored and select sampled sites, 2019.

	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)		
				Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park
Survey Start Date ¹	18-Mar	21-Mar	21-Mar	20-Mar	27-Mar	20-Mar	18-Mar	18-Mar	22-Mar	28-Mar	21-Mar	22-Mar	15-Mar
Survey End Date	12-Aug	9-Aug	31-Jul	15-Aug	24-Jul	15-Aug	5-Aug	8-Aug	25-Jul	24-Jul	31-Jul	2-Aug	18-Sep
Date First Detected	18-Mar	21-Mar	1-Apr	20-Mar	25-Mar	20-Mar	18-Mar	22-Mar	22-Mar	28-Mar	21-Mar	22-Mar	15-Mar
50% Arrival Observed	3-Apr	4-Apr	18-Apr	16-Apr	N/A	7-Apr	11-Apr	11-Apr	N/A	N/A	5-Apr	8-Apr	11-Apr
50% Pairs Observed	11-Apr	15-Apr	18-Apr	17-Apr	N/A	16-Apr	19-Apr	16-Apr	N/A	N/A	19-Apr	17-Apr	11-Apr
First Nest Found	3-Apr	2-Apr	15-Apr	3-Apr	N/A	3-Apr	5-Apr	10-Apr	N/A	N/A	12-Apr	9-Apr	2-Apr
Last Nest Found	25-Jul	2-Jul	10-Jun	20-Jun	N/A	8-Jul	19-Jun	27-Jun	N/A	N/A	3-Jul	5-Jul	19-Jul
First Nest Fledge	9-May	8-May	13-May	9-May	N/A	4-May	8-May	2-May	N/A	N/A	6-May	1-May	10-May
Last Nest Fledge	30-Jul	8-Jul	2-Jul	9-Jul	N/A	5-Aug	14-Jul	9-Jul	N/A	N/A	13-Jul	12-Jul	26-Jul
Date Last Detected ²	21-Aug	22-Aug	31-Jul	15-Aug	24-Jul	15-Aug	5-Aug	8-Aug	25-Jul	24-Jul	31-Jul	14-Aug	13-Sep

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

² May vary from last survey date as both incidental sightings and targeted surveys may be used

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, 2019.

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	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 ^{le} (<i>Arundo donax</i>)												1		1	<1%
Western Sycamore (<i>Platanus racemosa</i>)						1							1	2	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)		5		5		4	3	6			2	2		27	6%
Fremont Cottonwood (<i>Populus fremontii</i>)	1	6	1	2		3	1				1	1	1	17	4%
Narrowleaf Willow (<i>Salix exigua</i>)	24	4				3	1	2					6	40	10%
Goodding's Black Willow (<i>Salix gooddingii</i>)	4	9	2	1		8	5	2			3	1		35	8%
Red Willow (<i>Salix laevigata</i>)		23		1		5	1						1	31	7%
Arroyo Willow (<i>Salix lasiolepis</i>)		18	1	3		30	7	10						69	16%
Dead Arroyo Willow (<i>Salix lasiolepis</i>)								1						1	<1%
Yellow Willow (<i>Salix lasiandra</i>)								2						2	<1%
Western False Indigo (<i>Amorpha fruticosa</i>)	1													1	<1%
Blue Palo Verde (<i>Parkinsonia florida</i>)													1	1	<1%
Asian Pear ^e (<i>Cydonia oblonga</i>)		1												1	<1%
Toyon (<i>Heteromeles arbutifolia</i>)		1												1	<1%
California Wild Rose (<i>Rosa californica</i>)						1								1	<1%

Table 4 continued. Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2019.

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	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		
White Mulberry ^e (<i>Morus alba</i>)		2												2	<1%
Hoary Nettle (<i>Urtica dioica</i>)		1												1	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)		1												1	<1%
Southern California Black Walnut ^r (<i>Juglans californica</i>)												1		1	<1%
Laurel Sumac (<i>Malosma laurina</i>)											1	4	3	8	2%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)												1		1	<1%
Poison Oak (<i>Toxicodendron diversilobum</i>)											1			1	<1%
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)							1							1	<1%
Chaparral Mallow (<i>Malacothamnus fasciculatus</i>)		1												1	<1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)		1										4	2	7	2%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)						1								1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	4		1				1							6	1%
Fourwing Saltbush (<i>Atriplex canescens</i>)		1	1											2	<1%
Privet sp. ^e (<i>Ligustrum</i> sp.)										1				1	<1%

Table 4 continued. Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2019.

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	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded)				Upper Canyon	Green River Golf Club	Featherly Reg. Park		
Olive ^e (<i>Olea europaea</i>)		1												1	<1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)		1		1										2	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)		1											1	2	<1%
Coyote Brush (<i>Baccharis pilularis</i>)	9		1	1		1		1						13	3%
Mulefat (<i>Baccharis salicifolia</i>)	1	8		3		16	4	8			8	7	7	62	15%
Brittlebush (<i>Encelia farinosa</i>)		2												2	<1%
Arrowweed (<i>Pluchea sericea</i>)	2													2	<1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)		1		1									4	6	1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)		7	5			3	1	2			6	10	2	36	9%
Black Mustard (<i>B. nigra</i>) ^{ie} and Poison Hemlock (<i>C. maculatum</i>) ^{ie}													1	1	<1%
Unknown/No Data	1	1		6	1	2		1	16			1		29	7%
Total	47	96	12	24	1	78	25	35	16	1	22	33	30	419	100%

^e = non-native

ⁱ = invasive

^r = endangered, threatened, or sensitive

¹ = Using Jepson eFlora

Table 5. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2019.

	Parameter	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream					Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	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)			Upper Canyon	Green River Golf Club	Featherly Reg. Park	
A.	Number of known pairs	44	92	19	72	37	79	58	50	56	17	24	34	33	615
B.	Number of known breeding (nesting) pairs	44	75	12	58	31	77	52	48	40	12	19	32	28	528
C.	Number of breeding pairs that were well-monitored throughout the breeding season	7	39	3	8	0	39	10	16	0	0	9	12	8	151
D.	Number of 'known fledged young' OBSERVED	117	170	24	82	41	209	110	139	48	19	58	96	76	1,189
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	35	123	3	11	n/a	148	41	87	n/a	n/a	37	51	45	581
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.7	2.3	2.0	1.4	n/a	2.7	2.1	2.9	n/a	n/a	3.1	3.0	2.7	2.3
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	5.0	3.2	1.0	1.4	n/a	3.8	4.1	5.4	n/a	n/a	4.1	4.3	5.6	3.8
H.	Number of nests that were discovered	47	96	12	24	1	78	25	35	16	1	22	33	30	420
I.	Number of well-tracked nests	35	90	11	18	0	76	24	35	0	0	19	28	28	364
J.	Number of well-tracked nests that were successful (% = J/I x 100)	69% 24 / 35	44% 40 / 90	36% 4 / 11	39% 7 / 18	n/a	63% 48 / 76	71% 17 / 24	89% 31 / 35	n/a	n/a	74% 14 / 19	79% 22 / 28	64% 18 / 28	62% 225 / 364
K.	This row purposefully omitted														
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100) ¹	26% 5 / 19	15% 12 / 80	22% 2 / 9	41% 7 / 17	n/a	9% 6 / 64	0% 0 / 23	0% 0 / 35	n/a	n/a	0% 0 / 17	0% 0 / 26	0% 0 / 26	10% 32 / 316
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 1 / 35	4% 4 / 90	9% 1 / 11	22% 4 / 18	n/a	3% 2 / 76	8% 2 / 24	6% 2 / 35	n/a	n/a	0% 0 / 19	7% 2 / 28	14% 4 / 28	6% 22 / 364

Table 5 continued. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2019.

	Parameter	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream					Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded)	Norco Bluffs (I-15 to River Rd., non-mitigation)			Upper Canyon	Green River Golf Club	Featherly Reg. Park	
M.	B. Number of well-tracked nests that failed as a result of parasitism	3% 1 / 35	8% 7 / 90	9% 1 / 11	17% 3 / 18	n/a	1% 1 / 76	0% 0 / 24	0% 0 / 35	n/a	n/a	0% 0 / 19	0% 0 / 28	0% 0 / 28	4% 13 / 364
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	26% 9 / 35	43% 39 / 90	45% 5 / 11	22% 4 / 18	n/a	33% 25 / 76	21% 5 / 24	6% 2 / 35	n/a	n/a	26% 5 / 19	14% 4 / 28	21% 6 / 28	29% 104 / 364
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 35	0% 0 / 90	0% 0 / 11	0% 0 / 18	n/a	0% 0 / 76	0% 0 / 24	0% 0 / 35	n/a	n/a	0% 0 / 19	0% 0 / 28	0% 0 / 28	0% 0 / 364
	Average clutch size	3.5	3.7	3.8	4.0	n/a	3.8	3.6	3.8	n/a	n/a	3.7	3.7	3.6	3.7
N.	Number of eggs/Number of clutches	138 / 39	284 / 77	42 / 11	40 / 10	n/a	242 / 64	87 / 24	134 / 35	n/a	n/a	73 / 20	118 / 32	91 / 25	1,249 / 337
O.	Number of cowbird eggs found in or near vireo nests	5	12	2	6	n/a	6	0	0	0	0	0	0	0	31
P.	Number of cowbird nestlings removed from well-tracked nests	1	0	0	1	n/a	0	0	0	n/a	n/a	0	0	0	2
Q.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	1	0	0	0	0	1
R.	Number of 'manipulated' parasitized nests	6	8	1	5	n/a	6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	26
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	67% 4 / 6	38% 3 / 8	0% 0 / 1	20% 1 / 5	n/a	67% 4 / 6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	46% 12 / 26
T.	Number of vireo fledged from 'manipulated' parasitized nests	11	4	0	3	n/a	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	26
U.	Number of repaired nests	0	3	0	0	n/a	0	0	0	0	0	1	2	0	6
V.	% of successful repaired nests	n/a	33% 1 / 3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100% 1 / 1	100% 2 / 2	n/a	67% 4 / 6
W.	Number of vireo fledged from repaired nests	n/a	3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	3	n/a	9

¹Twelve of the 145 "tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these 12 nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

Table 5B. Least Bell's Vireo breeding biology data detailed for SBVMWD-funded surveys at monitored (restoration) and sampled (non-restoration) sites in upper SAR, 2019.

		Evans Lake Drain Restoration	Anza/Old Ranch Creeks Restoration	SAR - Riverside to Van Buren Non-Restoration	SAR - Riverside to Van Buren - Overall	Hidden Valley North	Lower Hole Creek Restoration	Hidden Valley South - Restoration	Hidden Valley South - Non - Restoration	Hidden Valley South - Overall	Goose Creek ³	SAR Upstream - Overall
A.	Number of territorial males	4	22	140	166	78	3	24	116	140	90	477
B.	Number of known pairs	2	16	54	72	37	1	23	56	79	58	247
C.	Number of known breeding (nesting) pairs	2	15	41	58	31	1	23	54	77	52	219
D.	Number of breeding pairs that were well-monitored throughout the breeding season	2	6	0	8	0	1	20	19	39	10	58
E.	Number of 'known fledged young' OBSERVED	4	29	49	82	41	0	75	134	209	110	442
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	4	7	0	11	n/a	0	70	78	148	41	200
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	2.0	1.9	1.2	1.4	n/a	0.0	3.3	2.5	2.7	2.1	2.0
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.0	1.2	n/a	1.4	n/a	0.0	3.5	4.1	3.8	4.1	3.4
I.	Projected total of recruitment of vireo young ¹ (HxB)	4	19	n/a	101	n/a	0	81	230	300	238	840
J.	Number of nests that were discovered	3	15	6	24	1	1	37	41	78	25	129
K.	Number of well-tracked nests	3	15	0	18	0	1	37	39	76	24	119
L.	Number of well-tracked nests that were successful	33% 1 / 3	40% 6 / 15	n/a	39% 7 / 18	n/a	0% 0 / 1	57% 21 / 37	69% 27 / 39	63% 48 / 76	71% 17 / 24	61% 72 / 119
M.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100) ²	0% 0 / 3	50% 7 / 14	n/a	41% 7 / 17	n/a	0% 0 / 1	21% 6 / 29	0% 0 / 35	9% 6 / 64	0% 0 / 23	12% 13 / 105
N.	A. Number of well-tracked nests that failed as a result of reproductive failure	33% 1 / 3	20% 3 / 15	n/a	22% 4 / 18	n/a	0% 0 / 1	5% 2 / 37	0% 0 / 39	3% 2 / 76	8% 2 / 24	7% 8 / 119
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 3	20% 3 / 15	n/a	17% 3 / 18	n/a	0% 0 / 1	3% 1 / 37	0% 0 / 39	1% 1 / 76	0% 0 / 24	3% 4 / 119

Table 5B continued. Least Bell's Vireo breeding biology data detailed for SBVMWD-funded surveys at monitored (restoration) and sampled (non-restoration) sites in upper SAR, 2019.

		Evans Lake Drain Restoration	Anza/Old Ranch Creeks Restoration	SAR - Riverside to Van Buren Non-Restoration	SAR - Riverside to Van Buren - Overall	Hidden Valley North	Lower Hole Creek Restoration	Hidden Valley South - Restoration	Hidden Valley South - Non - Restoration	Hidden Valley South - Overall	Goose Creek ³	SAR Upstream - Overall
N.	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 1 / 3	20% 3 / 15	n/a	22% 4 / 18	n/a	100% 1 / 1	35% 13 / 37	31% 12 / 39	33% 25 / 76	21% 5 / 24	29% 35 / 119
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 3	0% 0 / 15	n/a	0% 0 / 18	n/a	0% 0 / 1	0% 0 / 37	0% 0 / 39	0% 0 / 76	0% 0 / 24	0% 0 / 119
O.	Average clutch size	4.0	4.0	n/a	4.0	n/a	4.0	3.8	3.8	3.8	3.6	3.8
	Number of eggs/Number of clutches	12 / 3	28 / 7	n/a	40 / 10	n/a	4 / 1	99 / 26	143 / 38	242 / 64	87 / 24	373 / 99
P.	Number of cowbird eggs found in or near vireo nests	0	6	n/a	6	n/a	0	6	0	6	0	12
Q.	Number of cowbird nestlings removed from well-tracked nests	0	1	n/a	1	n/a	0	0	0	0	0	1
R.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0	0	0
S.	Number of 'manipulated' parasitized nests	0	5	n/a	5	n/a	0	6	0	6	n/a	11
T.	Number of 'successful, manipulated' nests (% = S/R x 100)	n/a	20% 1 / 5	n/a	20% 1 / 5	n/a	n/a	67% 4 / 6	n/a	67% 4 / 6	n/a	45% 5 / 11
U.	Number of vireo fledged from 'manipulated' parasitized nests	n/a	3	n/a	3	n/a	n/a	8	n/a	8	n/a	11
V.	Number of repaired nests	0	0	n/a	0	n/a	0	0	0	0	0	0
W.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
X.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

² 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)

³ This site includes mitigation areas funded by IERCD

Table 6. Observations of all species by location, 2019.

2019 Observations of All Species by Location							
		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Canada Goose	<i>Branta canadensis</i>			X		X	
Egyptian Goose ⁱ	<i>Alopochen aegyptiaca</i>					X	
Wood Duck	<i>Aix sponsa</i>	X		X		X	
Blue-winged Teal	<i>Spatula discors</i>			X			
Cinnamon Teal	<i>Spatula cyanoptera</i>	X		X			
Northern Shoveler	<i>Spatula clypeata</i>	X		X			
Gadwall	<i>Mareca strepera</i>	X		X			
American Wigeon	<i>Mareca americana</i>	X		X			
Mallard	<i>Anas platyrhynchos</i>	X	X	X	X	X	
Green-winged Teal	<i>Anas crecca</i>	X					
Ring-necked Duck	<i>Aythya collaris</i>	X					
Bufflehead	<i>Bucephala albeola</i>	X		X			
Ruddy Duck	<i>Oxyura jamaicensis</i>	X		X	X		
California Quail	<i>Callipepla californica</i>	X	X	X		X	
Pied-billed Grebe	<i>Podilymbus podiceps</i>	X		X	X		
Eared Grebe	<i>Podiceps nigricollis</i>	X					
Rock Pigeon ⁱ	<i>Columba livia</i>	X		X		X	
Band-tailed Pigeon	<i>Patagioenas fasciata</i>		X	X		X	
Eurasian Collared-Dove ⁱ	<i>Streptopelia decaocto</i>	X	X	X		X	
Common Ground-Dove	<i>Columbina passerina</i>	X	X	X	X		
Mourning Dove	<i>Zenaida macroura</i>	X	X	X	X	X	
Greater Roadrunner	<i>Geococcyx californianus</i>	X	X	X	X	X	
Vaux's Swift	<i>Chaetura vauxi</i>			X			
White-throated Swift	<i>Aeronautes saxatalis</i>	X	X	X	X	X	
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	X	X	X		X	
Anna's Hummingbird	<i>Calypte anna</i>	X	X	X	X	X	
Costa's Hummingbird	<i>Calypte costae</i>	X	X	X		X	
Rufous Hummingbird	<i>Selasphorus rufus</i>			X			
Allen's Hummingbird	<i>Selasphorus sasin</i>		X	X	X	X	

Table 6 continued. Observations of all species by location, 2019.

2019 Observations of All Species by Location							
		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Sora	<i>Porzana carolina</i>	X					
Common Gallinule	<i>Gallinula galeata</i>	X					
American Coot	<i>Fulica americana</i>	X	X	X	X	X	
Black-necked Stilt	<i>Himantopus mexicanus</i>	X		X		X	
American Avocet	<i>Recurvirostra americana</i>	X		X		X	
Killdeer	<i>Charadrius vociferus</i>	X	X	X		X	
Least Sandpiper	<i>Calidris minutilla</i>			X			
Peeps	<i>Calidris sp.</i>	X		X			
Greater Yellowlegs	<i>Tringa melanoleuca</i>			X			
Ring-billed Gull	<i>Larus delawarensis</i>				X		
California Gull	<i>Larus californicus</i>			X			
Gull spp.	<i>Larus spp.</i>	X		X			
Double-crested Cormorant	<i>Phalacrocorax auritus</i>			X	X	X	
American White Pelican	<i>Pelecanus erythrorhynchos</i>	X					
Great Blue Heron	<i>Ardea herodias</i>	X		X	X	X	
Great Egret	<i>Ardea alba</i>	X		X	X	X	
Snowy Egret	<i>Egretta thula</i>	X		X		X	
Green Heron	<i>Butorides virescens</i>	X			X	X	
Black-crowned Night-Heron ^r	<i>Nycticorax nycticorax</i>	X		X	X	X	
White-faced Ibis ^r	<i>Plegadis chihi</i>	X		X		X	
Turkey Vulture ^r	<i>Cathartes aura</i>	X		X		X	
Osprey ^r	<i>Pandion haliaetus</i>					X	
White-tailed Kite ^r	<i>Elanus leucurus</i>	X	X				X
Northern Harrier ^r	<i>Circus hudsonius</i>	X					X
Sharp-shinned Hawk ^r	<i>Accipiter striatus</i>			X			
Cooper's Hawk ^r	<i>Accipiter cooperii</i>	X	X	X	X	X	X
Bald Eagle ^r	<i>Haliaeetus leucocephalus</i>						X
Red-shouldered Hawk	<i>Buteo lineatus</i>	X	X	X	X	X	
Red-tailed Hawk	<i>Buteo jamaicensis</i>	X	X	X	X	X	

Table 6 continued. Observations of all species by location, 2019.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Barn Owl	<i>Tyto alba</i>	X	X	X			
Western Screech-Owl	<i>Megascops kennicottii</i>			X			
Great Horned Owl	<i>Bubo virginianus</i>	X	X	X	X		
Burrowing Owl ^r	<i>Athene cunicularia</i>						X
Belted Kingfisher	<i>Megaceryle alcyon</i>	X		X			
Acorn Woodpecker	<i>Melanerpes formicivorus</i>	X	X	X		X	
Downy Woodpecker ^r	<i>Dryobates pubescens</i>	X	X	X	X	X	
Nuttall's Woodpecker	<i>Dryobates nuttallii</i>	X	X	X	X	X	
Hairy Woodpecker	<i>Dryobates villosus</i>		X				
Northern Flicker	<i>Colaptes auratus</i>	X	X	X	X	X	
American Kestrel	<i>Falco sparverius</i>	X	X	X	X	X	
Merlin ^r	<i>Falco columbarius</i>	X		X			
Peregrine Falcon ^r	<i>Falco peregrinus</i>	X					X
Parakeet sp. ⁱ	<i>Psittacula sp.</i>		X				
Red-crowned Amazon ⁱ	<i>Amazona viridigenalis</i>					X	
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	X	X	X		X	
Cassin's Kingbird	<i>Tyrannus vociferans</i>	X	X	X	X	X	
Western Kingbird	<i>Tyrannus verticalis</i>	X	X	X	X	X	
Olive-sided Flycatcher	<i>Contopus cooperi</i>			X			
Western Wood-Pewee	<i>Contopus sordidulus</i>	X	X	X		X	
Willow Flycatcher ^r	<i>Empidonax traillii</i>		X	X	X		X
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	X	X	X	X	X	
Black Phoebe	<i>Sayornis nigricans</i>	X	X	X	X	X	
Say's Phoebe	<i>Sayornis saya</i>	X	X	X	X	X	
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>					X	
Loggerhead Shrike ^r	<i>Lanius ludovicianus</i>	X					X
Hutton's Vireo	<i>Vireo huttoni</i>		X	X	X	X	
Cassin's Vireo	<i>Vireo cassinii</i>			X			
Warbling Vireo	<i>Vireo gilvus</i>		X	X			
California Scrub-Jay	<i>Aphelocoma californica</i>		X	X	X	X	
American Crow	<i>Corvus brachyrhynchos</i>	X	X	X	X	X	

Table 6 continued. Observations of all species by location, 2019.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Common Raven	<i>Corvus corax</i>	X	X	X	X	X	
Horned Lark ^r	<i>Eremophila alpestris</i>	X		X		X	X
Tree Swallow ^r	<i>Tachycineta bicolor</i>	X		X	X	X	
Violet-green Swallow	<i>Tachycineta thalassina</i>	X		X			
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	X	X	X	X	X	
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	X	X	X	X	X	
Barn Swallow	<i>Hirundo rustica</i>	X	X	X	X		
Oak Titmouse	<i>Baeolophus inornatus</i>	X	X				
Bushtit	<i>Psaltiriparus minimus</i>	X	X	X	X	X	
White-breasted Nuthatch	<i>Sitta carolinensis</i>			X			
Rock Wren	<i>Salpinctes obsoletus</i>	X	X			X	
House Wren	<i>Troglodytes aedon</i>	X	X	X	X	X	
Marsh Wren	<i>Cistothorus palustris</i>	X			X		
Bewick's Wren	<i>Thryomanes bewickii</i>	X	X	X	X	X	
Coastal Cactus Wren ^r	<i>Campylorhynchus brunneicapillus</i>						X
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	X	X	X	X	X	
California Gnatcatcher ^r	<i>Poliophtila californica</i>	X		X		X	X
Ruby-crowned Kinglet	<i>Regulus calendula</i>	X	X	X	X	X	
Wrentit	<i>Chamaea fasciata</i>		X	X	X	X	
Western Bluebird	<i>Sialia mexicana</i>	X	X	X		X	
Swainson's Thrush	<i>Catharus ustulatus</i>		X	X	X	X	
Hermit Thrush	<i>Catharus guttatus</i>		X	X	X		
American Robin	<i>Turdus migratorius</i>		X	X	X	X	
California Thrasher	<i>Toxostoma redivivum</i>	X	X	X	X	X	
Northern Mockingbird	<i>Mimus polyglottos</i>	X	X	X	X	X	
European Starling ⁱ	<i>Sturnus vulgaris</i>	X	X	X		X	
Cedar Waxwing	<i>Bombycilla cedrorum</i>	X	X	X	X	X	
Phainopepla	<i>Phainopepla nitens</i>	X	X	X	X	X	
Pin-tailed Whydah ⁱ	<i>Vidua macroura</i>					X	
Scaly-breasted Munia ⁱ	<i>Lonchura punctulata</i>		X	X		X	

Table 6 continued. Observations of all species by location, 2019.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
House Sparrow ⁱ	<i>Passer domesticus</i>	X	X	X	X	X	
American Pipit	<i>Anthus rubescens</i>	X		X		X	
House Finch	<i>Haemorhous mexicanus</i>	X	X	X	X	X	
Lesser Goldfinch	<i>Spinus psaltria</i>	X	X	X	X	X	
Lawrence's Goldfinch	<i>Spinus lawrencei</i>	X	X	X	X	X	
American Goldfinch	<i>Spinus tristis</i>	X	X	X		X	
Spotted Towhee	<i>Pipilo maculatus</i>	X	X	X	X	X	
Rufous-crowned Sparrow ^r	<i>Aimophila ruficeps canescens</i>			X			X
California Towhee	<i>Melospiza crissalis</i>	X	X	X	X	X	
Brewer's Sparrow	<i>Spizella breweri</i>	X					
Vesper Sparrow	<i>Pooecetes gramineus</i>	X					
Lark Sparrow	<i>Chondestes grammacus</i>	X	X			X	
Bell's Sparrow ^r	<i>Artemisiospiza belli</i>						X
Savannah Sparrow	<i>Passerculus sandwichensis</i>	X	X				
Grasshopper Sparrow ^r	<i>Ammodramus savannarum</i>						X
Fox Sparrow	<i>Passerella iliaca</i>			X			
Song Sparrow	<i>Melospiza melodia</i>	X	X	X	X	X	
Lincoln's Sparrow ^r	<i>Melospiza lincolnii</i>	X	X	X			X
White-throated Sparrow	<i>Zonotrichia albicollis</i>	X					
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	X	X	X	X	X	
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>			X			
Yellow-breasted Chat ^r	<i>Icteria virens</i>	X	X	X	X	X	
Yellow-headed Blackbird ^r	<i>Xanthocephalus xanthocephalus</i>	X				X	X
Western Meadowlark	<i>Sturnella neglecta</i>	X	X	X			
Hooded Oriole	<i>Icterus cucullatus</i>	X	X	X	X	X	
Bullock's Oriole	<i>Icterus bullockii</i>	X	X	X		X	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	X	X	X		X	
Tricolored Blackbird ^r	<i>Agelaius tricolor</i>	X					X
Brown-headed Cowbird ⁱ	<i>Molothrus ater</i>	X	X	X	X	X	
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	X		X			

Table 6 continued. Observations of all species by location, 2019.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Avian							
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	X	X				
Orange-crowned Warbler	<i>Oreothlypis celata</i>	X	X	X	X	X	
MacGillivray's Warbler	<i>Geothlypis tolmiei</i>			X			
Common Yellowthroat	<i>Geothlypis trichas</i>	X	X	X	X	X	
Yellow Warbler ^r	<i>Setophaga petechia</i>	X	X	X	X	X	
Yellow-rumped Warbler	<i>Setophaga coronata</i>	X	X	X	X	X	
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>	X	X	X			
Wilson's Warbler ^r	<i>Cardellina pusilla</i>	X	X	X	X	X	
Western Tanager	<i>Piranga ludoviciana</i>	X	X	X		X	
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	X	X	X	X	X	
Blue Grosbeak	<i>Passerina caerulea</i>	X	X	X		X	
Lazuli Bunting	<i>Passerina amoena</i>	X	X	X		X	
Mammals (tracks/other evidence used)							
Virginia Opossum ⁱ	<i>Didelphis virginiana</i>			X			
San Diego Black-tailed Jackrabbit ^r	<i>Lepus californicus bennettii</i>	X					
Desert Cottontail	<i>Sylvilagus audubonii</i>	X	X	X	X	X	
Feral Dog ⁱ	<i>Canis familiaris</i>	X		X			
Coyote ^r	<i>Canis latrans</i>	X	X	X	X	X	X
Feral Cat ⁱ	<i>Felis catus</i>			X			
Bobcat ^r	<i>Lynx rufus</i>			X			
Striped Skunk	<i>Mephitis mephitis</i>	X		X			
Long-tailed Weasel ^r	<i>Mustela frenata</i>	X	X				
Badger ^r	<i>Taxidea taxus</i>	X					
Raccoon	<i>Procyon lotor</i>	X	X	X	X		
Mule Deer	<i>Odocoileus hemionus</i>		X			X	
Feral Pig ⁱ	<i>Sus scrofa</i>		X	X	X	X	
Woodrat sp. (nest)	<i>Neotoma sp.</i>	X	X			X	
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	X					
Botta's Pocket Gopher	<i>Thomomys bottae</i>	X	X	X	X	X	
Kangaroo Rat sp. (tracks)	<i>Dipodomys sp.</i>					X	
California Ground Squirrel	<i>Otospermophilus beecheyi</i>	X	X	X	X	X	

Table 6 continued. Observations of all species by location, 2019.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other ¹
Mammals (tracks/other evidence used)							
Eastern Fox Squirrel ⁱ	<i>Sciurus niger</i>		X			X	
Herpetofauna							
Western Toad	<i>Anaxyrus boreas</i>	X		X		X	
American Bullfrog ⁱ	<i>Lithobates catesbeianus</i>	X		X	X	X	
Baja California Treefrog	<i>Pseudacris hypochondriaca</i>	X	X	X		X	
California Legless Lizard ^r	<i>Eremophila alpestris actia</i>						X
Belding's Orange-throated Whiptail ^r	<i>Aspidoscelis hyperythra beldingi</i>		X				X
San Diegan Tiger Whiptail ^r	<i>Aspidoscelis tigris stejnegeri</i>		X			X	X
Zebra-tailed Lizard	<i>Callisaurus draconoides</i>			X			
Southern Alligator Lizard	<i>Elgaria multicarinata</i>		X		X		
Blainville's Horned Lizard ^r	<i>Phrynosoma blainvillii</i>	X		X			
Western Skink	<i>Plestiodon skiltonianus</i>			X			
Western Fence Lizard	<i>Sceloporus occidentalis</i>	X	X	X	X	X	
Granite Spiny Lizard ^r	<i>Sceloporus orcutti</i>					X	X
Side-blotched Lizard	<i>Uta stansburiana</i>	X	X	X	X	X	
Red Racer/Coachwhip	<i>Coluber flagellum piceus</i>	X	X	X		X	
Southern Pacific Rattlesnake	<i>Crotalus oreganus helleri</i>		X			X	
Red Diamond Rattlesnake ^r	<i>Crotalus ruber</i>					X	X
California Kingsnake	<i>Lampropeltis californiae</i>		X	X	X	X	
San Diego Gopher Snake	<i>Pituophis catenifer annectens</i>	X	X		X	X	
Two-striped Gartersnake ^r	<i>Thamnophis hammondi</i>	X					
Red-sided Gartersnake ^r	<i>Thamnophis sirtalis parietalis</i>						X
Red-eared Slider ⁱ	<i>Trachemys scripta elegans</i>	X			X	X	
Fish							
Santa Ana Sucker ^r	<i>Catostomus santaanae</i>			X			
Mosquitofish ⁱ	<i>Gambusia affinis</i>	X		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 15, 2019 to September 18, 2019.

Table 7. Brown-headed Cowbird trapping results, March-July 2019 (grouped by funding source).

Site Name	Trap/Location	2019 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
San Jacinto	SJWA E1	4/1-7/17	102	131	43	83	5	1.24	1.28
Subtotal			102	131	43	83	5	1.24	1.28
Santa Ana River (upstream)	Fairmount Park	3/20-7/26	103	15	7	7	1	0.14	0.15
	Crestmore	3/20-7/24	95	3	1	0	2	0.01	0.03
	Sunnyslope Maintenance	3/19-7/20	97	1	0	1	0	0.01	0.01
	Sunnyslope Lift Station	3/19-7/26	104	24	12	11	1	0.22	0.23
	Riverdale	3/19-3/21	2	0	0	0	0	0.00	0.00
	Goose Creek 2	3/19-7/24	96	2	0	2	0	0.02	0.02
Subtotal			497	45	20	21	4	0.08	0.09
Mockingbird Canyon	Reservoir	3/18-7/31	129	59	35	23	1	0.45	0.46
	Estates	3/18-7/30	128	3	2	1	0	0.02	0.02
	Ungerer	3/20-7/30	126	11	4	7	0	0.09	0.09
Subtotal			383	73	41	31	1	0.19	0.19
Prado/Chino Hills	McCoy	3/18-7/22	101	-3	-2	-3	2	-0.05	-0.03
	IEUA	3/18-7/23	114	46	24	16	6	0.35	0.40
	Regional Park	3/18-7/22	112	7	3	4	0	0.06	0.06
	Bluff	3/18-7/22	113	2	1	1	0	0.02	0.02
	Olive Grove	3/19-7/23	111	-1	-4	3	0	-0.01	-0.01
	Trailer	3/19-7/24	114	2	0	0	2	0.00	0.02
Subtotal			665	53	22	21	10	0.06	0.08

Table 7 continued. Brown-headed Cowbird trapping results, March-July 2019 (grouped by funding source).

Site Name	Trap/Location	2019 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
Temescal	New Sump	3/20-7/30	124	29	28	1	0	0.23	0.23
	Rockery	3/18-7/29	123	6	3	2	1	0.04	0.05
	Baker	3/20-7/17	105	7	6	0	1	0.06	0.07
	Salt Creek	3/18-7/8	103	5	3	2	0	0.05	0.05
Subtotal			455	47	40	5	2	0.10	0.10
San Jacinto, Prado and Lake Elsinore Dairies	Vanderwoude 2	3/18-7/31	127	685	551	110	24	5.20	5.39
	Tuls 1	3/19-7/31	124	202	103	60	39	1.31	1.63
	Scott Bros	3/18-7/31	127	756	518	204	34	5.69	5.95
	Euclid 1	3/19-7/25	115	199	121	64	14	1.61	1.73
	Euclid 2	3/19-7/25	115	100	67	22	11	0.77	0.87
	Weststeyn	3/19-7/25	95	304	195	96	13	3.06	3.20
	Dejongs	3/18-7/30	124	291	203	77	11	2.26	2.35
Subtotal			827	2,537	1,758	633	146	2.89	3.07
Santa Ana Canyon	Yorba Park	3/19-7/29	120	-2	0	-2	0	-0.02	-0.02
	RV Park E	3/19-7/28	117	1	0	0	1	0.00	0.01
	GR Golf W	3/20-7/27	114	4	2	1	1	0.03	0.04
	GR Eq	3/22-7/28	113	41	25	15	1	0.35	0.36
	Cielo Vista	4/29-7/29	77	0	1	-1	0	0.00	0.00
Subtotal			541	44	28	13	3	0.08	0.08

Table 7 continued. Brown-headed Cowbird trapping results, March-July 2019 (grouped by funding source).

Site Name	Trap/Location	2019 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project									
Anaheim	Burris Basin	3/21-7/24	113	8	9	-1	0	0.07	0.07
	Conrock	3/20-7/31	120	27	20	4	3	0.20	0.23
	Huckleberry	3/21-7/30	119	19	8	6	5	0.12	0.16
	Santiago	3/25-7/31	116	8	3	2	3	0.04	0.07
Subtotal			468	62	40	11	11	0.11	0.13
TOTAL (USFWS/USACE/SARM)			3,938	2,992	1,992	818	182	0.71	0.76
IERCD/SAWA									
San Timoteo	Headlee	3/18-7/30	126	44	22	17	5	0.31	0.35
	Harned	3/18-7/30	126	3	0	2	1	0.02	0.02
	Fishermans	3/18-7/30	126	10	6	3	1	0.07	0.08
	Younglove 1	3/18-7/26	122	15	12	2	1	0.11	0.12
Subtotal			500	72	40	24	8	0.13	0.14
Rivers and Lands Conservancy									
Meridian C.A. (former March SKR Preserve)	Meridian 1	3/19-7/29	124	4	2	1	1	0.02	0.03
	Meridian 2	3/19-7/29	124	1	1	0	0	0.01	0.01
Subtotal			248	5	3	1	1	0.02	0.02
GRAND TOTAL			4,686	3,069	2,035	843	191	0.61	0.65
*TOTAL BHCO FIELD HOURS			2,114						

*hours also include installation and removal of traps from field

Table 8. Non-target avian captures in Brown-headed Cowbird traps, March-July 2019.

2019 Non-target Species*		USFWS/USACE/SARM Project																IERCD		Lands Conservancy		2019 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
				caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died			caught	died		
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
California Towhee	<i>Melospiza crissalis</i>			97	1	112	0	228	1	148	1			143	1	101	2	43	3	41	0	913	9
Song Sparrow	<i>Melospiza melodia</i>			3	0			184	1	52	0			4	0	4	0					247	1
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	3	0			1	0	1	0			176	1	1	0	1	0	6	0	4	0	193	1
House Finch	<i>Haemorhous mexicanus</i>					90	0	2	0					7	0	29	1	1	0	1	0	130	1
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>			1	0							90	1									91	1
Northern Mockingbird	<i>Mimus polyglottos</i>	39	3					2	0	37	6					5	1	6	0			89	10
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>					7	0					74	0	1	0							82	0
Hooded Oriole	<i>Icterus cucullatus</i>			5	2									29	2	6	0	6	1			46	5
Bewick's Wren	<i>Thryomanes bewickii</i>			3	1	1	0	1	0	7	0			15	3			3	0			30	4
House Wren	<i>Troglodytes aedon</i>			11	1			2	0	1	0			4	1			6	2			24	4
Lark Sparrow	<i>Chondestes grammacus</i>									1	0			1	0			2	0	15	0	19	0
Tri-colored Blackbird	<i>Agelaius tricolor</i>											8	0	2	0							10	0
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	6	0											2	0							8	0
Bullock's Oriole	<i>Icterus bullockii</i>													5	0	2	0					7	0
Savannah Sparrow	<i>Passerculus sandwichensis</i>															3	1					3	1
Cooper's Hawk	<i>Accipiter cooperii</i>											2	0									2	0
Great-tailed Grackle	<i>Quiscalus mexicanus</i>											2	0									2	0
Black Phoebe	<i>Sayornis nigricans</i>									1	0			1	1							2	1
Blue Grosbeak	<i>Passerina caerulea</i>																			2	0	2	0
Spotted Towhee	<i>Pipilo maculatus</i>							1	0	1	0											2	0
Orange-crowned Warbler	<i>Oreothlypis celata</i>															2	0					2	0

Table 8 continued. Non-target avian captures in Brown-headed Cowbird traps, March-July 2019.

2019 Non-target Species*		USFWS/USACE/SARM Project																IERCD		Lands Conservancy		2019 Total	
		San Jacinto☐		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
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
Acorn Woodpecker	<i>Melanerpes formicivorus</i>			1	0																	1	0
Western Screech-owl	<i>Megascops kennicottii</i>					1	0															1	0
Green-tailed Towhee	<i>Pipilo chlorurus</i>															1	0					1	0
California Scrub Jay	<i>Aphelocoma californica</i>					1	0															1	0
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>																	1	0			1	0
Exotic Non-targets																							
Budgerigar	<i>Melopsittacus undulatus</i>													3	0			3	0			6	0
Scaly-breasted Munia	<i>Lonchura punctulata</i>															2	1					2	1
Pin-tailed Whydah	<i>Vidua macroura</i>															2	0					2	0
Orange Bishop	<i>Euplectes franciscanus</i>															1	0					1	0
TOTAL		48	3	121	5	213	0	421	2	248	7	352	2	218	8	159	6	77	6	63	0	1,920	39
#/trap day		0.5		0.2		0.6		0.6		0.5		0.4		0.4		0.7		0.2		0.3		0.4	
Mortality %			6.3%		4.1%		0.0%		0.5%		2.8%		0.6%		3.7%		3.8%		7.8%		0.0%		2.0%

*Number of dead non-targets included in number caught

Non-native captures in Brown-headed Cowbird Traps, March-July 2019.

2019 Exotic Nuisance Species**		USFWS/USACE/SARM Project																IERCD		Lands Conservancy		2019 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		Jacinto, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
Common Name	Scientific Name	rel	rem	rel	rem	rel	rem	rel	rem	rel	rem	rel	rem	rel	rem	rel	rem	rel	rem	rel	rem	rel	rem
European Starling	<i>Sturnus vulgaris</i>			11	1	1	0	27	1	6	2	3592	204	147	127	10	7	29	3			3,823	345
House Sparrow	<i>Passer domesticus</i>	0	1	3	0			2	31	3	0	47	538	0	6	3	266	21	74			79	916
TOTAL		0	1	14	1	1	0	29	32	9	2	3639	742	147	133	13	273	50	77	0	0	3,902	1,261

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

rel= released from trap back into the habitat

rem= removed from the trap and the habitat

Table 9. Brown-headed Cowbird trapping results, winter 2018-2019.

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 Dairy	7/30/18-3/17/19	167	1,297	452	502	343	5.7	7.8
	Euclid 2 Dairy	7/30/18-3/17/19	168	988	326	368	294	4.1	5.9
	Weststeyn 1 Dairy	7/30/18-3/17/19	167	2,939	848	1,178	913	12.1	17.6
	Weststeyn 2 Dairy	7/31/18-3/17/19	164	781	158	331	292	3.0	4.8
TOTAL			666	6,005	1,784	2,379	1,842	6.3	9.0

Table 10. Non-target avian captures in Brown-headed Cowbird traps, winter, 2018-2019.

2018-2019 Winter Non-target Species		Prado	
Common Name	Scientific Name	caught	died
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	10	0
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	1	0
Northern Mockingbird	<i>Mimus polyglottos</i>	1	0
TOTAL		12	0
#/trap day		0.02	
Mortality %			0.0%

Non-native captures in Brown-headed Cowbird traps, winter 2017-19.

2018-2019 Winter Exotic Nuisance Species		Prado	
Common Name	Scientific Name	released	removed
House Sparrow	<i>Passer domesticus</i>	6	56
European Starling	<i>Sturnus vulgaris</i>	6	28
TOTAL		12	84

APPENDIX A – SURVEY SITES, STARTING AND ENDING COORDINATES

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

Monitored Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>San Jacinto:</u>		
-San Jacinto River	506079, 3738423	493412, 3746014
-San Jacinto Wildlife Area	488443, 3746279	490979, 3750919
<u>San Timoteo Canyon:</u>		
-Riverside County	487098, 3760532	499659, 3753988
-San Bernardino County	481628, 3764975	483935, 3763472
<u>Santa Ana River (SAR):</u>		
-Riverside Ave. to Van Buren Blvd.	466416, 3765008	456998, 3758228
-Evans Lake Drain	464761, 3761889	463616, 3751226
-Anza/Old Ranch Creeks	462172, 3758697	459646, 3758831
-Hidden Valley, north side of river	456941, 3758360	451647, 3758651
-Hidden Valley, south side of river	456057, 3758181	451093, 3757549
-Hidden Valley South - Restoration	456067, 3758152	454817, 3758428
-Hidden Valley South - Control	454835, 3758920	451089, 3757558
-Lower Hole Creek	457147, 3757662	456737, 3758025
-Hidden Valley to River Rd ¹		
-SAR-Goose Creek, Norco to I-15	451560, 3758574	448772, 3756316
-Goose Creek Mitigation, Norco	451083, 3757763	450045, 3757296
-Norco Bluffs (I-15 to River Rd, non-mitigation)	448907, 3756725	444876, 3753717
<u>Santa Ana Canyon (SAC):</u>		
-Upper Canyon	441121, 3749692	438609, 3749795
-Green River Golf Club	438609, 3749795	436613, 3748409
-Featherly Park	436604, 3748585	430713, 3748516

Sampled Locations and Incidental Sighting Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>Santa Ana River & Tributaries:</u>		
Alessandro Arroyo/Prenda Arroyo	465500, 3754365	470391, 3751168
	465354, 3752493	468066, 3751913
Box Springs	471086, 3757494	472592, 3756430
Burris Basin ³	419850, 3743943	419150, 3742378
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
Castlevue Park ²	467826, 3755173	468565, 3754997
Chino Creek Wetlands Park	437541, 3758309	437358, 3758832
Chino Hills	438794, 3754812	429061, 3759386
Chino Hills State Park (Bane Cyn)	435061, 3757365	435376, 3753499

Sampled Locations and Incidental Sighting Locations (cont.)

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
Chino Hills State Park (Lower Aliso Cyn)	435288, 3753302	438033, 3749528
Chino Hills State Park (Telegraph Cyn)	434818, 3753694	424101, 3753165
Chino Hills State Park (Upper Aliso Cyn)	435111, 3753336	433834, 3755029
Cielo Vista ³	429929, 3750572	429929, 3750572
City Creek (Highland)	482136, 3775290	482454, 3777612
Conrock Basin (FHQ) ³	423314, 3746089	423465, 3746370
Fresno Canyon	440631, 3748012	440954, 3749370
Golden Star	465359, 3751458	466469, 3750869
Harrison Reservoir (aka McAllister Creek)	460113, 3749435	460002, 3747712
Hidden Valley Golf Club	451635, 3752238	451557, 3754114
Highway 71 ³	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
Norco Hills Park Mitigation ²	449570, 3751384	449818, 3751233
Plunge Creek	486953, 3774720	486987, 3775572
Poorman Reservoir	476434, 3758610	477243, 3757320
Pyrite Channel ²	456489, 3762199	455222, 3760761
Quail Run	469907, 3757374	471038, 3757541
Riverside (Van Buren and Jurupa)	457145, 3757620	457172, 3757560
Ryan Bonaminio Park ²	463782, 3759521	463195, 3759424
San Bernardino Flood Control	477956, 3771549	477956, 3771549
San Bernardino Flood Control	468779, 3767632	467036, 3766052
Sun Canyon Park ²	454614, 3749211	454788, 3749119
Sycamore Canyon	470209, 3757079	473225, 3753435
Talbert Park (Orange County)	411746, 3722974	411932, 3723803
Tequesquite Arroyo ²	467671, 3756303	468003, 3757103
Van Buren Blvd. (Bountiful)	469378, 3749894	469639, 3749825
Van Buren (Porter Road) ²	467009, 3749689	466421, 3750042
Wardlow Wash	442819, 3748289	441873, 3749262
Woodcrest	464548, 3751638	464847, 3751471
Wyle Labs (at El Paso only)	450068, 3751818	450200, 3752228
Yorba Linda (San Antonio Rd) ²	429199, 3750653	429494, 3751473
Yorba Linda (Starlight Dr.)	431071, 3749184	430987, 3750270
Yorba Linda Lakebed Park ²	424747, 3748248	424886, 3748817
San Jacinto River Sub-watershed:		
Cottonwood Canyon	475769, 3725678	477572, 3723954
Kabian Park	478467, 3734032	475650, 3730501
Lake Perris	483092, 3744484	485461, 3748329
Menifee (Salt Creek)	478287, 3726499	479548, 3727246
Temescal Canyon	451654, 3746425	471486, 3720612

Santiago Creek Sub-watershed:

Irvine Lake³ 432717, 3736629 434691, 3737547

Sampled Locations and Incidental Sighting Locations (cont.)

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
Irvine Trust Management Area	429806, 3738346	429896, 3738306
Limestone Canyon ²	434012, 3736548	434897, 3735784
Peter's Canyon	429752, 3738563	428604, 3735584
Santiago Basin ³	425344, 3740796	424678, 3740612
Santiago Canyon (Irvine Park)	430063, 3740268	428977, 3741769
Santiago Creek (above Irvine Lake)	437041, 3736718	435376, 3737521
Santiago Creek (Cambridge Road)	421800, 3737876	421425, 3737985
Santiago Creek (Chapman Ave.)	423094, 3738524	423740, 3739316
Santiago Oaks Regional Park (to Cannon Rd) ⁴	425540, 3741436	428769, 3742280
Silverado Canyon ²	437692, 3734768	438878, 3734047
Smith Basin ⁴	425362, 3741441	426377, 3741912

Miscellaneous Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
Moreno Valley	475810, 3758624	474960, 3759974
Tin Mine Road	455237, 3745859	455418, 3744783
Wolfskill	498097, 3747887	498135, 3748626

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

² Denotes sites that were not surveyed this year.

³ Incidental observations of LBVI at this site.

⁴ 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 area up to Cannon Road.

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

APPENDIX B: WATERSHED-WIDE ANNUAL RESULTS, 2000-2019

Appendix B-1. Least Bell's Vireo status and management and Brown-headed Cowbird management data at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2019.

	Parameter	2000-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	834	865	983	1,039	1,110	n/a
B.	Number of known pairs (breeding and non-breeding)	3,769	401	440	560	565	615	6,350
C.	Number of fledged young observed	6,078	590	610	994	691	1,189	10,152
D.	Projected total of recruitment of vireo young ¹	10,166	1,123	1,144	2,016	1,413	2,337	18,403
E.	Average number of fledglings per pair (C/B)	1.6	1.5	1.4	1.8	1.2	1.9	1.6
F.	Projected number of fledglings per pair (D/B)	2.7	2.8	2.6	3.6	2.5	3.8	2.9
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	12% 238 / 1,971	2% 4 / 188	3% 6 / 180	5% 13 / 279	3% 9 / 267	10% 32 / 316	9% 279 / 3,152
I.	Numbers of cowbirds removed from study area ³	30,166	1,245	3,177	1,953	2,637	2,637	41,815
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) ³	71,852	4,282	5,707	4,061	3,096	3,096	92,094
L.	Average number of cowbirds trapped per trap day (I/K)	0.42	0.29	0.56	0.48	0.85	0.85	0.45
M.	Number of field hours - LBVI	66,561	2,192	2,444	2,969	2,472	2,472	88,545
N.	Number of field hours - BHCO		2,052	2,163	2,024	1,598	1,598	

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

³All traps are not accounted for in this total.

Appendix B-2. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Giant Reed ^{le} (<i>Arundo donax</i>)	1				1	1	3	<1%
Western Sycamore (<i>Platanus racemosa</i>)	6			3	2	2	13	<1%
Coulter's Matilija Poppy ^f (<i>Romneya coulteri</i>)			1				1	<1%
Golden Currant (<i>Ribes aureum</i>)	4		1				5	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	95	17	14	21	19	27	193	5%
Fremont Cottonwood (<i>Populus fremontii</i>)	89	15	6	14	21	17	162	4%
Dead Fremont Cottonwood (<i>Populus fremontii</i>)	2						2	<1%
Black Cottonwood (<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>)	1	1	1				3	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	103	5	4	20	26	40	198	5%
Dead Narrowleaf Willow (<i>Salix exigua</i>)	1						1	<1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	280	20	19	28	24	35	406	11%
Dead Goodding's Black Willow (<i>Salix gooddingii</i>)	1						1	<1%
Dead Goodding's Black Willow covered with living Goodding's Black Willow	1						1	<1%
Red Willow (<i>Salix laevigata</i>)	229	26	25	30	22	31	363	10%
Arroyo Willow (<i>Salix lasiolepis</i>)	451	30	46	73	62	70	732	19%
Dead Arroyo Willow (<i>Salix lasiolepis</i>)	1				1		2	<1%
Yellow Willow (<i>Salix lasiandra</i>)	14	2	3			2	21	1%
Willow sp. (<i>Salix</i> sp.)	6	2			3		11	<1%
Dead Willow sp. (<i>Salix</i> sp.)	4			1			5	<1%
Castorbean ^{le} (<i>Ricinus communis</i>)	1			1			2	<1%
Bank Catclaw ^e (<i>Acacia redolens</i>)			1				1	<1%
Western False Indigo (<i>Amorpha fruticosa</i>)	1					1	2	<1%
Blue Palo Verde (<i>Parkinsonia florida</i>)						1	1	<1%
Asian Pear ^e (<i>Cydonia oblonga</i>)						1	1	<1%
Toyon (<i>Heteromeles arbutifolia</i>)	24	3		1		1	29	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, 2000-2019.

Host Plant Species (listed in taxonomic order)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Holly Leaf Cherry (<i>Prunus ilicifolia</i>)	1						1	<1%
California Wild Rose (<i>Rosa californica</i>)	5		2	1	1	1	10	<1%
California Blackberry (<i>Rubus ursinus</i>)	1			2			3	<1%
Chinese Elm ^e (<i>Ulmus parvifolia</i>)			1				1	<1%
Fig ^e (<i>Ficus</i> sp.)	1						1	<1%
White Mulberry ^e (<i>Morus alba</i>)	1					2	3	<1%
Hoary Nettle (<i>Urtica dioica</i>)	1					1	2	<1%
Coast Live Oak (<i>Quercus agrifolia</i>)	2						2	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)	4	2			1	1	8	<1%
Oak sp. (<i>Quercus</i> sp.)		1					1	<1%
Southern California Black Walnut ^f (<i>Juglans californica</i>)	11	1		5	1	1	19	<1%
White Alder (<i>Alnus rhombifolia</i>)	1			1			2	<1%
Laurel Sumac (<i>Malosma laurina</i>)	11	1	2	6	9	8	37	1%
Fragrant Sumac (<i>Rhus aromatica</i>)	1						1	<1%
Sugar Sumac (<i>Rhus ovata</i>)	2				1		3	<1%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)	10	2		3	4	1	20	1%
Brazilian Pepper Tree ^{ie} (<i>Schinus terebinthifolius</i>)	1						1	<1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	15	3	4	2		1	25	1%
Boxelder (<i>Acer negundo</i>)	1	1					2	<1%
Orange Tree ^e (<i>Citrus sinensis</i>)	3						3	<1%
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)	1				1	1	3	<1%
Chaparral Mallow (<i>Malacothamnus fasciculatus</i>)						1	1	<1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	11	1				7	19	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	5	1				1	7	<1%
Dead Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	1						1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	8	1		1	5	6	21	1%
Cape Leadwort ^e (<i>Plumbago auriculata</i>)	2						2	<1%
Fourwing Saltbush (<i>Atriplex canescens</i>)	2					2	4	<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, 2000-2019.

Host Plant Species (listed in taxonomic order)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Ash sp. (<i>Fraxinus</i> sp.)	1						1	<1%
Privet sp. ^e (<i>Ligustrum</i> sp.)	1					1	2	<1%
Olive ^e (<i>Olea europaea</i>)						1	1	<1%
Lollypop Tree ^{te} (<i>Myoporum laetum</i>)	1						1	<1%
Black Sage (<i>Salvia mellifera</i>)	1				1		2	<1%
Tree Tobacco ^{te} (<i>Nicotiana glauca</i>)	1				1	2	4	<1%
California Sagebrush (<i>Artemisia californica</i>)	1				1		2	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	23	1				2	26	1%
Coyote Brush (<i>Baccharis pilularis</i>)	8		3	2	4	13	30	1%
Mulefat (<i>Baccharis salicifolia</i>)	677	49	55	75	93	62	1,011	26%
Dead Mulefat (<i>Baccharis salicifolia</i>)	5		2	1			8	<1%
Willow Baccharis (<i>Baccharis salicina</i>)	3						3	<1%
Desertbroom Baccharis (<i>Baccharis sarothroides</i>)	1						1	<1%
Yellowspine Thistle ^{te} (<i>Cirsium ochrocentrum</i>)	2						2	<1%
Brittlebush (<i>Encelia farinosa</i>)	1					2	3	<1%
Common Sunflower (<i>Helianthus annuus</i>)	1						1	<1%
Arrowweed (<i>Pluchea sericea</i>)	3			1	1	2	7	<1%
Milk Thistle ^{te} (<i>Silybum marianum</i>)	1						1	<1%
Rough Cockelburr (<i>Xanthium strumarium</i>)	2						2	<1%
Wild Celery ^e (<i>Apium graveolens</i>)	1						1	<1%
Poison Hemlock ^{te} (<i>Conium maculatum</i>)	10	1				6	17	<1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	136	18	8	13	5	36	216	6%
Dead Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)				1			1	<1%
Fiddleneck sp. (<i>Amsinckia</i> sp.)	1						1	<1%
Thickleaf Yerba Santa (<i>Eriodictyon crassifolium</i>)	1	2					3	<1%
Yerba Santa sp. (<i>Eriodictyon</i> sp.)	1						1	<1%
Fresh water reed (<i>Typha</i> sp.) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Goodding's Black Willow (<i>S. gooddingii</i>)	1				1		2	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Desert Wild Grape (<i>V. girdiana</i>) and California Wild Rose (<i>R. californica</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Peruvian Pepper Tree ^{ie} (<i>S. molle</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	3	1		1			5	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Dead Goodding's Black Willow (<i>S. gooddingii</i>) and Hoary Nettle (<i>U. dioica</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Perennial Pepperweed ^{ie} (<i>L. latifolium</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Red Willow (<i>S. laevigata</i>) and Wild Cucumber (<i>Marah macrocarpa</i>)	0			1			1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and dead Hoary Nettle (<i>U. dioica</i>)	1						1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and Black Mustard ^{ie} (<i>B. nigra</i>)	1						1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and Sweet Fennel ^l (<i>Foeniculum vulgare</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.) and California Blackberry (<i>Rubus ursinus</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.) and Perennial Pepperweed ^{ie} (<i>L. latifolium</i>)	1						1	<1%
Castorbean ^{ie} (<i>R. communis</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Black Mustard (<i>B. nigra</i>) and Poison Hemlock (<i>C. maculatum</i>)	0					1	1	<1%
Black Mustard ^{ie} (<i>B. nigra</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Coyote Brush (<i>B. pilularis</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Mulefat (<i>B. salicifolia</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)	1						1	<1%
Deadfall	4	1					5	<1%
Unknown/No data	12	3	8	4	22	29	78	2%
Total	2,338	211	206	312	333	420	3,820	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

Appendix B-3. Least Bell's Vireo reproductive success and breeding biology data at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2019.

	Parameter	2000-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	3,769	401	440	560	565	615	6,350
B.	Number of known breeding (nesting) pairs	3,208	322	353	486	418	528	5,315
C.	Number of breeding pairs that were well-monitored throughout the breeding season	1,150	93	95	135	148	151	1,772
D.	Number of 'known fledged young' OBSERVED	6,078	590	610	994	691	1,189	10,152
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	3,126	256	248	490	363	581	5,064
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	1.8	1.7	2.0	1.7	2.3	1.9
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.7	2.8	2.6	3.6	2.5	3.8	2.9
H.	Number of nests that were discovered	2,398	220	206	316	333	420	3,893
I.	Number of well-tracked nests	1,971	188	180	279	267	364	3,249
J.	Number of well-tracked nests that were successful (% = J/I x 100)	59% 1,155 / 1,971	55% 103 / 188	52% 93 / 180	62% 172 / 279	52% 140 / 267	62% 225 / 364	51% 1,663 / 3,249
K.	This row purposefully omitted							
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	12% 238 / 1,971	2% 4 / 188	3% 6 / 180	5% 13 / 279	3% 9 / 267	10% 32 / 316	9% 300 / 3,249
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 81 / 1,971	10% 18 / 188	6% 10 / 180	4% 11 / 279	4% 10 / 267	6% 22 / 364	5% 152 / 3,249
	B. Number of well-tracked nests that failed as a result of parasitism	4% 76 / 1,971	0% 0 / 188	1% 1 / 180	2% 6 / 279	1% 2 / 267	4% 13 / 364	3% 98 / 3,249
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 650 / 1,971	36% 67 / 188	41% 74 / 180	31% 86 / 279	42% 113 / 267	29% 104 / 364	34% 1,094 / 3,249
	D. Number of well-tracked nests that failed for unknown reasons	<1% 5 / 1,971	0% 0 / 188	1% 2 / 180	1% 4 / 279	1% 2 / 267	0% 0 / 364	<1% 13 / 3,249
N.	Average clutch size	n/a	3.3	3.4	3.7	3.4	3.7	n/a
O.	Number of cowbird eggs found in or near vireo nests	289	4	8	13	12	31	357
P.	Number of cowbird nestlings removed from well-tracked nests	16	0	0	0	0	2	18
Q.	Number of cowbird young fledged by vireo observed	14	1	0	2	0	1	18
R.	Number of 'manipulated' parasitized nests	192	4	6	11	9	26	248
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	48% 92 / 192	25% 1 / 4	33% 2 / 6	9% 1 / 11	44% 4 / 9	46% 12 / 26	45% 112 / 248
T.	Number of vireo fledged from 'manipulated' parasitized nests	196	2	6	3	9	26	242
U.	Number of repaired nests	34	0	0	3	4	6	47
V.	% of successful repaired nests	74% 25 / 34	n/a	n/a	33% 1 / 3	50% 2 / 4	67% 4 / 6	68% 32 / 47
W.	Number of vireo fledged from repaired nests	70	n/a	n/a	4	6	9	89

* Unknown outcome for one of the manipulated nests.

APPENDIX C: SUMMARY TABLES BY MANAGED SITE, 2000-2019

Appendix C-1-A. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

San Jacinto

	Parameter	2003-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	29	37	45	74	63	n/a
B.	Number of known pairs (breeding and non-breeding)	170	7	17	27	34	44	299
C.	Number of fledged young observed	250	8	12	48	60	117	495
D.	Projected total of recruitment of vireo young ¹	476 (n=6yrs)	n/a	20.4	75.6	74.8	220	837 (n= 10yrs)
E.	Average number of fledglings per pair (C/B)	1.5	1.1	0.7	1.8	1.8	2.7	1.7
F.	Projected number of fledglings per pair (D/B)	2.8	n/a	1.2	2.8	2.2	5.0	2.8
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	10% 9 / 94	n/a	75% 6 / 8	9% 1 / 11	10% 3 / 30	26% 5 / 19	15% 24 / 162
I.	Numbers of cowbirds removed from study area	19,081	n/a	2,101	1,405	2099	1774	26,460
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	11,374	n/a	390	589	659	480	13,492
L.	Average number of cowbirds trapped per trap day (I/K)	1.68	n/a	5.39	2.39	3.19	3.70	1.96
M.	Number of field hours - LBVI	7759	n/a	83	201	295	340	10,019
N.	Number of field hours - BHCO		n/a	223	383	356	379	

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

Appendix C-1-B. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

San Timoteo Canyon

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	176	173	172	156	124	n/a
B.	Number of known pairs (breeding and non-breeding)	834	141	124	109	104	92	1,404
C.	Number of fledged young observed	1504	287	222	272	161	170	2,616
D.	Projected total of recruitment of vireo young ¹	2335	451	384	458	301.6	294	4,212
E.	Average number of fledglings per pair (C/B)	1.8	2.0	1.8	2.5	1.5	1.8	1.9
F.	Projected number of fledglings per pair (D/B)	2.8	3.2	3.1	4.2	2.9	3.2	3.0
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	17% 114 / 657	0% 0 / 114	0% 0 / 73	1% 1 / 91	0% 0 / 63	15% 12 / 80	12% 127 / 1078
I.	Numbers of cowbirds removed from study area	2219	169	87	93	88	72	2,728
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	12,005	996	832	794	574	500	15,701
L.	Average number of cowbirds trapped per trap day (I/K)	0.18	0.17	0.10	0.12	0.15	0.14	0.17
M.	Number of field hours - LBVI	11554	750	415	442	366	504	15443
N.	Number of field hours - BHCO		399	329	278	235	171	

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

Appendix C-1-C. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

Meridian Conservation Area*

	Parameter	2004-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	7	14	16	20	14	n/a
B.	Number of known pairs (breeding and non-breeding)	94	3	5	9	2	2	115
C.	Number of fledged young observed	154	3	6	23	2	2	190
D.	Projected total of recruitment of vireo young ¹	432 (n= 6yrs)	n/a	n/a	27	n/a	n/a	495 (n= 7yrs)
E.	Average number of fledglings per pair (C/B)	1.6	1.0	1.2	2.6	n/a	n/a	1.7
F.	Projected number of fledglings per pair (D/B)	4.6	n/a	n/a	3.0	n/a	n/a	4.3
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	0% 0 / 25	n/a	n/a	0% 0 / 5	n/a	n/a	0% 0 / 30
I.	Numbers of cowbirds removed from study area	208	8	3	18	6	5	248
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2346	260	248	260	221	248	3,583
L.	Average number of cowbirds trapped per trap day (I/K)	0.09	0.03	0.01	0.07	0.03	0.02	0.07
M.	Number of field hours - LBVI	737	n/a	29	61	16	12	855
N.	Number of field hours - BHCO	906	123	87	69	145	102	1432

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

*Former March SKR Preserve

Appendix C-1-D. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

Mockingbird Canyon

	Parameter	2003-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	37	25	29	43	43	n/a
B.	Number of known pairs (breeding and non-breeding)	243	23	7	15	15	19	322
C.	Number of fledged young observed	396	19	11	15	10	24	475
D.	Projected total of recruitment of vireo young ¹	729 (n=10 yrs)	n/a	21	n/a	n/a	19	934 (n=12 yrs)
E.	Average number of fledglings per pair (C/B)	1.6	0.8	1.6	1.0	n/a	1.3	1.5
F.	Projected number of fledglings per pair (D/B)	3.6	n/a	3.0	n/a	n/a	1.0	4.1
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	11% 16 / 148	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	22% 2 / 9	11% 18 / 167
I.	Numbers of cowbirds removed from study area	1852	63	52	84	52	73	2,176
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	9201	256	385	451	295	383	10,971
L.	Average number of cowbirds trapped per trap day (I/K)	0.20	0.25	0.14	0.19	0.18	0.19	0.20
M.	Number of field hours - LBVI	6045	77	157	87	60	116	7,474
N.	Number of field hours - BHCO		117	193	221	192	209	

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

Appendix C-1-E. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2002-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	109	109	155	164	166	n/a
B.	Number of known pairs (breeding and non-breeding)	269	37	43	95	96	72	612
C.	Number of fledged young observed	402	33	62	169	95	82	843
D.	Projected total of recruitment of vireo young ¹	675 (n= 8yrs)	n/a	172	276	192	101	1,533 (n=12yrs)
E.	Average number of fledglings per pair (C/B)	1.5	0.9	1.4	1.8	1.0	1.1	1.4
F.	Projected number of fledglings per pair (D/B)	2.5	n/a	4.0	2.9	2	1.4	2.5
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	13% 13 / 99	100% 3 / 3	0% 0 / 12	13% 6 / 46	21% 5 / 24	41% 7 / 17	17% 34 / 201
I.	Numbers of cowbirds removed from study area	624	30	65	46	14	43	822
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	6044	302	534	513	266	401	8,060
L.	Average number of cowbirds trapped per trap day (I/K)	0.10	0.10	0.12	0.09	0.05	0.11	0.10
M.	Number of field hours - LBVI	4567	175	439	557	367	359	7,777
N.	Number of field hours - BHCO		104	380	286	303	240	

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

Appendix C-1-F. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2005-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	39	40	36	62	78	n/a
B.	Number of known pairs (breeding and non-breeding)	39	23	27	17	38	37	181
C.	Number of fledged young observed	51	15	33	34	65	41	239
D.	Projected total of recruitment of vireo young ¹	84 (n= 2yrs)	n/a	99.9	68	121.6	n/a	558 (n= 5yrs)
E.	Average number of fledglings per pair (C/B)	1.3	0.7	1.2	2.0	1.7	n/a	1.3
F.	Projected number of fledglings per pair (D/B)	2.1	n/a	3.7	4.0	3.2	n/a	3.1
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	25% 3 / 12	n/a	0% 0 / 5	20% 2 / 10	0% 0 / 25	n/a	10% 5 / 52
I.	Numbers of cowbirds removed from study area	n/a	n/a	n/a	n/a	19	0	19
J.	This row purposefully omitted.							
K.	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	113	2	115
L.	Average number of cowbirds trapped per trap day (I/K)	n/a	n/a	n/a	n/a	0.17	0	0.17
M.	Number of field hours - LBVI	389	17	87	105	128	56	782
N.	Number of field hours - BHCO	n/a	n/a	n/a	n/a	n/a	n/a	n/a

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

Appendix C-1-G. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2000-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	104	121	123	141	140	n/a
B.	Number of known pairs (breeding and non-breeding)	420	27	66	67	60	79	719
C.	Number of fledged young observed	640	22	97	87	88	209	1143
D.	Projected total of recruitment of vireo young ¹	1,092 (n= 12yrs)	n/a	198	322	144	300	2,085 (n= 16yrs)
E.	Average number of fledglings per pair (C/B)	1.5	0.8	1.5	1.3	1.5	2.6	1.6
F.	Projected number of fledglings per pair (D/B)	2.6	n/a	3.0	4.8	2.4	3.8	2.9
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	7% 9 / 131	n/a	0% 0 / 16	0% 0 / 16	0% 0 / 45	9% 6 / 64	6% 15 / 272
I.	Numbers of cowbirds removed from study area	708	n/a	n/a	n/a	n/a	n/a	708
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	5215	n/a	n/a	n/a	n/a	n/a	5,215
L.	Average number of cowbirds trapped per trap day (I/K)	0.14	n/a	n/a	n/a	n/a	n/a	0.14
M.	Number of field hours - LBVI	5532	133	234	189	278	373	6,739
N.	Number of field hours - BHCO		n/a	n/a	n/a	n/a	n/a	

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

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

Appendix C-1-H. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2001-2014	2015*	2016**	2017	2018	2019	Combined
A.	Number of territorial males	110	71	63	73	91	90	n/a
B.	Number of known pairs (breeding and non-breeding)	491	36	31	34	56	58	706
C.	Number of fledged young observed	924	63	45	54	86	110	1,282
D.	Projected total of recruitment of vireo young ¹	1,522 (n= 12 yrs)	90	71.3	98.6	151.2	238	2,118 (n= 17yrs)
E.	Average number of fledglings per pair (C/B)	1.9	1.8	1.5	1.6	1.5	1.9	1.8
F.	Projected number of fledglings per pair (D/B)	3.1	2.5	2.3	2.9	2.7	4.1	3.0
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	6% 17 / 272	0% 0 / 13	0% 0 / 21	0% 0 / 19	0% 0 / 25	0% 0 / 24	5% 17 / 374
I.	Numbers of cowbirds removed from study area	527	29	12	7	11	2	588
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2317	226	136	129	110	96	3,014
L.	Average number of cowbirds trapped per trap day (I/K)	0.23	0.13	0.09	0.05	0.10	0.02	0.20
M.	Number of field hours - LBVI	3409	352	234	270	151	312	4,728
N.	Number of field hours - BHCO	1482	118	n/a	n/a	n/a	n/a	1,600

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

*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.

Appendix C-1-I. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	30	63	69	36	101	n/a
B.	Number of known pairs (breeding and non-breeding)	17	28	31	17	50	143
C.	Number of fledged young observed	43	45	76	39	139	342
D.	Projected total of recruitment of vireo young ¹	63	84	109	46	270	558
E.	Average number of fledglings per pair (C/B)	2.5	1.6	2.5	2.3	2.8	2.4
F.	Projected number of fledglings per pair (D/B)	3.7	3.0	3.5	2.7	5.4	3.9
G.	This row purposefully omitted.						
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 97
I.	Numbers of cowbirds removed from study area	n/a	n/a	n/a	n/a	2	2
J.	This row purposefully omitted.						
K.	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	113	113
L.	Average number of cowbirds trapped per trap day (I/K)	n/a	n/a	n/a	n/a	0.02	0.02
M.	Number of field hours - LBVI	124	180	190	130	226	850
N.	Number of field hours - BHCO	n/a	n/a	n/a	n/a	38	38

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

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

Appendix C-1-J. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

Temescal Canyon

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	123	93	109	106	127	n/a
B.	Number of known pairs (breeding and non-breeding)	415	21	9	59	48	56	608
C.	Number of fledged young observed	661	22	5	48	16	48	800
D.	Projected total of recruitment of vireo young ¹	1,162 (n= 11yrs)	n/a	n/a	177	n/a	n/a	1,702 (n= 12yrs)
E.	Average number of fledglings per pair (C/B)	1.6	1.0	0.6	0.8	n/a	n/a	1.3
F.	Projected number of fledglings per pair (D/B)	2.8	n/a	n/a	3.0	n/a	n/a	2.8
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	16% 31 / 192	n/a	n/a	23% 3 / 13	n/a	n/a	17% 34 / 205
I.	Numbers of cowbirds removed from study area	2828	435	297	240	212	338	4,350
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	11,422	93	644	652	547	579	13,937
L.	Average number of cowbirds trapped per trap day (I/K)	0.25	4.68	0.46	0.37	0.39	0.58	0.31
M.	Number of field hours - LBVI	10246	96	146	263	170	181	12,778
N.	Number of field hours - BHCO		n/a	485	491	328	372	

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by

²Calculation error in 2017 rectified in 2018 report.

Appendix C-1-K. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

Chino Hills

	Parameter	2003-2014	2015	2016*	2017	2018	2019	Combined
A.	Number of territorial males	n/a	24	18	25	26	29	n/a
B.	Number of known pairs (breeding and non-breeding)	64	6	11	7	9	17	114
C.	Number of fledged young observed	73	4	10	3	3	19	112
D.	Projected total of recruitment of vireo young ¹	90 (n= 6yrs)	7.8	n/a	n/a	n/a	n/a	160 (n= 7yrs)
E.	Average number of fledglings per pair (C/B)	1.1	0.7	0.9	0.4	n/a	n/a	1.0
F.	Projected number of fledglings per pair (D/B)	1.4	1.3	n/a	n/a	n/a	n/a	1.4
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	25% 6 / 24	20% 1 / 5	0% 0 / 2	n/a	50% 1 / 2	n/a	24% 8 / 33
I.	Numbers of cowbirds removed from study area	65	76	53	22	23	-3	236
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	833	219	262	113	92	101	1,620
L.	Average number of cowbirds trapped per trap day (I/K)	0.08	0.35	0.20	0.19	0.25	0.00	0.15
M.	Number of field hours - LBVI	605	60	83	31	35	38	852
N.	Number of field hours - BHCO	705	95	128	n/a	n/a	34	962

²Calculation error in 2017 rectified in 2018 report.

*2016 includes former assessment sites

Appendix C-1-L. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Upper Canyon

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	25	26	30	32	35	n/a
B.	Number of known pairs (breeding and non-breeding)	171	9	12	21	25	24	262
C.	Number of fledged young observed	276	10	18	32	23	58	417
D.	Projected total of recruitment of vireo young ¹	445 (n= 11yrs)	18	27.6	42	47.5	98	707 (n= 16yrs)
E.	Average number of fledglings per pair (C/B)	1.6	1.1	1.5	1.5	0.9	2.4	1.6
F.	Projected number of fledglings per pair (D/B)	2.6	2.0	2.3	2.0	1.9	4.1	2.7
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	5% 4 / 77	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 17	4% 4 / 113
I.	Numbers of cowbirds removed from study area	664	14	28	1	94	41	842
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3011	129	134	47	118	113	3,552
L.	Average number of cowbirds trapped per trap day (I/K)	0.22	0.11	0.21	0.02	0.80	0.36	0.24
M.	Number of field hours - LBVI ³		408	386	573	492	635	
N.	Number of field hours - BHCO ³	10734	479	425	296	184	273	14,885

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

³Hours include all of SAC (Upper Canyon, Green River Golf Club, Featherly Park)

Appendix C-1-M. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Green River Golf Club

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	31	33	42	42	45	n/a
B.	Number of known pairs (breeding and non-breeding)	181	23	26	33	38	34	335
C.	Number of fledged young observed	289	35	27	76	20	96	544
D.	Projected total of recruitment of vireo young ¹	434 (n= 13yrs)	37	29	145	22.8	146	838 (n= 18yrs)
E.	Average number of fledglings per pair (C/B)	1.6	1.5	1.0	2.3	0.5	2.9	1.6
F.	Projected number of fledglings per pair (D/B)	2.4	1.6	1.1	4.4	0.6	4.3	2.5
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	4% 4 / 96	0% 0 / 15	0% 0 / 13	0% 0 / 17	0% 0 / 16	0% 0 / 26	2% 4 / 183
I.	Numbers of cowbirds removed from study area	972	32	36	27	-1	4	1,070
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4012	237	260	130	83	114	4,836
L.	Average number of cowbirds trapped per trap day (I/K)	0.24	0.14	0.14	0.21	0.01	0.04	0.22
M.	Number of field hours - LBVI							
N.	Number of field hours - BHCO							

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

Appendix C-1-N. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Featherly Regional Park

	Parameter	2002-2014	2015	2016	2017	2018	2019	Combined
A.	Number of territorial males	n/a	65	64	59	66	69	n/a
B.	Number of known pairs (breeding and non-breeding)	273	38	39	36	25	33	444
C.	Number of fledged young observed	322	37	23	57	25	76	540
D.	Projected total of recruitment of vireo young ¹	491 (n= 11yrs)	49	39	126	52.5	185	977 (n= 16yrs)
E.	Average number of fledglings per pair (C/B)	1.2	1.0	0.6	1.6	1	2.3	1.2
F.	Projected number of fledglings per pair (D/B)	1.8	1.3	1.0	3.5	2.1	5.6	2.2
G.	This row purposefully omitted.							
H.	Rate of cowbird nest parasitism (well-tracked nests) ²	5% 5 / 109	0% 0 / 19	0% 0 / 12	0% 0 / 22	0% 0 / 12	0% 0 / 26	3% 5 / 200
I.	Numbers of cowbirds removed from study area	408	44	8	10	26	-1	495
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3183	495	398	383	239	237	4,935
L.	Average number of cowbirds trapped per trap day (I/K)	0.13	0.09	0.02	0.03	0.11	0.00	0.10
M.	Number of field hours - LBVI							
N.	Number of field hours - BHCO							

¹Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

²Calculation error in 2017 rectified in 2018 report.

Appendix C-2-A. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

San Jacinto

Host Plant Species (listed in taxonomic order ¹)	2004-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Fremont Cottonwood (<i>Populus fremontii</i>)					1	1	2	1%
Narrowleaf Willow (<i>Salix exigua</i>)	55		1	5	23	24	108	50%
Dead Narrowleaf Willow (<i>Salix exigua</i>)	1						1	<1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	5		4	3	5	4	21	10%
Red Willow (<i>Salix laevigata</i>)			2	1			3	1%
Western False Indigo (<i>Amorpha fruticosa</i>)						1	1	<1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	1						1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	2				3	4	9	4%
Coyote Brush (<i>Baccharis pilularis</i>)	1		3	2	3	9	18	8%
Mulefat (<i>Baccharis salicifolia</i>)	34		1	1	1	1	38	18%
Arrowweed (<i>Pluchea sericea</i>)				1	1	2	4	2%
Unknown/No data	4			3	1	1	9	4%
Total	103	0	11	16	38	47	215	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-2-B. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

San Timoteo Canyon

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Western Sycamore (<i>Platanus racemosa</i>)	1						1	<1%
Golden Currant (<i>Ribes aureum</i>)	4		1				5	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	46	10	8	13	8	5	90	8%
Fremont Cottonwood (<i>Populus fremontii</i>)	29	8	3	3	8	6	57	5%
Dead Fremont Cottonwood (<i>Populus fremontii</i>)	1						1	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	20	2	1	6	1	4	34	3%
Goodding's Black Willow (<i>Salix gooddingii</i>)	64	5	4	3	3	9	88	7%
Red Willow (<i>Salix laevigata</i>)	114	20	16	14	6	23	193	16%
Arroyo Willow (<i>Salix lasiolepis</i>)	150	24	22	33	26	18	273	23%
Yellow Willow (<i>Salix lasiandra</i>)	8	1	3				12	1%
Willow sp. (<i>Salix</i> sp.)		1					1	<1%
Dead Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Asian Pear (<i>Cydonia oblonga</i>)						1	1	<1%
Toyon (<i>Heteromeles arbutifolia</i>)	18	3		1		1	23	2%
California Wild Rose (<i>Rubus californica</i>)	1			1			2	<1%
White Mulberry ^e (<i>Morus alba</i>)	1					2	3	<1%
Hoary Nettle (<i>Urtica dioica</i>)						1	1	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)		1			1	1	3	<1%
Oak sp. (<i>Quercus</i> sp.)		1					1	<1%
Southern California Black Walnut ^f (<i>Juglans californica</i>)	1			1	1		3	<1%
Fragrant Sumac (<i>Rhus aromatica</i>)	1						1	<1%
Sugar Sumac (<i>Rhus ovata</i>)					1		1	<1%

Appendix C-2-B continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Boxelder (<i>Acer negundo</i>)	1	1					2	<1%
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)	1						1	<1%
Chaparral Mallow (<i>Malacothamnus fasciculatus</i>)						1	1	<1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	1					1	2	<1%
Mustard sp. ^{ie} (<i>Brassica</i> sp.)	4						4	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)		1					1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	1	1					2	<1%
Fourwing Saltbush (<i>Atriplex canescens</i>)	1					1	2	<1%
Olive ^e (<i>Olea europaea</i>)						1	1	<1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)						1	1	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	18	1				1	20	2%
Mulefat (<i>Baccharis salicifolia</i>)	205	34	19	14	19	8	299	25%
Willow Baccharis (<i>Baccharis salicina</i>)	1						1	<1%
Brittlebush (<i>Encelia farinosa</i>)						2	2	<1%
Poison Hemlock (<i>Conium maculatum</i>)						1	1	<1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	29	9	1	5	1	7	52	4%
Desert Wild Grape (<i>V. girdiana</i>) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	<1%
Arroyo Willow (<i>S. lasiolepis</i>) and Sweet Fennel ⁱ (<i>Foeniculum vulgare</i>)	1						1	<1%
Deadfall	1	1					2	<1%
Unknown/No data		2				1	3	<1%
Total	725	126	78	94	75	96	1,194	100%

^{ie} = Invasive

^e = non-native

ⁱ = endangered, threatened, or sensitive

¹ Using Jepson eFlora

Appendix C-2-C. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Meridian Conservation Area*

Host Plant Species (listed in taxonomic order ¹)	2004-2014 (n= 6 years)	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Goodding's Black Willow (<i>Salix gooddingii</i>)	10						10	32%
Red Willow (<i>Salix laevigata</i>)	7			2			9	29%
Arroyo Willow (<i>Salix lasiolepis</i>)	8			1			9	29%
Dead Willow sp. (<i>Salix</i> sp.)	0			1			1	3%
Mulefat (<i>Baccharis salicifolia</i>)	1			1			2	6%
Total	26	0	0	5	0	0	31	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

*Former March SKR Preserve

¹Using Jepson eFlora

Appendix C-2-D. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

Mockingbird Canyon

Host Plant Species (listed in taxonomic order ¹)	2003-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Western Sycamore (<i>Platanus racemosa</i>)	1						1	1%
Desert Wild Grape (<i>Vitis girdiana</i>)	7						7	4%
Fremont Cottonwood (<i>Populus fremontii</i>)	2					1	3	2%
Narrowleaf Willow (<i>Salix exigua</i>)		1					1	1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	31					2	33	17%
Red Willow (<i>Salix laevigata</i>)	54	2					56	29%

Appendix C-2-D continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2003-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Arroyo Willow (<i>Salix lasiolepis</i>)	15		1			1	17	9%
Willow sp. (<i>Salix</i> sp.)	1						1	1%
Dead Willow sp. (<i>Salix</i> sp.)	1						1	1%
Hollyleaf Cherry (<i>Prunus ilicifolia</i>)	1						1	1%
Southern California Black Walnut ^r (<i>Juglans californica</i>)	1						1	1%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)	4						4	2%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	3						3	2%
Dead Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	2						2	1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)						1	1	1%
Fourwing Saltbush (<i>Atriplex canescens</i>)	1					1	2	1%
Coyote Brush (<i>Baccharis pilularis</i>)						1	1	1%
Mulefat (<i>Baccharis salicifolia</i>)	15						15	8%
Willow Baccharis (<i>Baccharis salicina</i>)	2						2	1%
Arrowweed (<i>Pluchea sericea</i>)	1						1	1%
Wild Celery ^e (<i>Apium graveolens</i>)	1						1	1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	25	2	2			5	34	18%
Desert Wild Grape (<i>V. girdiana</i>) and Goodding's Black Willow (<i>S. gooddingii</i>)	1						1	1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Perennial Pepperweed ^{ie} (<i>L. latifolium</i>)	1						1	1%
Willow sp. (<i>Salix</i> sp.) and Perennial Pepperweed ^{ie} (<i>L. latifolium</i>)	1						1	1%
Coyote Brush (<i>B. pilularis</i>) and Mulefat (<i>B.</i> <i>salicifolia</i>)	1						1	1%
Unknown/No data	2						2	1%
Total	174	5	3	0	0	12	194	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, 2000-2019.

Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.								
Host Plant Species (listed in taxonomic order ¹)	2003-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Western Sycamore (<i>Platanus racemosa</i>)				3			3	1%
Desert Wild Grape (<i>Vitis girdiana</i>)	4	2	2	4	4	5	21	8%
Fremont Cottonwood (<i>Populus fremontii</i>)	8			4		2	14	5%
Narrowleaf Willow (<i>Salix exigua</i>)	5			5			10	4%
Goodding's Black Willow (<i>Salix gooddingii</i>)	11		2	7	5	1	26	10%
Dead Goodding's Black Willow (<i>Salix gooddingii</i>)	1						1	<1%
Red Willow (<i>Salix laevigata</i>)	8		1	5	6	1	21	8%
Arroyo Willow (<i>Salix lasiolepis</i>)	37		3	9	3	3	55	21%
Yellow Willow (<i>Salix lasiandra</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.)	1				1		2	1%
California Wild Rose (<i>Rosa californica</i>)	1		1				2	1%
California Blackberry (<i>Rubus ursinus</i>)				1			1	<1%
Hoary Nettle (<i>Urtica dioica</i>)	1						1	<1%
California Scrub Oak (<i>Quercus berberidifolia</i>)	2						2	1%
White Alder (<i>Alnus rhombifolia</i>)				1			1	<1%
Poison Oak (<i>Toxicodendron diversilobum</i>)			1				1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	1			1			2	1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)	1					1	2	1%
Coyote Brush (<i>Baccharis pilularis</i>)						1	1	<1%

Appendix C-2-E continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

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

Host Plant Species (listed in taxonomic order ¹)	2003-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Mulefat (<i>Baccharis salicifolia</i>)	37		5	16	10	3	71	28%
Poison Hemlock ^{le} (<i>Conium maculatum</i>)						1	1	<1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	4		1	2			7	3%
Desert Wild Grape (<i>V. girdiana</i>) and Goodding's Black Willow (<i>S. gooddingii</i>)					1		1	<1%
Dead Goodding's Black Willow (<i>S.</i> <i>gooddingii</i>) and Hoary Nettle (<i>U. dioica</i>)	1						1	<1%
Unknown/No Data					2	6	8	3%
Total	124	2	16	58	32	24	256	100%

^l = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-2-F. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

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

Host Plant Species (listed in taxonomic order ¹)	2010-2014 (n= 3 years)	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Arundo ⁱ (<i>Arundo donax</i>)					1		1	2%
Western Sycamore (<i>Platanus racemosa</i>)					1		1	2%
Desert Wild Grape (<i>Vitis girdiana</i>)	3						3	5%
Fremont Cottonwood (<i>Populus fremontii</i>)			1	3	1		5	9%
Narrowleaf Willow (<i>Salix exigua</i>)	1						1	2%
Goodding's Black Willow (<i>Salix gooddingii</i>)					2		2	4%
Red Willow (<i>Salix laevigata</i>)	2			1			3	5%
Arroyo Willow (<i>Salix lasiolepis</i>)	1		2	2	5		10	18%
California Blackberry (<i>Rubus ursinus</i>)				1			1	2%
Mulefat (<i>Baccharis salicifolia</i>)	6		2	4	15		27	49%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	3						3	5%
Unknown/No Data						1	1	2%
Total	13	0	5	11	25	1	55	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-2-G. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

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

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Western Sycamore (<i>Platanus racemosa</i>)						1	1	<1%
Desert Wild Grape (<i>Vitis girdiana</i>)	11		1		4	4	20	7%
Fremont Cottonwood (<i>Populus fremontii</i>)			1			3	4	1%
Narrowleaf Willow (<i>Salix exigua</i>)	3		1		1	3	8	3%
Goodding's Black Willow (<i>Salix gooddingii</i>)	18		1	2	5	8	34	11%
Red Willow (<i>Salix laevigata</i>)	10		3	5	2	5	25	8%
Arroyo Willow (<i>Salix lasiolepis</i>)	56		2	4	17	30	109	36%
Yellow Willow (<i>Salix lasiandra</i>)	1						1	<1%
Willow sp. (<i>Salix</i> sp.)	2						2	1%
California Wild Rose (<i>Rosa californica</i>)			1			1	2	1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	1						1	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)						1	1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)					1		1	<1%
Coyote Brush (<i>Baccharis pilularis</i>)	1					1	2	1%
Mulefat (<i>Baccharis salicifolia</i>)	46		4	2	17	16	85	28%
Dead Mulefat (<i>Baccharis salicifolia</i>)				1			1	<1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	3		1	1		3	8	3%
Dead Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)				1			1	<1%
Fresh water reed (Typha sp.) and Arroyo Willow (<i>S. lasiolepis</i>)	1						1	100%

Appendix C-2-G continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Desert Wild Grape (<i>V. girdiana</i>) and California Wild Rose (<i>R. californica</i>)	1						1	<1%
Red Willow (<i>S. laevigata</i>) and Wild Cucumber (<i>Marah macrocarpa</i>)				1			1	<1%
Willow sp. (<i>Salix</i> sp.) and California Blackberry (<i>Rubus ursinus</i>)	1						1	<1%
Mulefat (<i>B. salicifolia</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)	1						1	<1%
Unknown/No data	2		6	1		2	11	4%
Total	147	0	20	18	43	78	306	100%

ⁱ=invasive

^e=non-native

^r=endangered, threatened, or sensitive

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

¹Using Jepson eFlora

Appendix C-2-H. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

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

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Desert Wild Grape (<i>Vitis girdiana</i>)	15	4		1	1	3	24	6%
Fremont Cottonwood (<i>Populus fremontii</i>)	14			1	3	1	19	4%
Dead Fremont Cottonwood (<i>Populus fremontii</i>)	1						1	<1%
Narrowleaf Willow (<i>Salix exigua</i>)	11	1		1	1	1	15	3%
Goodding's Black Willow (<i>Salix gooddingii</i>)	47	4	2			5	58	13%
Red Willow (<i>Salix laevigata</i>)	4	3	1	2	6	1	17	4%
Arroyo Willow (<i>Salix lasiolepis</i>)	100		9	6	5	7	127	29%
Dead Arroyo Willow (<i>Salix lasiolepis</i>)	2						2	<1%
Yellow Willow (<i>Salix lasiandra</i>)		1					1	<1%

Appendix C-2-H continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Willow sp. (<i>Salix</i> sp.)		1			2		3	1%
Dead Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Southern California Black Walnut ^r (<i>Juglans californica</i>)	1						1	<1%
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)						1	1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)						1	1	<1%
Ash sp. (<i>Fraxinus</i> sp.)	1						1	<1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	4						4	1%
California Sagebrush (<i>Artemisia californica</i>)					1		1	<1%
Mulefat (<i>Baccharis salicifolia</i>)	108	4	8	7	9	4	140	32%
Dead Mulefat (<i>Baccharis salicifolia</i>)	4		2				6	1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	3			1		1	5	1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Poison Hemlock ^{ie} (<i>C. maculatum</i>)	1						1	<1%
Unknown/No data	3						3	1%
Total	320	18	22	19	28	25	432	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

¹Using Jepson eFlora

Appendix C-2-I. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

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

Host Plant Species (listed in taxonomic order ¹)	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Desert Wild Grape (<i>Vitis girdiana</i>)		3	2	2	6	13	14%
Narrowleaf Willow (<i>Salix exigua</i>)		1	1		2	4	4%
Goodding's Black Willow (<i>Salix gooddingii</i>)	3	2	5	3	2	15	16%
Arroyo Willow (<i>Salix lasiolepis</i>)	5	5	10	5	10	35	37%
Dead Arroyo Willow (<i>Salix lasiolepis</i>)				1	1	2	2%
Yellow Willow (<i>Salix lasiandra</i>)					2	2	2%
California Wild Rose (<i>Rosa californica</i>)				1		1	1%
Coyote Brush (<i>Baccharis pilularis</i>)					1	1	1%
Mulefat (<i>Baccharis salicifolia</i>)	5	1	6	4	8	24	25%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)					2	2	2%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	1		1			2	2%
Unknown/No Data					1	1	1%
Total	14	9	23	14	35	95	100%

¹ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

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

¹Using Jepson eFlora

Appendix C-2-J. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Temescal Canyon

Host Plant Species (listed in taxonomic order ¹)	2001-2013	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Western Sycamore (<i>Platanus racemosa</i>)	1						1	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	4			1			5	2%
Narrowleaf Willow (<i>Salix exigua</i>)	1			1			2	1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	30		1	4			35	12%
Red Willow (<i>Salix laevigata</i>)	14						14	5%
Arroyo Willow (<i>Salix lasiolepis</i>)	72			5			77	26%
Yellow Willow (<i>Salix lasiandra</i>)	4						4	1%
Dead Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Toyon (<i>Heteromeles arbutifolia</i>)	1						1	<1%
California Blackberry (<i>Rubus ursinus</i>)	1						1	<1%
Sugar Sumac (<i>Rhus ovata</i>)	2						2	1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	1						1	<1%
Mustard sp. ^{ie} (<i>Brassica</i> sp.)	1						1	<1%
Perennial Pepperweed ^{ie} (<i>Lepidium latifolium</i>)	1						1	<1%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)	4						4	1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	1						1	<1%
Coyote Brush (<i>Baccharis pilularis</i>)	2						2	1%
Mulefat (<i>Baccharis salicifolia</i>)	80			5			85	29%
Dead Mulefat (<i>Baccharis salicifolia</i>)	4						4	1%
Brittlebush (<i>Encelia farinosa</i>)	1						1	<1%
Common Sunflower (<i>Helianthus annuus</i>)	1						1	<1%
Arrowweed (<i>Pluchea sericea</i>)	2						2	1%

Appendix C-2-J continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2001-2013	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	8						8	3%
Arroyo Willow (<i>S. lasiolepi</i> and dead Hoary Nettle (<i>U. dioica</i>)	1						1	<1%
Deadfall	3						3	1%
Unknown/No data	0				19	16	35	12%
Total	241	0	1	16	19	16	293	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-2-K. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Chino Hills

Host Plant Species (listed in taxonomic order ¹)	2003-2014 (n=9 years)	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Desert Wild Grape (<i>Vitis girdiana</i>)	1						1	2%
Goodding's Black Willow (<i>Salix gooddingii</i>)	9	5	1				15	34%
Red Willow (<i>Salix laevigata</i>)	6		1				7	16%
Arroyo Willow (<i>Salix lasiolepis</i>)	1						1	2%
Bank Catclaw ^e (<i>Acacia redolens</i>)			1				1	10%
Toyon (<i>Heteromeles arbutifolia</i>)	1						1	2%
Chinese Elm ^e (<i>Ulmus parvifolia</i>)			1				1	2%
Coast Live Oak (<i>Quercus agrifolia</i>)	1						1	2%
California Scrub Oak (<i>Quercus berberidifolia</i>)		1					1	2%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)					1		1	2%
Privet sp. ^e (<i>Ligustrum</i> sp.)						1	1	2%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	3						3	7%
Mulefat (<i>Baccharis salicifolia</i>)	9	1					10	23%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	2				1		3	7%
Unknown/No Data							0	0%
Total	31	7	4	0	1	1	44	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-2-L. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Santa Ana Canyon (SAC) - Upper Canyon

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Desert Wild Grape (<i>Vitis girdiana</i>)	4					2	6	4%
Fremont Cottonwood (<i>Populus fremontii</i>)	8				1	1	10	6%
Narrowleaf Willow (<i>Salix exigua</i>)	1						1	1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	11			1		3	15	9%
Red Willow (<i>Salix laevigata</i>)	3				1		4	3%
Arroyo Willow (<i>Salix lasiolepis</i>)	3						3	2%
Willow sp. (<i>Salix</i> sp.)	1						1	1%
Castorbean ^{ie} (<i>Ricinus communis</i>)	1						1	1%
Toyon (<i>Heteromeles arbutifolia</i>)	1						1	1%
California Wild Rose (<i>Rosa californica</i>)	3						3	2%
Coast Live Oak (<i>Quercus agrifolia</i>)	1						1	1%
Scrub Oak (<i>Quercus berberidifolia</i>)	2						2	1%
Laurel Sumac (<i>Malosma laurina</i>)					1	1	2	1%
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)	1	1			1		3	2%
Poison Oak (<i>Toxicodendron diversilobum</i>)	5					1	6	4%
Mustard sp. ^{ie} (<i>Brassica</i> sp.)	2						2	1%
Coyote Brush (<i>Baccharis pilularis</i>)	1						1	1%
Mulefat (<i>Baccharis salicifolia</i>)	43		2	2	7	8	62	39%
Desertbroom Baccharis (<i>Baccharis sarothroides</i>)	1						1	1%
Milk Thistle ^{ie} (<i>Silybum marianum</i>)	1						1	1%

Appendix C-2-L continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Rough Cocklebur (<i>Xanthium strumarium</i>)	1						1	1%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	2						2	1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	18		1	1	2	6	28	18%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	1%
Mustard ^{ie} (<i>Brassica</i> sp.) and Mulefat (<i>B. salicifolia</i>)	1						1	1%
Total	116	1	3	4	13	22	159	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-2-M. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Giant Reed ^{ie} (<i>Arundo donax</i>)	1					1	2	1%
Desert Wild Grape (<i>Vitis girdiana</i>)	2	1		1		2	6	3%
Fremont Cottonwood (<i>Populus fremontii</i>)	5	2		2	4	1	14	6%
Narrowleaf Willow (<i>Salix exigua</i>)	2						2	1%
Goodding's Black Willow (<i>Salix gooddingii</i>)	11	2	1	2	1	1	18	8%
Red Willow (<i>Salix laevigata</i>)	4	1	1				6	3%
Arroyo Willow (<i>Salix lasiolepis</i>)	4		1	1			6	3%
Toyon (<i>Heteromeles arbutifolia</i>)	2						2	1%
Southern California Black Walnut ^r (<i>Juglans californica</i>)	1			3		1	5	2%
Laurel Sumac (<i>Malosma laurina</i>)	3		2	2	3	4	14	6%

Appendix C-2-M continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2001-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Peruvian Pepper Tree ^{ie} (<i>Schinus molle</i>)	5	1		3	2	1	12	5%
Brazilian Pepper Tree ^{ie} (<i>Schinus terebinthifolius</i>)	1						1	<1%
Poison Oak (<i>Toxicodendron diversilobum</i>)	2	1	2				5	2%
Tree of Heaven ^{ie} (<i>Ailanthus altissima</i>)					1		1	<1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)						4	4	2%
Cape Leadwort ^e (<i>Plumbago auriculata</i>)	2						2	1%
Privet sp. ^e (<i>Ligustrum</i> sp.)	1						1	<1%
Lollypop Tree ^{ie} (<i>Myoporum laetum</i>)	1						1	<1%
Tree Tobacco ^{ie} (<i>Nicotiana glauca</i>)					1		1	<1%
California Sagebrush (<i>Artemisia californica</i>)	1						1	<1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)	1						1	<1%
Coyote Brush (<i>Baccharis pilularis</i>)	3				1		4	2%
Mulefat (<i>Baccharis salicifolia</i>)	46	4	5	7	6	7	75	34%
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)	2						2	1%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	10	3	2	1	1	10	27	12%
Yerba Santa sp. (<i>Eriodictyon</i> sp.)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Peruvian Pepper Tree ^{ie} (<i>S. molle</i>)	1						1	<1%
Desert Wild Grape (<i>V. girdiana</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Goodding's Black Willow (<i>S. gooddingii</i>) and Blue Elderberry (<i>S. n. caerulea</i>)	1						1	<1%
Unknown/No data		1				1	2	1%
Total	114	16	14	22	20	33	219	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-2-N. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed in taxonomic order ¹)	2002-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Coulter's Matilija Poppy ^r (<i>Romneya coulteri</i>)			1				1	<1%
Western Sycamore (<i>Platanus racemosa</i>)	3				1	1	5	2%
Desert Wild Grape (<i>Vitis girdiana</i>)	1						1	<1%
Fremont Cottonwood (<i>Populus fremontii</i>)	18	5	1		3	1	28	11%
Black Cottonwood (<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>)	1	1	1				3	1%
Narrowleaf Willow (<i>Salix exigua</i>)	4	1		1		6	12	5%
Goodding's Black Willow (<i>Salix gooddingii</i>)	19	1	1	1			22	8%
living Goodding's Black Willow (<i>Salix gooddingii</i>)	1						1	<1%
Red Willow (<i>Salix laevigata</i>)	4				1	1	6	2%
Arroyo Willow (<i>Salix lasiolepis</i>)	4	1	1	2	1		9	3%
Willow sp. (<i>Salix</i> sp.)	1						1	<1%
Blue Palo Verde (<i>Parkinsonia florida</i>)						1	1	<1%
Castorbean ^{ie} (<i>Ricinus communis</i>)				1			1	<1%
Toyon (<i>Heteromeles arbutifolia</i>)	1						1	<1%
Southern California Black Walnut ^t (<i>Juglans californica</i>)	7	1		1			9	3%
White Alder (<i>Alnus rhombifolia</i>)	1						1	<1%
Laurel Sumac (<i>Malosma laurina</i>)	8	1		4	5	3	21	8%
Poison Oak (<i>Toxicodendron diversilobum</i>)	6	2	1	2			11	4%
Orange Tree ^e (<i>Citrus sinensis</i>)	3						3	1%
Black Mustard ^{ie} (<i>Brassica nigra</i>)	2	1		2		2	7	3%
Tamarisk ^{ie} (<i>Tamarix ramosissima</i>)					1		1	<1%
Black Sage (<i>Salvia mellifera</i>)	1				1		2	1%
Douglas' Sagewort (<i>Artemisia douglasiana</i>)						1	1	<1%
Mulefat (<i>Baccharis salicifolia</i>)	33	1	8	8	5	7	62	23%
Yellowspine Thistle ^{ie} (<i>Cirsium ochrocentrum</i>)	2						2	1%
Rough Cockelburr (<i>Xanthium strumarium</i>)	1						1	<1%

Appendix C-2-N continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2019.

Host Plant Species (listed in taxonomic order ¹)	2002-2014	2015	2016	2017	2018	2019	Combined	Percentage of Combined
Poison Hemlock ^{ie} (<i>Conium maculatum</i>)		1				4	5	2%
Blue Elderberry (<i>Sambucus nigra</i> ssp. <i>caerulea</i>)	25	4		2		2	33	12%
Fiddleneck sp. (<i>Amsinckia</i> sp.)							0	0%
Thickleaf Yerba Santa (<i>Eriodictyon crassifolium</i>)		2					2	1%
Desert Wild Grape (<i>V. girdiana</i>) and Mulefat (<i>B. salicifolia</i>)	2						2	1%
Arroyo Willow (<i>S. lasiolepis</i>) and Black Mustard ^{ie} (<i>B. nigra</i>)	1						1	<1%
Castorbean ^{ie} (<i>R. communis</i>) and Mulefat (<i>B. salicifolia</i>)	1						1	<1%
Black Mustard (<i>B. nigra</i>) and Poison Hemlock (<i>C. maculatum</i>)						1	1	<1%
Unknown/No data	1		2				3	1%
Total	155	22	16	24	18	30	265	100%

ⁱ = invasive

^e = non-native

^r = endangered, threatened, or sensitive

¹Using Jepson eFlora

Appendix C-3-A. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019

San Jacinto

	Parameter	2004-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	170	7	17	27	34	44	299
B.	Number of known breeding (nesting) pairs	139	7	10	25	30	44	255
C.	Number of breeding pairs that were well-monitored throughout the breeding season	45	0	5	8	18	7	83
D.	Number of 'known fledged young' OBSERVED	250	8	12	48	60	117	495
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	127	n/a	6	22	40	35	230
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.8	1.1	1.2	1.9	2	2.7	1.9
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.8	n/a	1.2	2.8	2.2	5.0	2.8
H.	Number of nests that were discovered	112	0	11	17	38	47	225
I.	Number of well-tracked nests	94	n/a	8	11	30	35	178
J.	Number of well-tracked nests that were successful (% = J/I x 100)	53% 50 / 94	n/a	25% 2 / 8	64% 7 / 11	63% 19 / 30	69% 24 / 35	57% 102 / 178
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	10% 9 / 94	n/a	75% 6 / 8	9% 1 / 11	10% 3 / 30	26% 5 / 19	15% 24 / 162
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 4 / 94	n/a	0% 0 / 8	9% 1 / 11	7% 2 / 30	3% 1 / 35	4% 8 / 178
	B. Number of well-tracked nests that failed as a result of parasitism	6% 6 / 94	n/a	13% 1 / 8	9% 1 / 11	7% 2 / 30	3% 1 / 35	6% 11 / 178
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	36% 34 / 94	n/a	63% 5 / 8	18% 2 / 11	23% 7 / 30	26% 9 / 35	32% 57 / 178
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 94	n/a	0% 0 / 8	0% 0 / 11	0% 0 / 30	0% 0 / 35	0% 0 / 178
M.	Average clutch size	n/a	n/a	4.0	3.8	3	3.5	n/a
N.	Number of cowbird eggs found in or near vireo nests	12	n/a	8	1	3	5	29
O.	Number of cowbird nestlings removed from vireo nests	0	n/a	0	0	0	1	1
P.	Number of cowbird young fledged by vireo observed	7	n/a	0	0	0	0	7
Q.	Number of 'manipulated' parasitized nests	5	n/a	6	0	3	6	20
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	60% 3 / 5	n/a	33% 2 / 6	n/a	33% 1 / 3	67% 4 / 6	50% 10 / 20
S.	Number of vireo fledged from 'manipulated' parasitized nests	7	n/a	6	n/a	1	11	25
T.	Number of repaired nests	3	n/a	0	0	0	0	3
U.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	n/a	n/a	100% 3 / 3
V.	Number of vireo fledged from repaired nests	10	n/a	n/a	n/a	n/a	n/a	10

*corrected from Appendix D

Appendix C-3-B. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

San Timoteo Canyon

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	834	141	124	109	104	92	1,404
B.	Number of known breeding (nesting) pairs	695	126	107	99	85	75	1,187
C.	Number of breeding pairs that were well-monitored throughout the breeding season	353	56	39	48	30	39	565
D.	Number of 'known fledged young' OBSERVED	1,504	287	222	272	161	170	2,616
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	1,006	181	119	202	86	123	1,717
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.2	2.3	2.1	2.7	1.9	2.3	2.2
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.8	3.2	3.1	4.2	2.9	3.2	3.0
H.	Number of nests that were discovered	744	126	78	94	75	96	1,213
I.	Number of well-tracked nests	657	114	73	91	63	90	1,088
J.	Number of well-tracked nests that were successful (% = J/I x 100)	57% 373 / 657	58% 66 / 114	51% 37 / 73	63% 57 / 91	44% 28 / 63	44% 40 / 90	55% 601 / 1,088
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	17% 114 / 657	0% 0 / 114	0% 0 / 73	1% 1 / 91	0% 0 / 63	15% 12 / 80	12% 127 / 1,078
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 26 / 657	10% 11 / 114	7% 5 / 73	2% 2 / 91	8% 5 / 63	4% 4 / 90	5% 53 / 1,088
	B. Number of well-tracked nests that failed as a result of parasitism	4% 28 / 657	0% 0 / 114	0% 0 / 73	0% 0 / 91	0% 0 / 63	8% 7 / 90	3% 35 / 1,088
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	35% 227 / 657	32% 37 / 114	42% 31 / 73	35% 32 / 91	48% 30 / 63	43% 39 / 90	36% 396 / 1,088
	D. Number of well-tracked nests that failed for unknown reasons	0% 3 / 657	0% 0 / 114	0% 0 / 73	0% 0 / 91	0% 0 / 63	0% 0 / 90	0% 3 / 1,088
M.	Average clutch size	n/a	3.3	3.5	3.8	3.4	3.7	n/a
N.	Number of cowbird eggs found in or near vireo nests	128	0	0	1	2	12	143
O.	Number of cowbird nestlings removed from vireo nests	7	0	0	0	0	0	7
P.	Number of cowbird young fledged by vireo observed	2	0	0	0	0	0	2
Q.	Number of 'manipulated' parasitized nests	93	0	0	1	0	8	102
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	51% 47 / 93	n/a	n/a	0% 0 / 1	n/a	38% 3 / 8	49% 50 / 102
S.	nests	102	n/a	n/a	0	n/a	4	106
T.	Number of repaired nests	8	0	0	1	1	3	13
U.	% of successful repaired nests	75% 6 / 8	n/a	n/a	0% 0 / 1	0	33% 1 / 3	54% 7 / 13
V.	Number of vireo fledged from repaired nests	18	n/a	n/a	0	0	3	21

Appendix C-3-C. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

Meridian Conservation Area*

	Parameter	2004-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	94	3	5	9	2	2	115
B.	Number of known breeding (nesting) pairs	74	3	1	8	2	2	90
C.	Number of breeding pairs that were well-monitored throughout the breeding season	13	0	0	3	0	0	16
D.	Number of 'known fledged young' OBSERVED	154	3	6	23	2	2	190
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	60	n/a	n/a	9	n/a	n/a	69
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.1	1.0	6.0	2.9	n/a	n/a	2.1
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	4.6	n/a	n/a	3.0	n/a	n/a	4.3
H.	Number of nests that were discovered	26	n/a	1	5	0	0	32
I.	Number of well-tracked nests	25	n/a	0	5	n/a	0	30
J.	Number of well-tracked nests that were successful (% = J/I x 100)	72% 18 / 25	n/a	n/a	100% 5 / 5	n/a	n/a	77% 23 / 30
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	0% 0 / 25	n/a	n/a	0% 0 / 5	n/a	n/a	0% 0 / 30
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 25	n/a	n/a	0% 0 / 5	n/a	n/a	0% 0 / 30
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 25	n/a	n/a	0% 0 / 5	n/a	n/a	0% 0 / 30
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	28% 7 / 25	n/a	n/a	0% 0 / 5	n/a	n/a	23% 7 / 30
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 25	n/a	n/a	0% 0 / 5	n/a	n/a	0% 0 / 30
M.	Average clutch size	n/a	n/a	4.0	3.8	n/a	n/a	n/a
N.	Number of cowbird eggs found in or near vireo nests	1	n/a	0	0	n/a	n/a	1
O.	Number of cowbird nestlings removed from vireo nests	0	n/a	0	0	n/a	n/a	0
P.	Number of cowbird young fledged by vireo observed	0	n/a	n/a	0	n/a	n/a	0
Q.	Number of 'manipulated' parasitized nests	0	n/a	0	0	n/a	n/a	0
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	n/a 0 / 0	n/a	n/a	n/a	n/a	n/a	n/a 0 / 0
S.	nests	0	n/a	n/a	n/a	n/a	n/a	0
T.	Number of repaired nests	0	n/a	0	0	0	n/a	0
U.	% of successful repaired nests	n/a 0 / 0	n/a	n/a	n/a	n/a	n/a	n/a 0 / 0
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0

*Former March SKR Preserve

**n = 8 years

Appendix C-3-D. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

Mockingbird Canyon

	Parameter	2002-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	243	23	7	15	15	19	322
B.	Number of known breeding (nesting) pairs	214	16	4	13	10	12	269
C.	Number of breeding pairs that were well-monitored throughout the breeding season	64	0	1	0	0	3	68
D.	Number of 'known fledged young' OBSERVED	396	19	11	15	10	24	475
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	194	n/a	3	n/a	n/a	3	200
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	1.2	2.8	1.2	n/a	2.0	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	3.0	n/a	3.0	n/a	n/a	1.0	2.9
H.	Number of nests that were discovered	175	5	3	2	0	12	197
I.	Number of well-tracked nests	148	5	3	2	n/a	11	169
J.	Number of well-tracked nests that were successful (% = J/I x 100)	53% 79 / 148	40% 2 / 5	67% 2 / 3	50% 1 / 2	n/a	36% 4 / 11	52% 88 / 169
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	11% 16 / 148	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	22% 2 / 9	11% 18 / 167
	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 10 / 148	20% 1 / 5	0% 0 / 3	0% 0 / 2	n/a	9% 1 / 11	7% 12 / 169
	B. Number of well-tracked nests that failed as a result of parasitism	4% 6 / 148	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	9% 1 / 11	4% 7 / 169
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	34% 51 / 148	40% 2 / 5	33% 1 / 3	50% 1 / 2	n/a	45% 5 / 11	36% 60 / 169
L.	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 148	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	0 0 / 11	1% 2 / 169
M.	Average clutch size	n/a	3.4	3.3	3.5	n/a	3.8	n/a
N.	Number of cowbird eggs found in or near vireo nests	27	0	0	0	n/a	2	29
O.	Number of cowbird nestlings removed from vireo nests	2	0	0	0	n/a	0	2
P.	Number of cowbird young fledged by vireo observed	1	0	0	0	n/a	0	1
Q.	Number of 'manipulated' parasitized nests	13	0	0	0	n/a	1	14
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	31% 4 / 13	n/a	n/a	n/a	n/a	0 0 / 1	29% 4 / 14
S.	Number of vireo fledged from 'manipulated' parasitized nests	8	n/a	n/a	n/a	n/a	0	8
T.	Number of repaired nests	3	0	0	0	n/a	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

Appendix C-3-E. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

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

	Parameter	2002-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	270	37	43	95	96	72	613
B.	Number of known breeding (nesting) pairs	224	27	29	87	68	58	493
C.	Number of breeding pairs that were well-monitored throughout the breeding season	72	0	7	27	12	8	126
D.	Number of 'known fledged young' OBSERVED	393	33	62	169	95	82	834
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	179	n/a	28	78	24	11	320
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.8	1.2	2.1	1.9	1.4	1.4	1.7
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.5	n/a	4.0	2.9	2	1.4	2.5
H.	Number of nests that were discovered	129	11	16	58	32	24	270
I.	Number of well-tracked nests	99	3	12	46	24	18	202
J.	Number of well-tracked nests that were successful (% = J/I x 100)	66% 65 / 99	33% 1 / 3	83% 10 / 12	59% 27 / 46	63% 15 / 24	39% 7 / 18	62% 125 / 202
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	13% 13 / 99	100% 3 / 3	0% 0 / 12	13% 6 / 46	21% 5 / 24	41% 7 / 17	17% 34 / 201
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 3 / 99	0% 0 / 3	0% 0 / 12	7% 3 / 46	0% 0 / 24	22% 4 / 18	5% 10 / 202
	B. Number of well-tracked nests that failed as a result of parasitism	7% 7 / 99	0% 0 / 3	0% 0 / 12	9% 4 / 46	0% 0 / 24	17% 3 / 18	7% 14 / 202
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	24% 24 / 99	67% 2 / 3	17% 2 / 12	26% 12 / 46	38% 9 / 24	22% 4 / 18	26% 53 / 202
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 99	0% 0 / 3	0% 0 / 12	0% 0 / 46	0% 0 / 24	0% 0 / 18	0% 0 / 202
M.	Average clutch size	n/a	3.7	3.9	3.7	3.2	4.0	n/a
N.	Number of cowbird eggs found in or near vireo nests	18	3	0	6	6	6	39
O.	Number of cowbird nestlings removed from vireo nests	0	0	0	0	0	1	1
P.	Number of cowbird young fledged by vireo observed	2	1	0	1	0	0	4
Q.	Number of 'manipulated' parasitized nests	11	3	0	6	5	5	30
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	18% 2 / 11	33% 1 / 3	n/a	0% 0 / 6	60% 3 / 5	20% 1 / 5	23% 7 / 30
S.	Number of vireo fledged from 'manipulated' parasitized nests	5	2	n/a	0	8	3	18
T.	Number of repaired nests	1	0	0	0	0	0	1
U.	% of successful repaired nests	0% 0 / 1	n/a	n/a	n/a	n/a	n/a	0% 0 / 1
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0

Appendix C-3-F. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

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

	Parameter	2009-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	38	23	27	17	38	37	180
B.	Number of known breeding (nesting) pairs	25	11	20	16	35	31	138
C.	Number of breeding pairs that were well-monitored throughout the breeding season	10	0	3	6	11	0	30
D.	Number of 'known fledged young' OBSERVED	51	15	33	34	65	41	239
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	22	n/a	11	24	35	n/a	92
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.0	1.4	1.7	2.1	1.9	n/a	1.7
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.2	n/a	3.7	4.0	3.2	n/a	3.1
H.	Number of nests that were discovered	16	0	5	11	25	1	58
I.	Number of well-tracked nests	12	n/a	5	10	25	0	52
J.	Number of well-tracked nests that were successful (% = J/I x 100)	58% 7 / 12	n/a	60% 3 / 5	70% 7 / 10	56% 14 / 25	n/a	60% 31 / 52
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	25% 3 / 12	n/a	0% 0 / 5	20% 2 / 10	0% 0 / 25	n/a	10% 5 / 52
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 12	n/a	0% 0 / 5	0% 0 / 10	0% 0 / 25	n/a	0% 0 / 52
	B. Number of well-tracked nests that failed as a result of parasitism	25% 3 / 12	n/a	0% 0 / 5	10% 1 / 10	0% 0 / 25	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	17% 2 / 12	n/a	20% 1 / 5	20% 2 / 10	44% 11 / 25	n/a	52% 27 / 52
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 12	n/a	20% 1 / 5	0% 0 / 10	0% 0 / 25	n/a	2% 1 / 52
M.	Average clutch size	n/a	n/a	3.4	4.0	3.7	n/a	n/a
N.	Number of cowbird eggs found in or near vireo nests	4	n/a	0	2	0	n/a	6
O.	Number of cowbird nestlings removed from vireo nests	0	n/a	0	0	0	n/a	0
P.	Number of cowbird young fledged by vireo observed	0	n/a	0	0	0	n/a	0
Q.	Number of 'manipulated' parasitized nests	2	n/a	0	2	n/a	n/a	4
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	0% 0 / 2	n/a	n/a	50% 1 / 2	n/a	n/a	25% 1 / 4
S.	Number of vireo fledged from 'manipulated' parasitized nests	0	n/a	n/a	3	n/a	n/a	3
T.	Number of repaired nests	0	n/a	0	0	0	n/a	0
U.	% of successful repaired nests	n/a 0 / 0	n/a	n/a	n/a	n/a	n/a	n/a 0 / 0
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0

Appendix C-3-G. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

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

	Parameter	2000-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	420	27	66	67	60	79	719
B.	Number of known breeding (nesting) pairs	374	18	57	54	46	77	626
C.	Number of breeding pairs that were well-monitored throughout the breeding season	85	0	7	4	28	39	163
D.	Number of 'known fledged young' OBSERVED	640	22	97	87	88	209	1,143
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	217	n/a	21	19	67	148	472
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.7	1.2	1.7	1.6	1.9	2.7	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.6	n/a	3.0	4.8	2.4	3.8	2.9
H.	Number of nests that were discovered	168	0	21	18	47	78	332
I.	Number of well-tracked nests	131	n/a	16	16	45	76	284
J.	Number of well-tracked nests that were successful (% = J/I x 100)	60% 79 / 131	n/a	75% 12 / 16	44% 7 / 16	49% 22 / 45	63% 48 / 76	59% 168 / 284
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	7% 9 / 131	n/a	0% 0 / 16	0% 0 / 16	0% 0 / 45	9% 6 / 64	6% 15 / 272
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	2% 3 / 131	n/a	0% 0 / 16	0% 0 / 16	4% 2 / 45	3% 2 / 76	2% 7 / 284
	B. Number of well-tracked nests that failed as a result of parasitism	5% 6 / 131	n/a	0% 0 / 16	0% 0 / 16	0% 0 / 45	1% 1 / 76	3% 8 / 284
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	28% 37 / 131	n/a	25% 4 / 16	44% 7 / 16	47% 21 / 45	33% 25 / 76	33% 94 / 284
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 131	n/a	0% 0 / 16	13% 2 / 16	0% 0 / 45	0% 0 / 76	1% 2 / 284
M.	Average clutch size	n/a	n/a	3.5	3.6	3.5	3.8	n/a
N.	Number of cowbird eggs found in or near vireo nests	8	n/a	0	0	0	6	14
O.	Number of cowbird nestlings removed from vireo nests	2	n/a	0	0	0	0	2
P.	Number of cowbird young fledged by vireo observed	0	n/a	0	0	0	0	0
Q.	Number of 'manipulated' parasitized nests	3	n/a	n/a	n/a	n/a	6	9
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	0% 0 / 3	n/a	n/a	n/a	n/a	67% 4 / 6	44% 4 / 9
S.	Number of vireo fledged from 'manipulated' parasitized nests	8	n/a	n/a	n/a	n/a	8	16
T.	Number of repaired nests	0	n/a	0	0	1	0	1
U.	% of successful repaired nests	n/a 0 / 0	n/a	n/a	n/a	100% 1 / 1	n/a	100% 1 / 1
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	3	n/a	3

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

Appendix C-3-H. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

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

	Parameter	2001-2014	2015*	2016**	2017	2018	2019	Combined
A.	Number of known pairs	491	36	31	34	56	58	706
B.	Number of known breeding (nesting) pairs	466	29	28	32	46	52	653
C.	Number of breeding pairs that were well-monitored throughout the breeding season	157	13	9	7	16	10	212
D.	Number of 'known fledged young' OBSERVED	924	63	45	54	86	110	1,282
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	487	33	21	20	43	41	645
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.0	2.2	1.6	1.7	1.9	2.1	2.0
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	3.1	2.5	2.3	2.9	2.7	4.1	3.0
H.	Number of nests that were discovered	322	18	22	19	28	25	434
I.	Number of well-tracked nests	272	13	21	19	25	24	374
J.	Number of well-tracked nests that were successful (% = J/I x 100)	67% 181 / 272	77% 10 / 13	43% 9 / 21	68% 13 / 19	64% 16 / 25	71% 17 / 24	66% 246 / 374
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	6% 17 / 272	0% 0 / 13	0% 0 / 21	0% 0 / 19	0% 0 / 25	0% 0 / 23	5% 17 / 373
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 12 / 272	8% 1 / 13	0% 0 / 21	0% 0 / 19	0% 0 / 25	8% 2 / 24	4% 15 / 374
	B. Number of well-tracked nests that failed as a result of parasitism	1% 4 / 272	0% 0 / 13	0% 0 / 21	0% 0 / 19	0% 0 / 25	0% 0 / 24	1% 4 / 374
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	28% 75 / 272	15% 2 / 13	52% 11 / 21	32% 6 / 19	36% 9 / 25	21% 5 / 24	29% 108 / 374
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 272	0% 0 / 13	5% 1 / 21	0% 0 / 19	0% 0 / 25	0% 0 / 24	0% 1 / 374
M.	Average clutch size	n/a	3.5	3.4	3.5	3.8	3.6	n/a
N.	Number of cowbird eggs found in or near vireo nests	22	0	0	0	0	0	22
O.	Number of cowbird nestlings removed from vireo nests	1	0	0	0	0	0	1
P.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
Q.	Number of 'manipulated' parasitized nests	16	n/a	n/a	n/a	n/a	n/a	16
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	0% 0 / 16	n/a	n/a	n/a	n/a	n/a	0% 0 / 16
S.	Number of vireo fledged from 'manipulated' parasitized nests	18	n/a	n/a	n/a	n/a	n/a	18
T.	Number of repaired nests	2	0	0	1	1	0	4
U.	% of successful repaired nests	0% 0 / 2	n/a	n/a	100% 1 / 1	100% 1 / 1	n/a	50% 2 / 4
V.	Number of vireo fledged from repaired nests	4	n/a	n/a	4	3	n/a	11

*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

Appendix C-3-I. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

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

	Parameter	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	17	28	31	17	50	143
B.	Number of known breeding (nesting) pairs	17	28	30	17	48	140
C.	Number of breeding pairs that were well-monitored throughout the breeding season	3	5	12	13	16	49
D.	Number of 'known fledged young' OBSERVED	43	45	76	39	139	342
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	11	15	42	35	87	190
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.5	1.6	2.5	2.3	2.9	2.4
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	3.7	3.0	3.5	2.7	5.4	3.9
H.	Number of nests that were discovered	14	12	25	16	35	102
I.	Number of well-tracked nests	13	12	22	15	35	97
J.	Number of well-tracked nests that were successful (% = J/I x 100)	69% 9 / 13	58% 7 / 12	77% 17 / 22	73% 11 / 15	89% 31 / 35	77% 75 / 97
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 97
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	15% 2 / 13	8% 1 / 12	5% 1 / 22	7% 1 / 15	6% 2 / 35	7% 7 / 97
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 97
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	15% 2 / 13	33% 4 / 12	18% 4 / 22	20% 3 / 15	6% 2 / 35	15% 15 / 97
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 35	0% 0 / 97
M.	Average clutch size	3.4	3.4	3.6	3.6	3.8	n/a
N.	Number of cowbird eggs found in or near vireo nests	0	0	0	0	0	0
O.	Number of cowbird nestlings removed from vireo nests	0	0	0	0	0	0
P.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0
Q.	Number of 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	0
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of vireo fledged from 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	0
T.	Number of repaired nests	0	0	0	0	0	0
U.	% of successful repaired nests	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

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

Appendix C-3-J. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019

Temescal Canyon

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	415	21	9	59	48	56	608
B.	Number of known breeding (nesting) pairs	331	20	4	39	21	40	455
C.	Number of breeding pairs that were well-monitored throughout the breeding season	118	0	0	1	0	0	119
D.	Number of 'known fledged young' OBSERVED	661	22	5	48	16	48	800
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	327	n/a	n/a	3	n/a	n/a	330
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.0	1.1	1.3	1.2	n/a	n/a	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.8	n/a	n/a	3.0	n/a	n/a	2.8
H.	Number of nests that were discovered	245	0	1	16	19	16	297
I.	Number of well-tracked nests	192	n/a	0	13	0	0	205
J.	Number of well-tracked nests that were successful (% = J/I x 100)	65% 124 / 192	n/a	n/a	38% 5 / 13	n/a	n/a	63% 129 / 205
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	16% 31 / 192	n/a	n/a	23% 3 / 13	n/a	n/a	17% 34 / 205
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 5 / 192	n/a	n/a	15% 2 / 13	n/a	n/a	3% 7 / 205
	B. Number of well-tracked nests that failed as a result of parasitism	3% 6 / 192	n/a	n/a	0% 0 / 13	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	n/a	n/a	31% 4 / 13	n/a	n/a	30% 61 / 205
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 192	n/a	n/a	15% 2 / 13	n/a	n/a	1% 2 / 205
M.	Average clutch size	n/a	n/a	n/a	3.3	n/a	n/a	n/a
N.	Number of cowbird eggs found in or near vireo nests	39	n/a	0	3	n/a	0	42
O.	Number of cowbird nestlings removed from vireo nests	2	n/a	n/a	0	n/a	0	2
P.	Number of cowbird young fledged by vireo observed	2	n/a	n/a	1	n/a	1	4
Q.	Number of 'manipulated' parasitized nests	32	n/a	0	2	n/a	n/a	34
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	0% 0 / 32	n/a	n/a	0% 0 / 2	n/a	n/a	0% 0 / 34
S.	Number of vireo fledged from 'manipulated' parasitized nests	34	n/a	n/a	0	n/a	n/a	34
T.	Number of repaired nests	3	n/a	0	0	n/a	0	3
U.	% of successful repaired nests	0% 0 / 3	n/a	n/a	n/a	n/a	n/a	0% 0 / 3
V.	Number of vireo fledged from repaired nests	3	n/a	n/a	n/a	n/a	n/a	3

Appendix C-3-K. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

Chino Hills

	Parameter	2003-2014	2015	2016*	2017	2018	2019	Combined
A.	Number of known pairs	64	6	11	7	9	17	114
B.	Number of known breeding (nesting) pairs	48	3	8	3	5	12	79
C.	Number of breeding pairs that were well-monitored throughout the breeding season	20	3	0	0	0	0	23
D.	Number of 'known fledged young' OBSERVED	73	4	10	3	3	19	112
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	28	4	n/a	n/a	n/a	n/a	32
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.5	1.3	1.3	1.0	n/a	n/a	1.4
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	1.4	1.3	n/a	n/a	n/a	n/a	1.4
H.	Number of nests that were discovered	29	7	4	0	2	1	43
I.	Number of well-tracked nests	24	5	2	n/a	2	0	33
J.	Number of well-tracked nests that were successful (% = J/I x 100)	38% 9 / 24	20% 1 / 5	50% 1 / 2	n/a	0% 0 / 2	n/a	33% 11 / 33
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	25% 6 / 24	20% 1 / 5	0% 0 / 2	n/a	50% 1 / 2	n/a	24% 8 / 33
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 1 / 24	20% 1 / 5	50% 1 / 2	n/a	0% 0 / 2	n/a	9% 3 / 33
	B. Number of well-tracked nests that failed as a result of parasitism	8% 2 / 24	0% 0 / 5	0% 0 / 2	n/a	0% 0 / 2	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	50% 12 / 24	60% 3 / 5	0% 0 / 2	n/a	100% 2 / 2	n/a	52% 17 / 33
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 24	0% 0 / 5	0% 0 / 2	n/a	0% 0 / 2	n/a	0% 0 / 33
M.	Average clutch size	n/a	3.4	3.0	n/a	n/a	n/a	n/a
N.	Number of cowbird eggs found in or near vireo nests	9	1	0	n/a	1	0	11
O.	Number of cowbird nestlings removed from vireo nests	0	0	0	n/a	0	0	0
P.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
Q.	Number of 'manipulated' parasitized nests	6	1	0	n/a	1	n/a	8
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	0% 0 / 6	0% 0 / 1	n/a	n/a	0% 0 / 1	n/a	0% 0 / 8
S.	Number of vireo fledged from 'manipulated' parasitized nests	0	0	n/a	n/a	0	n/a	0
T.	Number of repaired nests	0	0	0	n/a	1	0	1
U.	% of successful repaired nests	n/a 0 / 0	n/a	n/a	n/a	0% 0 / 1	n/a	0% 0 / 1
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	0	n/a	0

*2016 includes former assessment sites

Appendix C-3-L. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

Santa Ana Canyon (SAC) - Upper Canyon

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	171	9	12	21	25	24	262
B.	Number of known breeding (nesting) pairs	150	6	11	18	15	19	219
C.	Number of breeding pairs that were well-monitored throughout the breeding season	55	1	3	1	7	9	76
D.	Number of 'known fledged young' OBSERVED	276	10	18	32	23	58	417
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	145	2	7	2	13	37	206
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.8	1.7	1.6	1.8	1.5	3.1	1.9
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.6	2.0	2.3	2.0	1.9	4.1	2.7
H.	Number of nests that were discovered	117	1	3	6	13	22	162
I.	Number of well-tracked nests	77	1	3	5	10	19	115
J.	Number of well-tracked nests that were successful (% = J/I x 100)	68% 52 / 77	100% 1 / 1	100% 3 / 3	40% 2 / 5	50% 5 / 10	74% 14 / 19	67% 77 / 115
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	5% 4 / 77	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 17	4% 4 / 113
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 3 / 77	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 19	3% 3 / 115
	B. Number of well-tracked nests that failed as a result of parasitism	3% 2 / 77	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 19	2% 2 / 115
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	26% 20 / 77	0% 0 / 1	0% 0 / 3	60% 3 / 5	50% 5 / 10	26% 5 / 19	29% 33 / 115
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 77	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 19	0% 0 / 115
M.	Average clutch size	n/a	4.0	3.3	3.7	3.1	3.7	n/a
N.	Number of cowbird eggs found in or near vireo nests	3	0	0	0	0	0	3
O.	Number of cowbird nestlings removed from vireo nests	1	0	0	0	0	0	1
P.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
Q.	Number of 'manipulated' parasitized nests	1	0	0	0	n/a	n/a	1
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	100% 1 / 1	n/a	n/a	n/a	n/a	n/a	100% 1 / 1
S.	Number of vireo fledged from 'manipulated' parasitized nests	1	n/a	n/a	n/a	n/a	n/a	1
T.	Number of repaired nests	2	0	0	0	0	1	3
U.	% of successful repaired nests	0% 0 / 2	n/a	n/a	n/a	n/a	100% 1 / 1	33% 1 / 3
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	3	3

Appendix C-3-M. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

Santa Ana Canyon (SAC) - Green River Golf Club

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	181	23	26	33	38	34	335
B.	Number of known breeding (nesting) pairs	159	19	22	30	22	32	284
C.	Number of breeding pairs that were well-monitored throughout the breeding season	65	8	8	7	5	12	105
D.	Number of 'known fledged young' OBSERVED	289	35	27	76	20	96	543
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	158	13	9	31	3	51	265
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.8	1.8	1.2	2.5	0.9	3.0	1.9
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.4	1.6	1.1	4.4	0.6	4.3	2.5
H.	Number of nests that were discovered	115	16	14	21	20	33	219
I.	Number of well-tracked nests	96	15	13	17	16	28	185
J.	Number of well-tracked nests that were successful (% = J/I x 100)	64% 61 / 96	47% 7 / 15	31% 4 / 13	76% 13 / 17	25% 4 / 16	79% 22 / 28	60% 111 / 185
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	4% 4 / 96	0% 0 / 15	0% 0 / 13	0% 0 / 17	0% 0 / 16	0% 0 / 26	2% 4 / 183
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 5 / 96	7% 1 / 15	23% 3 / 13	0% 0 / 17	0% 0 / 16	7% 2 / 28	6% 11 / 185
	B. Number of well-tracked nests that failed as a result of parasitism	1% 1 / 96	0% 0 / 15	0% 0 / 13	0% 0 / 17	0% 0 / 16	0% 0 / 28	1% 1 / 185
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	30% 29 / 96	47% 7 / 15	46% 6 / 13	24% 4 / 17	69% 11 / 16	14% 4 / 28	33% 61 / 185
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 96	0% 0 / 15	0% 0 / 13	0% 0 / 17	6% 1 / 16	0% 0 / 28	1% 1 / 185
M.	Average clutch size	n/a	2.8	2.7	3.5	3.4	3.7	n/a
N.	Number of cowbird eggs found in or near vireo nests	4	0	0	0	0	0	4
O.	Number of cowbird nestlings removed from vireo nests	0	0	0	0	0	0	0
P.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
Q.	Number of 'manipulated' parasitized nests	2	0	0	0	n/a	n/a	2
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	1 2 / 2	n/a	n/a	n/a	n/a	n/a	100% 2 / 2
S.	Number of vireo fledged from 'manipulated' parasitized nests	6	n/a	n/a	n/a	n/a	n/a	6
T.	Number of repaired nests	5	0	0	0	0	2	7
U.	% of successful repaired nests	80% 4 / 5	n/a	n/a	n/a	n/a	100% 2 / 2	86% 6 / 7
V.	Number of vireo fledged from repaired nests	10	n/a	n/a	n/a	n/a	3	13

Appendix C-3-N. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2019.

Santa Ana Canyon (SAC) - Featherly Regional Park

	Parameter	2001-2014	2015	2016	2017	2018	2019	Combined
A.	Number of known pairs	273	38	39	36	25	33	444
B.	Number of known breeding (nesting) pairs	227	30	25	32	18	28	360
C.	Number of breeding pairs that were well-monitored throughout the breeding season	68	9	8	11	8	8	112
D.	Number of 'known fledged young' OBSERVED	322	37	23	57	25	76	540
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	121	12	8	38	17	45	241
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.4	1.2	0.9	1.8	1.4	2.7	1.5
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	1.8	1.3	1.0	3.5	2.1	5.6	2.2
H.	Number of nests that were discovered	155	22	16	24	18	30	265
I.	Number of well-tracked nests	109	19	12	22	12	28	202
J.	Number of well-tracked nests that were successful (% = J/I x 100)	46% 50 / 109	32% 6 / 19	25% 3 / 12	50% 11 / 22	50% 6 / 12	64% 18 / 28	47% 94 / 202
K.	Number of well-tracked nests that were parasitized by cowbirds (% = K/I x 100)	5% 5 / 109	0% 0 / 19	0% 0 / 12	0% 0 / 22	0% 0 / 12	0% 0 / 26	3% 5 / 200
L.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 5 / 109	5% 1 / 19	0% 0 / 12	9% 2 / 22	0% 0 / 12	14% 4 / 28	6% 12 / 202
	B. Number of well-tracked nests that failed as a result of parasitism	2% 2 / 109	0% 0 / 19	0% 0 / 12	0% 0 / 22	0% 0 / 12	0% 0 / 28	1% 2 / 202
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	48% 52 / 109	63% 12 / 19	75% 9 / 12	41% 9 / 22	42% 5 / 12	21% 6 / 28	46% 93 / 202
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 109	0% 0 / 19	0% 0 / 12	0% 0 / 22	8% 1 / 12	0% 0 / 28	0% 1 / 202
M.	Average clutch size	n/a	3.2	3.2	3.8	3	3.6	n/a
N.	Number of cowbird eggs found in or near vireo nests	4	0	0	0	0	0	4
O.	Number of cowbird nestlings removed from vireo nests	1	0	0	0	0	0	1
P.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
Q.	Number of 'manipulated' parasitized nests	3	0	0	0	n/a	n/a	3
R.	Number of 'successful, manipulated' nests (% = R/Q x 100)	33% 1 / 3	n/a	n/a	n/a	n/a	n/a	33% 1 / 3
S.	Number of vireo fledged from 'manipulated' parasitized nests	2	n/a	n/a	n/a	n/a	n/a	2
T.	Number of repaired nests	7	0	0	1	0	0	8
U.	% of successful repaired nests	86% 6 / 7	n/a	n/a	0% 0 / 1	n/a	n/a	75% 6 / 8
V.	Number of vireo fledged from repaired nests	18	n/a	n/a	0	n/a	n/a	18

APPENDIX D: SUMMARY TABLES BY MANAGED SITE, 2000-2014

Available by request under separate cover.