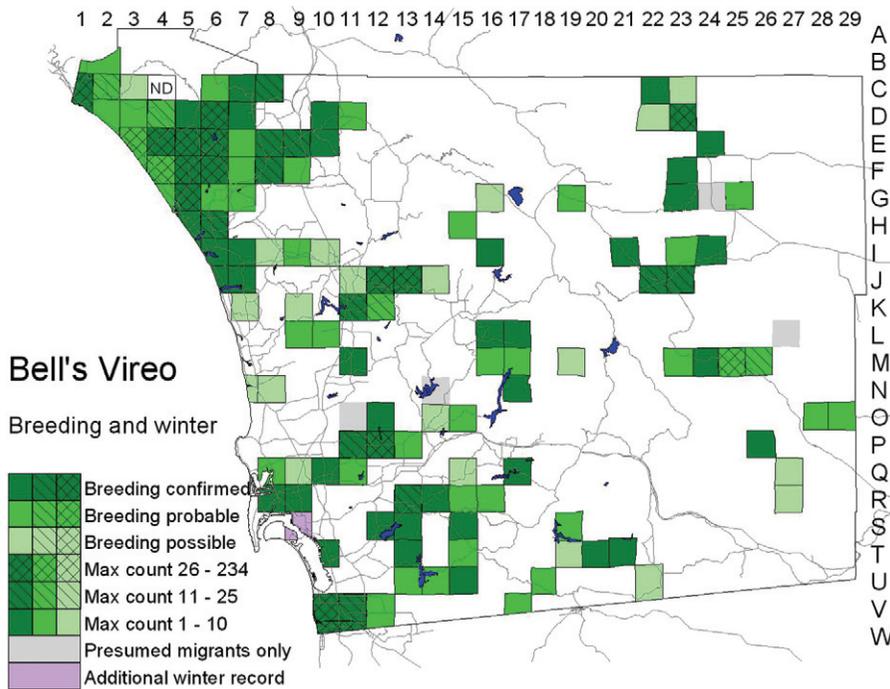


Bell's Vireo *Vireo bellii*

Early in the 20th century, California's subspecies of Bell's Vireo was abundant. Then clearing of its riparian woodland habitat and parasitism by the invading Brown-headed Cowbird decimated it. By the early 1980s the population in the United States was down to about 300 pairs—about half in San Diego County. As a result, the California Department of Fish and Game listed the subspecies, the Least Bell's Vireo, as endangered in 1984, and the U.S. Fish and Wildlife Service followed suit in 1986. Listing



Photo by Anthony Mercieca



Santee (Q10/Q11/P11/P12; 55 territorial males in 1997, Kus and Beck 1998), the Sweetwater River from Sweetwater Reservoir to the Rancho San Diego/Cottonwood golf course (S13/R13/R14; 102 territorial males in 2001, P. Famolaro), Jamul and Dulzura creeks (U14/U15/T15; 24 territorial males in 1996, USFWS 1998), Otay River (V11/V12; about 19 territorial males in 1997, Kus and Beck 1998, C. W. Bouscaren), and the Tijuana River valley (V10/V11/W10/W11; 134 territorial males in 1997, Wells and Turnbull 1998). Spread away from the major centers has been less extensive in central and southern San Diego County than in the northwest, though it is still noticeable, with up to three territorial males in La Jolla Valley (L10) 7 May 2000

opened the door to protection of the vireo's habitat and widespread trapping of cowbirds, leading to a remarkable recovery: an increase by a factor of six in just 15 years (Kus 2002). Nevertheless, many threats remain; weaning the vireo from cowbird trapping in perpetuity will be a delicate experiment.

Breeding distribution: Riparian woodland supporting the Least Bell's Vireo typically has both a dense canopy, where the birds forage, and a dense understory, where they nest. The population is concentrated in the coastal lowland, especially along the Santa Margarita River, other creeks in Camp Pendleton, along the San Luis Rey River upstream to Pala (D11), and along Windmill and Pilgrim creeks, tributaries of the San Luis Rey. This area accounted for about 74% of the 1423 territorial males known in the county in 1996—and about 59% of California's total population, demonstrating that it is the core habitat for the entire subspecies (USFWS 1998). By 1998, the population in Camp Pendleton alone had increased to 1010 territorial males, though it dropped to 783 in 2000 (J. and J. Griffith, data courtesy of Camp Pendleton), and the birds spread along small side creeks as well as all the major ones. In the late 1990s, the vireos continued to recolonize sites in northwestern San Diego County where they had not been recorded up until 1996 (USFWS 1998), sometimes in fair numbers, as along Buena Vista Creek (H6; 15 territorial males in 1997, Kus and Beck 1998), Agua Hedionda Creek (I6; seven on 25 April 1999, P. A. Ginsburg), and in a side canyon north of San Marcos Creek at La Costa (J7; seven on 24 June 1998, M. Baumgartel).

Elsewhere in the coastal lowland, the major sites are the San Dieguito River from Lake Hodges east to San Pasqual (K11/K12/J12/J13; 104 territorial males in 1997, Kus and Beck 1998), the San Diego River from Interstate 805 to

(K. J. Winter) and three in Sycamore Canyon (O12) 3 May 1998 (I. S. Quon).

In San Diego County's foothills, Bell's Vireo is scattered in small numbers at only a few sites, principally the San Diego River above El Capitan Reservoir (L17/M17; five territorial males in 1997, Kus and Beck 1998; N17; four, including a fledgling, 20 June 2000, D. C. Seals), Cottonwood Creek in Hauser Canyon (T20/T21; up to 11 territorial males and eight nesting pairs in 1998, J. M. Wells), and Cottonwood and Tecate creeks in Marron Valley (V17; eight on 12 June 2000, P. P. Beck). At most other foothill sites the species is irregular. For example, it was absent 1997–2002 from a section of Pine Valley Creek (R19) where six to eight territorial males persisted from the late 1980s to 1994 (Winter and McKelvey 1999, Kus et al. 2003b). Along Santa Ysabel Creek at Black Canyon (I16) Bell's Vireos occurred regularly from the early 1990s to 1998 (pair at nest 22 May, K. J. Winter) but were absent in 2002 (Kus et al. 2003b). From 1997 to 2003, during his intensive study of the Willow Flycatchers nesting along the San Luis Rey River below Lake Henshaw (F16/G16), W. E. Haas encountered only a single Bell's Vireo, 31 May 1999. Two observations during the atlas period 1997–2001 well away from previously reported sites were along Boulder Creek at Boulder Creek Road (M19; one singing male and one juvenile 29 June 1997, C. Jones) and along Buena Vista and San Ysidro creeks 2.1–2.4 miles east of Warner Ranch (G19; two singing males 25 June 2000, P. Unitt). At 3800 feet, one in Noble Canyon (O22) 10 and 26 July 2002 was at the highest elevation yet reported for Bell's Vireo in San Diego County (Kus et al. 2003b); the species was absent at that site during repeated surveys 1992–99.

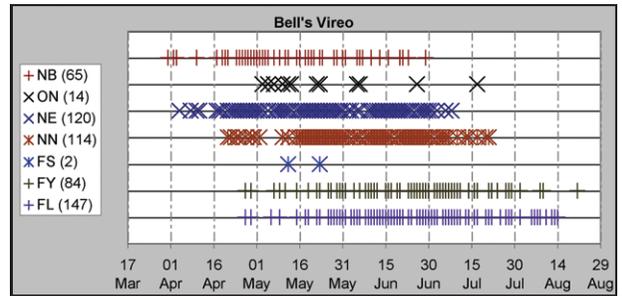
Oases in the Anza–Borrego Desert also contribute significantly to the population. The vireos there use thickets of mesquite as well as woodland dominated by willows.

In this region the important sites are along Coyote Creek, at both Middle Willows (C22; up to five territorial males 28 May 1998, P. D. Jorgensen) and Lower Willows (D23; 18 territorial males or pairs in 2000, Wells and Kus 2001; 31 in 2002, J. R. Barth), Borrego Palm Canyon (F23; up to seven territorial males 5–8 July 2001, L. J. Hargrove), along San Felipe Creek near Paroli Spring (I21; up to six singing males 16 June 2000, J. O. Zimmer), near Scissors Crossing (J22; about 17 territorial males or pairs in 2002, 20 in 2003, J. R. Barth), and in Sentenac Ciénega and Canyon (J23; up to 17 territorial males 9 May 2001, R. Thériault; I23; up to five on 23 April 1997, P. K. Nelson), and along Vallecito Creek, near Campbell Grade (M23/M24; up to 17 territorial males 6 May 1998, R. Thériault) and near Vallecito Stage Station (M24/M25; counts of territorial males varying from 19 in 2002 to in 33 in 1996, M. C. Jorgensen, P. D. Jorgensen; Wells and Kus 2001).

Several smaller oases also support a few Bell's Vireos. Some of these were previously known: Sheep and Indian canyons (D22), Hellhole Canyon (G23), Yaqui Well (I24), Agua Caliente Springs (M26), and Carrizo Wash and Marsh (O28/O29). Our numbers at Agua Caliente were notably higher than previously reported, up to six territorial males 6 June 1998 (E. C. Hall). Other sites came to light as a result of field work for this atlas and may represent newly established territories: the Borrego Valley's mesquite bosque (G25), with one territorial male 27 April and 4 June 1998 and an apparent family group of four on 11 June 1998 (R. Thériault), Bow Willow Canyon (P26), with up to four territorial males 12 May 2000 and 19 May 2001, Jacumba Jim Canyon, elevation 1350 feet (Q27), with one on 13 May 2000, and Carrizo Canyon, elevation 1110 feet (R27), with one on 23 April 2000 (L. J. Hargrove). An unexpected site for nesting Bell's Vireos in the Borrego Valley was Ellis Farms, a commercial nursery (E24); three there 11 June 2001 included a singing male and a fledgling (P. D. Jorgensen).

Although Bell's Vireo is a characteristically riparian species, it uses upland scrub adjacent to riparian woodland regularly, foraging at distances up to 200 feet from the riparian edge and even nesting in the nonriparian habitat (Kus and Miner 1989). The use of such marginal habitats increases when, after an unusually wet winter, nearby riparian woodland is flooded and the upland habitat becomes unusually lush. In the wet El Niño year 1998, 8 of 31 territories along Pilgrim Creek (F6) were at the base of slopes in mustard that had grown to a height of 10 feet (B. E. Kus). That year, near Sweetwater Reservoir (S12), one pair nested in sage scrub 1 mile from riparian woodland and three others nested in a field dominated by mustard and exotic trees (P. Famolaro). The vireos persisted in these nonriparian territories near Sweetwater Reservoir for some years but eventually abandoned them.

Nesting: Many studies have addressed the Least Bell's Vireo's nesting (e.g., Franzreb 1987, Greaves 1987, Kus 1999, 2002). Typically, the birds nest at openings and edges where there is dense vegetation near the ground, placing the nest, on average, about 1 meter off the ground in a fork of slender twigs. On the coastal slope, willows



and mulefat predominate as nest sites (USFWS 1998); in the Anza-Borrego Desert, willows and mesquite predominate (Wells and Kus 2001). Even where cowbirds have been trapped almost to elimination, Bell's Vireos lose many nests to predation; of 25 nests videotaped by Peterson (2002, Peterson et al. 2004), 12 suffered predation, eight to scrub-jays and three to nonnative scavengers, two to Virginia opossums and one to Argentine ants. Along the Sweetwater River P. Famolaro has repeatedly observed nests destroyed by Argentine ants.

In San Diego County, Bell's Vireo's nesting season generally lasts from April to July, with egg laying from about 1 April to late June, rarely mid July. Around Sweetwater Reservoir, P. Famolaro has noted nests with eggs from 4 April to 8 July, nests with nestlings from 21 April to 21 July. On the basis of 34 nests followed in the Anza-Borrego Desert in 2000, Wells and Kus (2001) estimated egg laying to have taken place from 14 April to 16 June, peaking in late April. Our dates for fledglings ranged from 27 April to 21 August.

Migration: The Least Bell's Vireo usually arrives in San Diego County in the third week of March. During the atlas period our first dates varied from 13 March (1997) and 14 March (1998) to 29 March (2000) and 31 March (2001); arrival was notably late in the two latter years. Fall departure generally takes place from mid August to late September; stragglers in breeding habitat as late as October are rare. At the upper end of Sweetwater Reservoir, surveyed regularly, the latest date on record is 16 September 1998 (P. Famolaro).

Many Least Bell's Vireos have been banded, and these studies show the birds are highly site tenacious, usually returning in successive years to the same drainage basin, males nearly always to the same territory. Males generally maintain the same territory through a season; females sometimes move from male to male with successive nest attempts (Greaves 1987). But longer-distance dispersal is known on the basis of birds banded in San Diego County observed in Santa Barbara and Ventura counties and vice versa (Greaves and Labinger 1997, USFWS 1998). Among the more notable examples are of an adult female banded on the Santa Clara River that later nested along the Sweetwater River (P. Famolaro) and a young banded along the Santa Margarita River in summer 1987 that was seen in Carpinteria, Santa Barbara County, 24 August–1 September that same year (AB 42:138, 1988).

Sightings of migrant Bell's Vireos away from breeding habitat are rare, suggesting that most birds fly nonstop

between nesting sites in southern California and their next stop in Mexico. In spring such migrants are most likely in the Anza–Borrego Desert, where records during the atlas period were of one in Borrego Springs (G24) 24 and 29 April 2000 (R. Thériault) and one in Fish Creek Wash (L27) 13 April 2000 (M. B. Mulrooney). Fall migrants have been noted at Point Loma (S7) 10 October 1988 (R. E. Webster, AB 43:169, 1989) and 16 October 1993 (G. McCaskie, AB 48:153, 1994).

Winter: Bell's Vireo essentially vacates the United States for the winter, but 13 winter occurrences are known for San Diego County. Eleven of these are near the coast. Unitt (1984) listed the first five; subsequently, winter records have been published from Carlsbad (I6) 2 February 1982 (E. Copper, AB 36:332, 1982), Coronado (S9) 19 January–3 March 1985 (D. R. Willick, AB 39:211, 1985) and 15 December 2001 (R. E. Webster, NAB 56:224, 2002), and the Tijuana River valley 27 January 1982 (C. G. Edwards, AB 36:332, 1982), 2 December 1990–5 January 1991, and 15 December 1990 (R. E. Webster, G. McCaskie, AB 45:322, 1991). Two winter records are from the Anza–Borrego Desert, of one at Yaqui Well (I24) 20 January 1984 (B. Wagner, AB 38:358, 1984) and one in the mesquite bosque 3.3 miles southeast of Borrego Springs 24 January 1984 (SDNHM 42925).

Conservation: Though Stephens (1919a) called the Least Bell's Vireo "common" in San Diego County, surveys of the best remaining habitat from 1978 to 1981 (Goldwasser et al. 1980, L. R. Salata) revealed only 61 territorial males. More thorough surveys in 1985 raised this to 223—76% of the population in the entire state (Franzreb 1987). Once the subspecies was listed as endangered by the California Department of Fish and Game in 1984 and the U.S. Fish and Wildlife Service in 1986, the regulatory mechanism allowing the species' recovery was in place. The vireo's subsequent history must be regarded as one of the greatest successes for the Endangered Species Act anywhere in the United States.

Arresting and reversing the loss of riparian woodland was critical to arresting and reversing the vireo's decline. Once the vireo was formally designated as endangered, section 404 of the Clean Water Act of 1977 obliged the U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service to confer on any proposal to disrupt wetlands—and therefore Least Bell's Vireo habitat. As a result, the pace of the vireo's habitat loss, through the installation of reservoirs and the building of roads, housing, golf courses, and other commercial developments, slowed considerably. Designation in 1994 of about half of the habitat occupied by the vireo as "critical" under the Endangered Species Act helped as well. Once disturbance of many stands of riparian woodland was minimized, the vireo's habitat was able to spread through natural regeneration. Though noticeable at many places in San Diego County, this spread was most striking in the Tijuana River valley, where riparian woodland increased from almost none in the 1970s to extensive by the late 1990s and vireos increased from one territory in 1980 to 134 by 1997.

Bell's Vireos recolonize and nest successfully in adequately restored riparian woodland, more rapidly if the restored habitat is adjacent to mature habitat. They nested in restored habitat the first year in Mission Trails Regional Park, where previously occupied habitat was adjacent (Kus 1998), but took eight years to colonize revegetated shores of the San Diego River in Mission Valley, at a site surrounded by commercial development (P. Unitt).

Brood-parasitism by the Brown-headed Cowbird has also been critical to the vireo's decline. Soon after the cowbird invaded coastal southern California in the early 1900s, the vireo became a primary host (Hanna 1928). In the early 1980s, parasitism rates in San Diego County varied from 47% to 80%; few if any vireos fledge from parasitized nests (USFWS 1998). Even pairs that desert parasitized nests suffer significantly reduced success, as their subsequent nests are parasitized disproportionately often (Kus 1999, 2002).

Once trapping of cowbirds was instituted widely in the late 1980s, the rate of parasitism dropped, to 1% or less in intensively trapped Camp Pendleton (USFWS 1998). Kus (1999, 2002) noted an inverse association between the intensity of trapping and parasitism rate along the San Luis Rey River. It appears that cowbird trapping is most effective where many traps can be deployed and the cowbird population depressed over a wide region. The critical role of trapping in enabling the vireo's recovery is especially clear in Anza–Borrego Desert State Park, where the habitat has changed little while the vireo population has rebounded. In the Cleveland National Forest, however, where the vireos are scattered and rugged topography makes the traps difficult to deploy and monitor, trapping proved ineffective, parasitism rates remained high, and the vireo deserted two sites in the 1990s (Winter and McKelvey 1999).

Cowbird trapping, however successful, is a finger-in-the-dike approach to managing an endangered species. Ideally, habitat should be managed so as to be less attractive to cowbirds and the parasitism rate kept down to a level where the vireo (and other parasitism-sensitive species) can maintain themselves. Ideally, exposure to some level of parasitism would allow the vireo to persist while compelling it to evolve better defenses, if only an increased rate of deserting parasitized nests (Kus 2002). The cycle of flooding and regeneration has been broken by the dams built on most of San Diego County's rivers, allowing some riparian woodland to become senescent. Invasion of exotic plants, especially saltcedar and giant reed, threatens native riparian woodland. Some of the vireo's primary nest predators, especially the Western Scrub-Jay, are on the increase. In spite of the short-term success in recovering the Least Bell's Vireo, balancing conflicts until the vireo becomes self sustaining is a long-term challenge.

Taxonomy: The Least, *V. b. pusillus* Coues, 1866, is the drabdest of the four subspecies of Bell's Vireo; it has only a hint of olive color on the rump in fresh plumage, and that fades to gray by the time the birds return to their

breeding range in spring. Identified by Phillips (1991), the January specimen from the Borrego Valley is *V. b. arizonae* Ridgway, 1903; it has the lower back and rump distinctly olive and the flanks vaguely yellowish. A Bell's Vireo at Point Loma 10 October 1988 was "felt to be of

the nominate race" (R. E. Webster, AB 43:169–170, 1989). This subspecies, breeding in the Mississippi basin and the green extreme of the species, is likely in California as a rare vagrant but has not been confirmed with a specimen or photograph.