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SOUTHWESTERN WILLOW FLYCATCHER POPULATIONS IN CALIFORNIA: DISTRIBUTION, ABUNDANCE, AND POTENTIAL FOR CONSERVATION

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Abstract. Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in California occupy a range extending from the United States-Mexico border north to the southern Sierra Nevada and adjacent valleys. Surveys conducted by numerous investigators in 1999–2001 indicate a statewide population of at least 194 territories distributed across 58 sites in ten counties, representing 20% of the US population. Flycatcher numbers at 26 sites surveyed in all three years increased slightly from 131 to 138 territories (5%) between 1999 and 2001. Populations ranged from 1–50 territories in size, with nearly half the flycatchers concentrated in three "large" (>15 territories) sites, including the South Fork of the Kern, upper San Luis Rey, and lower Santa Margarita rivers. Ninety percent of sites supported five or fewer territories, suggesting a potentially high degree of vulnerability to extinction by stochastic events. Rangewide surveys conducted in 1997 of over 500 km of riparian habitat in southern California revealed that over half was highly disturbed, and an additional third moderately disturbed, by sand mining, agriculture, grazing, urbanization, altered hydrology, and invasion by exotic plants. This suggests that availability of suitable habitat may be severely limited and conservation measures are needed to restore habitat. High spatial and temporal variability in patterns of nesting success, productivity, and population growth complicate efforts to identify factors limiting flycatcher populations and to provide conditions conducive to recovery.

Key Words: California, *Empidonax traillii extimus*, endangered species, habitat conservation, riparian, Southwestern Willow Flycatcher.

Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in California occupy a range extending from the United States-Mexico border north to the southern Sierra Nevada range, and from the Pacific Ocean east to the Colorado River (Unitt 1987). Within this range, most flycatcher habitat—usually dense stands of willow-dominated vegetation (Sogge and Marshall 2000)—occurs along streams and rivers in lowland valleys draining the west-facing slopes of the Coast Range, although habitat also occurs inland at higher elevations, for example, along the upper San Luis Rey River near Lake Henshaw in San Diego County (elevation 800 m), at several sites in the San Bernardino Mountains (elevation 900–2150 m), and along the South Fork of the Kern River in the southern Sierra (elevation 800 m). Habitat also occurs in the arid regions east of the mountains, primarily in discontinuous patches along the Colorado River in Imperial County.

Formerly a widespread and common breeder in southern California lowlands, Southwestern Willow Flycatchers have declined in the last half-century as habitat loss and, to a lesser extent, parasitism by Brown-headed Cowbirds (*Molothrus ater*), reduced the subspecies to the point of "virtual extirpation" by the early 1980s (Remsen 1978, Garrett and Dunn 1981; Harris et al. 1987, 1988; Unitt 1987, Schlorff 1990). Fortunately, predictions of the flycatcher's imminent extirpation from California have not been borne out, probably attributable in some measure to cowbird control and other management since the mid-1980s targeting the endangered Least Bell's Vireo (*Vireo bellii pusillus*), a species with which the flycatcher is sympatric. Nevertheless, Southwestern Willow Flycatcher numbers remain low in this as well as the other six states comprising its United States range. The purpose of this paper is to summarize the flycatcher's current distribution and abundance in California, describe recent trends in population size, discuss factors limiting flycatchers, and present information on the condition of riparian habitat in southern California and the potential for species conservation.

METHODS

POPULATION DATA

Information on flycatcher locations and numbers were compiled from technical reports and personal communications with investigators (including ourselves) conducting surveys in 1999–2001, as reported to the U.S. Fish and Wildlife Service Southwestern Willow Flycatcher California working group. Population trend analyses were limited to three large sites for which long-term data from standardized surveys were available: the South Fork of the Kern River upstream of Lake Isabella, Kern County (Whitfield and Strong 1995; Whitfield and Enos 1996, 1998; Whitfield et al. 1998, 1999a; Whitfield and Lynn 2001, Whitfield 2002); the lower Santa Margarita River at Marine Corps Base Camp Pendleton, San Diego County (Griffith Wildlife Biology 2000, Kus 2001, Kus and Ferree 2002); and a 2.5 km segment of the upper San Luis Rey River within the Cleveland National Forest, San

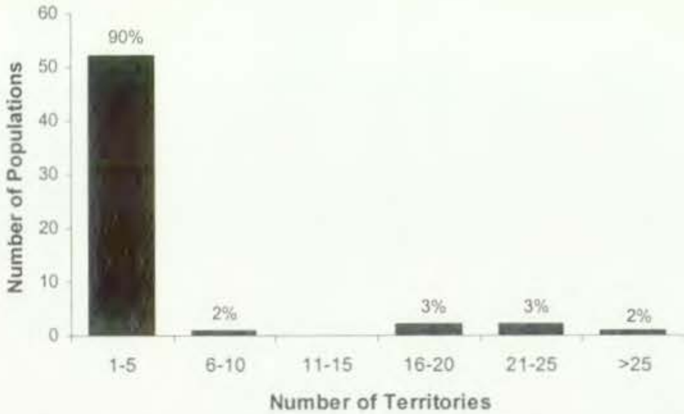

FIGURE 1. Population sizes (number of territories per population) of Southwestern Willow Flycatchers in California, 1999–2001. Values above bars represent % of total sites (N = 58).

Diego County, part of a larger population that occurs along 10 km of habitat below Lake Henshaw (Kus et al. 1999; Varanus Biological Services 2000d, 2001; W. Haas, unpubl. data). Data on reproductive success and productivity were drawn from these same sources.

Riparian Habitat Conditions

We assessed the condition of riparian habitat in southern California as part of a regional survey for Southwestern Willow Flycatchers and Least Bell's Vireos in 1997 (Kus and Beck 1998). In selecting sites to survey, we attempted to evaluate entire drainages populated by vireos or flycatchers, concentrating effort on areas outside of those regularly monitored for these species. Beginning with the major rivers in San Diego County, we systematically expanded our study area to the north and east, and evaluated a total of 566 km of habitat within 17 drainages. Of this habitat, 275 km were surveyed on foot between 2 April and 31 July; the remaining habitat was either surveyed by other investigators (53 km), was physically or otherwise inaccessible (e.g., private property; 64 km), or supported either no habitat or degraded habitat lacking the structure required by these species (175 km). The latter two types of areas were evaluated by driving along the river or by spot checks of the habitat from access or vantage points. Drainages were surveyed in sections, the lengths of which were determined by either by the amount of habitat that could be thoroughly surveyed on foot in one field day (dawn to approximately midday), or by the spatial configuration of habitat patches within a drainage. For each segment we characterized level (low, moderate, high) and nature of disturbance, and degree of invasion by exotic vegetation (low, moderate, high), where "low" corresponded roughly with an estimated areal cover of 25% or less, "moderate" 25–75%, and "high" greater than 75%. The types of land use adjacent to each segment were also recorded. Drainage segments were weighted by length for analysis.

RESULTS

Flycatcher Distribution and Abundance

Surveys between 1999 and 2001 documented breeding flycatchers at a total of 58 sites across ten southern California counties (Appendix). Between 163 and 194 flycatcher territories were confirmed each year, although not all sites were surveyed every year. Fifty-five to 46% of the flycatchers in 1999–2001, respectively, were concentrated in three "large" populations: the lower Santa Margarita River (17–18 territories annually), the Kern River (21–25 territories), and the upper San Luis Rey River (46–50 territories), currently the largest population in California. The remaining flycatchers were distributed in small populations numbering 1–12 territories (Appendix). The distribution of population size is highly skewed, with 90% of the sites occupied between 1999 and 2001 supporting just five or fewer territories (based on population size in the most recent year surveyed or occupied; Fig. 1). Only 5% of sites supported populations of more than 20 territories, including Owen's Valley, a previously little known site with a population of 24 territories in 2001 (B. Kus and M. Whitfield, unpubl. data).

Recent Population Trends

Rangewide, flycatcher numbers at 26 sites surveyed annually between 1999 and 2001 increased slightly from 131 to 138 territories (5%) over the 2-year period (Appendix). Most of this increase resulted from expansion of flycatchers into sites at which they had previously been confirmed absent (Piru Creek, Santa Barbara County; lower San Luis Rey River, San Diego County), rather than increases of existing populations. Of the three consistently monitored large populations, the lower Santa Margarita and upper San Luis Rey river populations have remained virtually constant in size since 1995, which might be predicted given that all three sites are managed to control cowbirds through annual trapping and removal (Fig. 2). In contrast, flycatcher

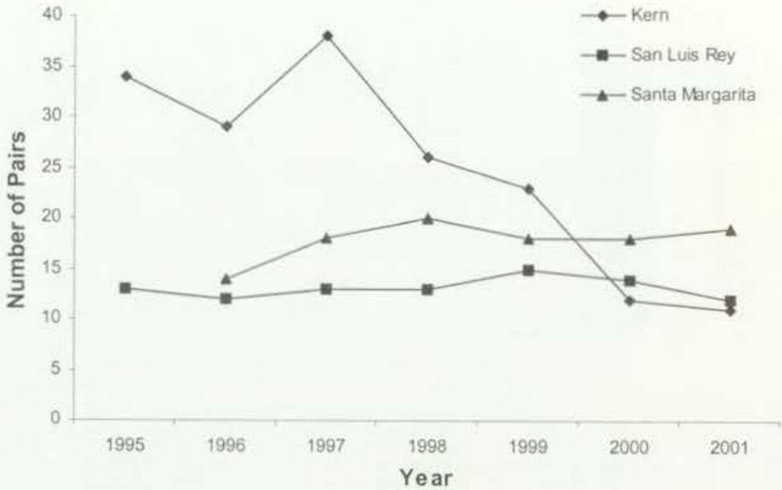

FIGURE 2. Recent population trends of Southwestern Willow Flycatchers at three California sites. Data for Santa Margarita River reflect number of territories, since pairing not determined in all years. Sources: Whitfield and Strong 1995; Whitfield and Enos 1996, 1998; Whitfield et al. 1998, 1999a; Whitfield and Lynn 2001, Whitfield 2002, Kus et al. 1999, Kus 2001, Kus and Ferree 2000, Griffith Wildlife Biology 2000; Varanus Biological Services 2000d, 2001; W. Haas, unpubl. data. See text for description of site locations.

numbers at the Kern River, which fluctuated between roughly 25–40 pairs between 1995 and 1998, now appear to be in steady decline, with only 11 pairs documented in 2001.

NEST SUCCESS AND PRODUCTIVITY

Systematic nest monitoring at the three large sites revealed a high degree of temporal as well as spatial variability in nest success and productivity (Figs. 3, 4). For example, between 1995 and 2001, the percent of nests fledging flycatcher young at the Kern River ranged from 29–69%. In contrast, nest success at the Santa Margarita River in 1999 (the first year of monitoring) was approximately twice that at the Kern River during the same year, was even higher in 2000, and then dropped to a level comparable to that at the Kern River in 2001. Nest success at the San Luis Rey River varied over a range similar to that observed at the Kern River, but in a

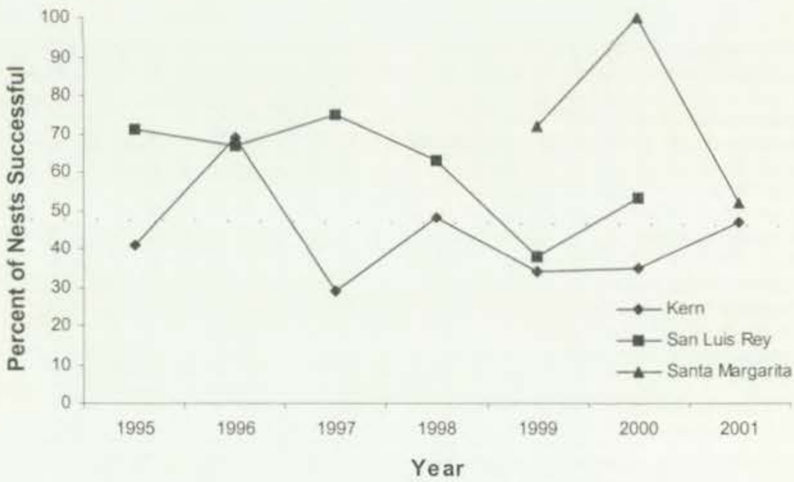

FIGURE 3. Nest success of Southwestern Willow Flycatchers at three California sites. Sources: Whitfield and Strong 1995; Whitfield and Enos 1996, 1998; Whitfield et al. 1998, 1999a; Whitfield and Lynn 2001, Whitfield 2002, Kus et al. 1999, Kus 2001, Kus and Ferree 2002, Griffith Wildlife Biology 2000; Varanus Biological Services 2000d, 2001. See text for description of site locations.

FIGURE 4. Productivity of Southwestern Willow Flycatchers at three California sites. Sources: Whitfield and Strong 1995; Whitfield and Enos 1996, 1998; Whitfield et al. 1998, 1999a; Whitfield and Lynn 2001; Whitfield 2002, Kus et al. 1999, Kus 2001, Kus and Ferree 2002, Griffith Wildlife Biology 2000; Varanus Biological Services 2000d, 2001. See text for description of site locations.

pattern different from those at the other two sites. Similarly, productivity (fledglings per female) varied within and among sites between 1995 and 2001, showing no indication of spatial correspondence among sites. Since 1998, the Kern and San Luis Rey populations have shown similar productivity rates and trends; however, the Santa Margarita population appears distinct, with consistently higher productivity than the other two populations.

RIPARIAN HABITAT CONDITION

Habitat conditions were recorded for 514 km of habitat in 105 reaches along 17 drainages (Fig. 5). With the exception of an 88-km section of the Mojave River, study reaches ranged from 0.2–38.4 km (mean = 4.1 ± 5.3). Degree of disturbance was rated as high in 63% of the surveyed habitat, moderate in 28%, and low in 9%. Disturbance was particularly intense and widespread at the Mojave River, where 82% of the 171 km evaluated was highly disturbed, and 17% moderately disturbed. To avoid potentially biasing results for the remaining drainages by inclusion of this very large and highly disturbed river, we excluded the Mojave River from further analyses. Even with this exclusion, disturbance was rated as high in 54% of the habitat surveyed (N = 343 km total), moderate in 31%, and low in 13%.

Sources of disturbance were numerous and included a wide range of activities and habitat conversion associated with flood control and channelization, grazing, agriculture, sand and gravel extraction, recreation, and urban development (Table 1). Natural disturbance, such as scouring by floods, was evident in 10% of the reaches. Typically, more than one type of disturbance was present in a given reach, intensifying the effects on native habitat.

By far the most common type of disturbance along rivers was the presence of invasive exotic plants, particularly trees and shrubs, which occurred in 94% of reaches for which disturbance and presence of exotics were determined (N = 80 reaches, 263 km of habitat). The only sites from which exotics were absent were those virtually devoid of woody vegetation, such as sand mining sites and golf courses. Degree of invasion by exotics was rated as high in 43% of the reaches with exotics and moderate in 35%; only 22% of the reaches were characterized by a low presence of exotic plants. Not surprisingly, the degree of invasion by exotics was significantly correlated with disturbance level ($r = 0.54$, $P < 0.01$, $N = 75$), although it accounted for only 29% of the variation in disturbance, indicating that other sources were important contributors to habitat condition as well.

Of the exotics encountered in the study area, the most common were *Arundo donax* (giant reed) and *Tamarix ramosissima* (tamarisk or saltcedar), occurring either alone or in combination. *A. donax* was present in 87% of surveyed reaches, and was absent only from the Coachella Valley and grazed areas in the vicinity of Lake Henshaw on the upper San Luis Rey River, both relatively dry sites where tamarisk thrives. Tamarisk was equally widespread, occurring in 85% of reaches. *Arundo donax* and tamarisk occurred

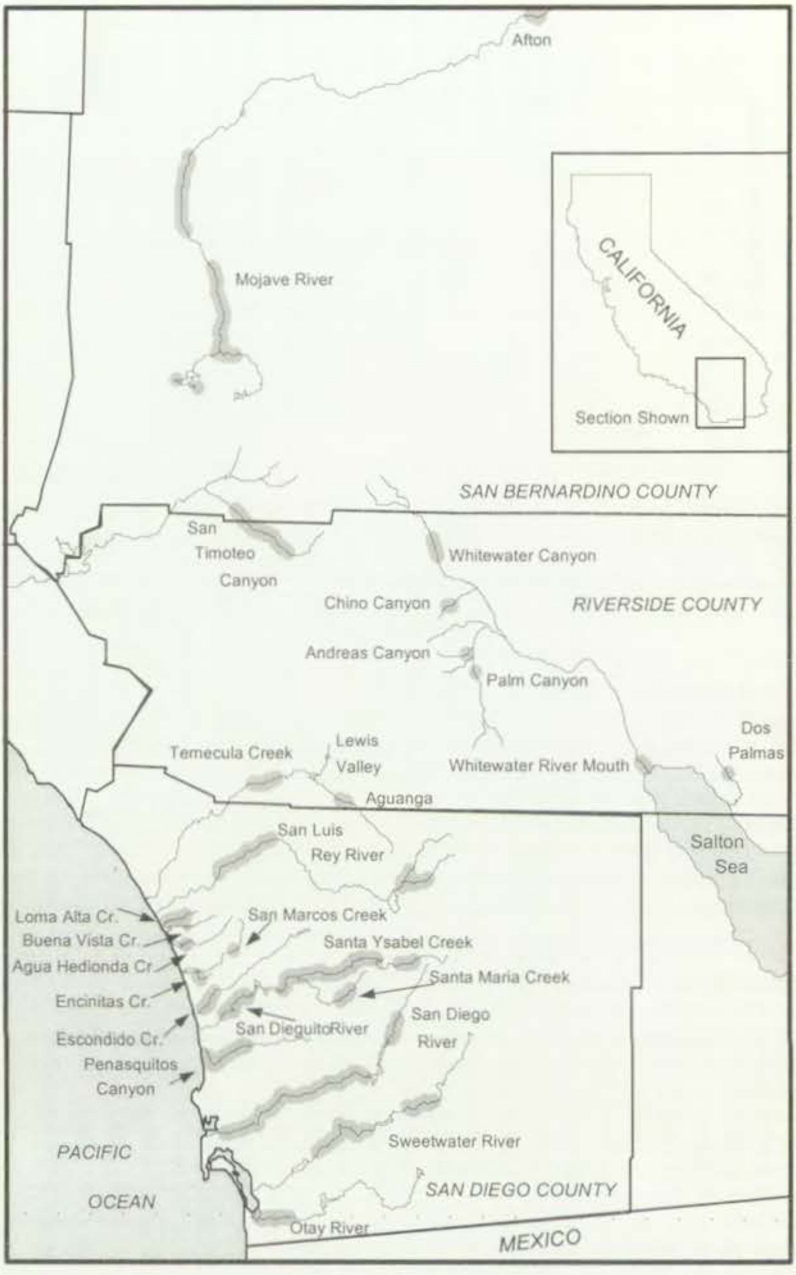

FIGURE 5. Southern California drainages assessed for riparian habitat condition in 1997. Surveyed sections highlighted in gray.

together in nearly half of the study reaches. Other common exotics included eucalyptus (*Eucalyptus* spp.), non-native palms, and castor bean (*Ricinus communis*).

DISCUSSION

The California population of Southwestern Willow Flycatchers, at 194 territories, represents 20% of the entire flycatcher population within the species' United States range (Sogge et al. *this volume*). Although effort was not devoted in all surveys to determining the pairing status of each male located, survey data for 1999–2001 indicate that the majority of males were paired and probably nesting. The persistence of the flycatcher two decades after its anticipated extir-

TABLE 1. TYPES OF DISTURBANCE IN SOUTHERN CALIFORNIA RIPARIAN HABITAT

Type of Disturbance	% of Reaches (N = 89)
Exotic vegetation	94[a]
Channelization	45
Grazing	38
Urbanization[b]	32
Agriculture	30
Recreational activities[c]	21
Sand and gravel extraction	17
Natural	10
Other[d]	2

[a] N = 80; occurrence of exotics not ascertained in nine reaches.
[b] Includes residential and commercial development, golf courses.
[c] E.g., equestrian use, picnic grounds.
[d] Itinerant campsites.

pation from California provides optimism that the species' decline has been arrested, although the potential for future population growth remains uncertain.

As elsewhere in their range (Marshall 2000, Sogge et al. *this volume*), the majority of flycatchers in California are distributed in small populations numbering fewer than five territories, making them potentially very vulnerable to extinction through stochastic events. Although at least some small populations have persisted for several years, data are not available with which to predict their capacity for long-term persistence. Small populations may persist through mechanisms not currently known, allowing overall population stability despite apparent vulnerability to local extinction. One possibility is that populations are connected by dispersal in a metapopulation, where individual populations are "rescued" from extinction by the immigration of colonizers from other populations. A population viability analysis of Southwestern Willow Flycatcher metapopulations in seven different geographic recovery units, including two in California, concluded that flycatchers in coastal California exhibit greater population stability than any other region analyzed, largely the result of high proximity of numerous small sites to one another as well as to a few large source populations (Lamberson et al. 2000). While encouraging for the future of flycatchers in southern California, the model's predictions for populations in the southern Sierra and Great Basin to the east were less optimistic, suggesting low persistence capability as a result of high isolation of the few sites known to exist. While useful in predicting the effects on flycatchers of various changes in riparian habitat distribution and suitability, and consequently carrying capacity for flycatchers, the conclusions of the population viability analysis and their applicability to actual flycatcher population dynamics should be viewed with caution until several aspects of flycatcher life history are better understood. Primary among these are the extent to which flycatchers actually function as metapopulations and the degree to which the model used to study flycatchers accurately captured dispersal behavior, endeavors that will require systematic tracking of color-banded individuals to quantify rates and patterns of movement between populations. Also needed are data on long-term persistence of small populations, as well as information on the composition and turnover of breeding populations, age-specific survival and dispersal probabilities, within- and between-season movement of breeding birds, and the dependence upon large populations as a source of colonizers.

While the persistence capabilities of small flycatcher populations are currently unknown, the persistence of California's three largest populations has been high, at least to the extent ascertainable from historical records. The Kern, upper San Luis Rey, and Santa Margarita river sites were among the few willow flycatcher populations known in the early 1980s when concerns over the flycatcher's future in California peaked (Serena 1982, Unitt 1987, Harris et al. 1988). The overall growth of the state's flycatcher population between the early 1980s and the mid-1990s was largely attributable to growth of each of these three core populations, coinciding with changes in land management at each site including the removal of grazing and the introduction of cowbird control programs. However, most of this growth occurred within a few years of the change in management, and none of the three populations show evidence of substantial continued growth since the mid-1990s. In fact, the Kern River population, formerly the largest in California, declined to an all-time low of 11 pairs in 2001, possibility the result of declining egg hatchability (Whitfield 2002). Particularly perplexing is the failure of the Santa Margarita population at Marine Corps Base Camp Pendleton to grow beyond the average of 15 territories reported by L. Salata (in Unitt 1987) in the mid-1980s, despite an abundance of apparently suitable habitat and annual trapping of cowbirds, which allowed the local Least Bell's Vireo population to increase from 15 to over 1000 territories during the same period (Salata 1980, Griffith Wildlife Biology 2001).

The apparent stability of the California population, particularly when viewed from the perspective of species recovery, raises the question of what currently limits flycatcher abundance and distribution. The answer to this will define what can realistically be expected in the future and help shape strategies for achieving flycatcher recovery. Most investigations of factors limiting populations, particularly populations of endangered species, focus on demographic factors and habitat availability. Studies of willow flycatcher nest success and productivity at the three large populations in California reveal a high degree of temporal and spatial variability in both parameters, and a general lack of correspondence among populations in trends of these variables. This suggests that flycatchers are influenced less by large-scale events and processes occurring rangewide than by localized site-specific factors. Such site-specificity in the factors influencing flycatcher populations will require corresponding specificity in tailoring management plans appropriate to particular populations.

The high degree of variability in productivity at the California sites is of interest with regard to the role of cowbird parasitism in limiting flycatcher populations. Although all three sites are subject to cowbird control, tremendous variability in productivity still exists, both within and among sites. Although reducing parasitism rates through cowbird control has been shown to increase flycatcher productivity at the Kern River (Whitfield et al. 1999b), none of the three populations has exhibited sustained growth over the one to two decades that they have been managed for cowbirds. This suggests that while cowbird parasitism may at one time have reduced the growth of these populations, other factors are currently limiting them. While cowbird control may have prevented local extinctions and allowed populations to stabilize, perhaps even grow, it no longer is sufficient as recovery-oriented management, and should be augmented or replaced by other strategies to facilitate population growth as they become identified.

Because extensive habitat loss and degradation throughout the flycatcher's range was responsible for the species' initial decline (Unitt 1987, Schlorff 1990), it is reasonable to hypothesize that habitat availability continues to limit populations, particularly where populations have increased and then stabilized. Management to enhance productivity will remain effective only as long as sufficient suitable habitat is available for occupation. Our evaluation of riparian condition in southern California indicates that the landscape available to willow flycatchers, indeed to all riparian species, is highly disturbed, calling into question just how much suitable habitat exists. A variety of land use practices and human activities, as well as the spread of invasive plants, have altered the condition of the majority of riparian woodlands to an extent that their current suitability for flycatchers is unknown. Some types of disturbance are clearly detrimental, such as those that result in removal or fragmentation of native habitat, interfere with seedling recruitment, alter stream geomorphology and hydrology, and elevate levels of predation, parasitism, or other threats such as fire. Other forms of disturbance are less clear in their effects on flycatchers. For example, the presence of tamarisk, an invasive exotic species, does not necessarily deter flycatchers from breeding (S. Sferra, unpubl. data). Agricultural and urban runoff systems often create hydrologic conditions favorable to flycatchers that would not otherwise exist. In fact, nearly half of the California sites occupied by flycatchers in 1999–2001 are dependent upon supplemental flows produced by agricultural and urban runoff, effluent outflow, or river regulation (e.g., canals, dams, reservoirs) for maintenance of existing habitat conditions (U.S. Fish and Wildlife Service 2001). Thus, while our findings indicate a level of habitat disturbance worthy of concern, the nature and magnitude of the effect of this disturbance on flycatcher habitat suitability is complex and remains to be quantified.

What are the future prospects for Southwestern Willow Flycatchers in California? We suggest that the future will depend on our ability to understand and manage the processes maintaining existing populations, as well as the conditions necessary for growth and expansion. This will require that we move beyond studies of nesting success and productivity to address other aspects of flycatcher demography, in particular, dispersal and survival. We must also expand our current focus to include small populations, in which nearly half of the state's flycatcher population resides. Moving research in these directions will allow us to improve our understanding of population structure and the processes responsible for population persistence, as well as to seek other factors influencing and currently limiting population growth. An improved understanding of the dynamics of small populations and their contribution to overall flycatcher persistence will aid in evaluating management options and allocating recovery effort. In addition, it is essential that we refine our knowledge of flycatcher habitat requirements through more detailed and experimental investigations of the conditions that render sites suitable for flycatchers. Quantitative modeling such as that undertaken for Willow Flycatcher habitat in northern California (C. Stermer, unpubl. data) holds promise for improving our ability to identify and protect existing suitable habitat as well as to create additional habitat through restoration and alleviation of stressors. Settlement patterns of dispersing flycatchers provide an opportunity to test predictions of such models, and to refine hypotheses regarding the critical components of habitat suitability. We suggest that these research needs provide a high priority context for flycatcher studies during the next decade, for it is only through such efforts that we can expect to develop effective management to secure the flycatcher's existence into the future.

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APPENDIX. NUMBERS AND LOCATIONS OF SOUTHWESTERN WILLOW FLYCATCHERS IN CALIFORNIA, 1999–2001

Location	Number of Territories 1999	2000	2001	Source
Kern County:				
Kern River	24	25	21	Whitfield et al. 1999a, Whitfield and Lynn 2001, Whitfield 2002
Inyo County:				
Owen's Valley	>12	—[a]	24	M. Whitfield, unpubl. data; B. Kus and M. Whitfield, unpubl. data
3 km W of Lone Pine	2	—		R. McKernan, unpubl. data
7 km S of Big Pine	2	—		R. McKernan, unpubl. data
Santa Barbara County:				
Santa Ynez River:				
Gardner Ranch	—	4	4	J. Greaves, unpubl. data; M. Holmgren, unpubl. data
Buellton–Yvonne	10[b]	>18[b]	—	Greaves et al. 1999; Farmer et al. 2001, *this volume*
Santa Rosa Park	—	4	—	Farmer et al. 2001
Vandenberg	3	1	1	Farmer et al. 2001, *this volume*
Upper Piru Creek	0	0	4	J. Uyehara, unpubl. data
Ventura County:				
Santa Clara River	3	3	3	Z. Labinger and J. Greaves, unpubl. data
Los Angeles County:				
San Francisquito Creek	—	—	3	J. Berkeley, unpubl. data
Soledad Canyon	—	—	2	J. Berkeley, unpubl. data
San Gabriel River	—	—	1	BonTerra 2001
Santa Clara River	—	—	2	BonTerra 2001
San Bernardino County:				
Day Canyon	1	1	1	R. McKernan, unpubl. data
Mojave Forks	1	2	2	R. McKernan, unpubl. data
Waterman Creek	1	1	0	R. McKernan, unpubl. data
San Timoteo Creek	3	2	2	Crook 1999, SAWA 2000; R. McKernan, unpubl. data
Oak Glenn	—	—	3	R. McKernan, unpubl. data
Mountain Home Village	3	4	4	R. McKernan, unpubl. data
Greenspot Thicket	—	1	1	R. McKernan, unpubl. data
Forest Falls	—	3	2	R. McKernan, unpubl. data
Jenks Meadow	1	2	3	R. McKernan, unpubl. data
Sand Creek	1	1	1	R. McKernan, unpubl. data
Rattlesnake Creek	1	1	1	R. McKernan, unpubl. data
Metcalf Creek	—	—	1	S. Myers, unpubl. data
Bear Creek	—	2	3	R. McKernan, unpubl. data
Cienega Seca	1	1	—	R. McKernan, unpubl. data
Little Bear Springs	1	1	4	R. McKernan, unpubl. data
Headgate Rock	1	—	—	R. McKernan, unpubl. data
Strawberry Creek	—	—	—	D. Guthrie, unpubl. data
Deer Creek	—	—	2	R. McKernan, unpubl. data
Van Dusen Canyon	—	—	2	R. McKernan, unpubl. data
Banning Canyon	—	—	1	R. McKernan, unpubl. data
S.R. 38 bridge (Mill Creek)	—	1	—	J. Konecny, unpubl. data
Mojave River	6	6	5	M. Crook, unpubl. data; S. Lawrey, unpubl. data
Santa Ana River (lowlands)	2	0	0	R. McKernan, unpubl. data; S. Lawrey, unpubl. data
San Bernardino/Riverside County				
Prado Basin (Santa Ana River)	5	5	7	Pike et al. 1999, 2000, 2002
Riverside County:				
Big Hole Slough	1	1	—	R. McKernan and G. Braden, unpubl. data

APPENDIX. CONTINUED

Location	Number of Territories 1999	2000	2001	Source
Orange County:				
Laguna Lakes	1	0[c]	—	R. Erickson, unpubl. data
Canada Gobernadora	1	1	1	P. Bloom, unpubl. data
San Diego County:				
Santa Margarita River (Camp Pendleton)	18	17	18	Griffith Wildlife Biology 2000, Kus 2001, Kus and Ferree 2002
Fallbrook Creek (Camp Pendleton)	0	1	1	Griffith Wildlife Biology 2000, Kus 2001, Kus and Ferree 2002
Pilgrim Creek	1	0	0	Kus et al. 2000, 2001; Kus and Peterson 2002
San Luis Rey River:				
Upper	46	47	50	Kus et al. 1999; Varanus Biological Services 2000d, 2001; W. Haas, unpubl. data
Pala	—	2	1	Varanus Biological Services 2000b; W. Haas, unpubl. data
Couser Canyon	2	2	2	J. Wells, unpubl. data; J. Konecny, unpubl. data; B. Kus, unpubl. data
I15-College Avenue	0	1	2	B. Kus, unpubl. data
College Avenue–I5	0	3	2	Wells and Turnbull 2000; B. Kus, unpubl. data
Macario Canyon	1	0	0	Varanus Biological Services 2000c; W. Haas, unpubl. data
Aqua Caliente Creek	—	2	0	W. Haas, unpubl. data
San Dieguito River	2	3	2	B. Kus and P. Beck, unpubl. data; W. Haas, unpubl. data
San Diego River (El Capitan)	—	—	2	B. Kus, unpubl. data
Sweetwater River	1	0	0	Sweetwater Authority 2000, 2001, 2002
Agua Tibia Creek	—	—	1	K. Weaver, unpubl. data
San Felipe Creek	4	3	2	Varanus Biological Services 2000a; W. Haas, unpubl. data
William Heise Park (Cedar Creek)	—	—	1	J. Barth, unpubl. data
Imperial County:				
Gila Confluence North	1	1	—	R. McKernan and G. Braden, unpubl. data
TOTALS	163	174[d]	194[d]	

[a] No data.
[b] Survey effort varied between years.
[c] Partial survey or not a focused Willow Flycatcher survey.
[d] Not all sites surveyed in each year.