



Distribution, Abundance, and Breeding Activities of the Southwestern Willow Flycatcher at Marine Corps Base Camp Pendleton, California

2002 Annual Report



Prepared for:

**Assistant Chief of Staff, Environmental Security
U.S. Marine Corps Base Camp Pendleton**

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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TABLE OF CONTENTS

<i>LIST OF TABLES</i>	<u>Page</u> i
<i>LIST OF FIGURES</i>	ii
EXECUTIVE SUMMARY	iv
INTRODUCTION	1
STUDY AREAS AND METHODS	2
Field Surveys	2
Nest Monitoring	10
Banding	10
RESULTS	10
Population Size and Distribution	10
Habitat Characteristics	20
Breeding Activities	35
Nest Site Characteristics	36
Cowbird Parasitism	37
Banded Birds	37
DISCUSSION AND RECOMMENDATIONS	40
LITERATURE CITED	43

LIST OF TABLES

1. Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2002	32
2. Nesting activity of southwestern willow flycatcher pairs at Marine Corps Base Camp Pendleton in 2002	36
3. Nest site characteristics of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2002	37
4. Band status of willow flycatchers at Marine Corps Base Camp Pendleton in 2002	39

TABLE OF CONTENTS
(continued)

LIST OF FIGURES

1. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2002: Santa Margarita River, De Luz Creek and Fallbrook Creek	4
2. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2002: Santa Margarita River, Newton Canyon, Cockleburr Canyon, French Creek, and Aliso Creek	5
3. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2002: Cristianitos Creek, San Mateo Creek and San Onofre Creek	6
4. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2002: San Mateo Creek and San Onofre Creek	7
5. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2002: Las Flores Creek, Piedra de Lumbre Cayon, and Horno Canyon	8
6. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2002: Windmill Canyon and Pilgrim Creek	9
7. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: Santa Margarita River and De Luz Creek	11
8. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: Santa Margarita River and Fallbrook Creek	12
9. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: Santa Margarita River and Newton Canyon	13
10. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: San Mateo Creek and Cristianitos Creek	14
11. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: San Mateo Creek and San Onofre Creek	15
12. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: Horno Canyon and San Onofre Creek, South Fork	16
13. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: Las Flores Creek and Piedra de Lumbre Canyon	17
14. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: Las Flores Creek and Cockleburr Canyon	18
15. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2002: Windmill Canyon and Pilgrim Creek	19
16. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Lake O'Neill, Fallbrook Creek	21
17. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Below Hospital, Santa Margarita River	22
18. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Air Station, Santa Margarita River	23
19. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Pump Road, Santa Margarita River	24
20. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Pueblitos Area, Santa Margarita River	25

TABLE OF CONTENTS

(continued)

LIST OF FIGURES

(continued)

21. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Northeast Ysidora Basin, Santa Margarita River	26
22. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: North Central Ysidora Basin, Santa Margarita River	27
23. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: South Central Ysidora Basin, Santa Margarita River	28
24. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Southwest Central Ysidora Basin, Santa Margarita River	29
25. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Southwest Ysidora Basin, Santa Margarita River	30
26. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2002: Below Ysidora, Santa Margarita River	31

EXECUTIVE SUMMARY

Surveys for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) were conducted at Marine Corps Base Camp Pendleton, California, between 15 May and 31 August 2002. One hundred and two transient flycatchers of unknown subspecies were detected during surveys. Transients occurred in a range of habitat types including mixed willow riparian, willow-oak-sycamore dominated riparian, willow-cottonwood dominated riparian, riparian scrub and upland scrub. The distance from transient locations to the nearest surface water averaged 489 ± 603 m (N = 101).

Eighteen southwestern willow flycatcher breeding territories were located. With the exception of one territory at Lake O'Neill on Fallbrook Creek, all territories were along the Santa Margarita River, including a new site near the Base hospital, and one downstream of the concentration of birds between Rifle Range Road and Ysidora Basin. Ninety-four percent (17/18) of territories were located in mixed willow riparian habitat. Exotic vegetation, particularly and giant reed (*Arundo donax*), tamarisk (*Tamarix ramosissima*), and poison hemlock (*Conium maculatum*) was present in all territories, and was dominant (% cover > 50) in 11% (2/18) of territories. Resident flycatchers exhibited a bimodal distribution with regard to distance to surface water, with 60% within 70 m, and the remainder 100-900 m away from it.

The resident flycatcher population included two non-territorial "floater" males, two unpaired males, and 16 pairs. Nesting was documented for all 16 pairs, which produced 1-2 nests each. Fifty-three percent (10/29) of nests were successful, and flycatchers fledged an average of 1.5 young per pair. No instances of cowbird parasitism were observed. Pairs placed nests in five species of plants, including black willow (*Salix gooddingii*), arroyo willow (*S. lasiolepis*), giant reed, tamarisk, and maiden's bower (*Clematis ligusticifolia*).

Fourteen resident males and seven females were birds banded previously at Camp Pendleton between 1998 and 2001. Three birds (two males and one female) were immigrants from the San Luis Rey River. In addition, a male color banded in Costa Rica during the winter of 2001-2002 was resighted at the Base in July. Four resident males and four females were captured and color banded in 2002, and 10 nestlings in five nests were banded. None of the transients observed during surveys carried bands.

INTRODUCTION

The southwestern willow flycatcher (*Empidonax traillii extimus*) is one of four subspecies of willow flycatcher in the United States, with a breeding range including southern California, Arizona, New Mexico, extreme southern portions of Nevada and Utah, and western Texas (Hubbard 1987, Unitt 1987). Restricted to riparian habitat for breeding, the southwestern willow flycatcher has declined in recent decades in response to widespread habitat loss throughout its range and, possibly, cowbird parasitism (Wheelock 1912; Willett 1912, 1933; Grinnell and Miller 1944; Remson 1978; Garrett and Dunn 1981; Unitt 1984, 1987; Gaines 1988; Schlorff 1990; Whitfield and Sogge 1999). By 1993, the species was believed to number approximately 70 pairs in California (USFWS 1993) in small disjunct populations. The southwestern willow flycatcher was listed as endangered by the State of California in 1992 and by the U.S. Fish and Wildlife Service in 1995.

Willow flycatchers in southern California co-occur with the least Bell's vireo (*Vireo bellii pusillus*), another riparian obligate endangered by habitat loss and cowbird parasitism. However, unlike the vireo, which has increased six-fold since the mid-1980's in response to management alleviating these threats (USGS unpubl. data), willow flycatcher numbers have remained low. Currently, the majority of southwestern willow flycatchers in California are concentrated in three sites: the South Fork of the Kern River in Kern County (Whitfield 2002), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Varanus Biological Services 2001), and Marine Corps Base Camp Pendleton in San Diego County (Kus 2001). Outside of these sites, southwestern willow flycatchers occur as small, isolated populations of one to half a dozen pairs (Kus *et al.* in press). Data on the distribution and demography of the flycatcher, as well as identification of factors limiting the species, are critical information needs during the current stage of recovery planning.

The purpose of this study was to document the status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in San Diego County, California. Specifically, our goals were to (1) determine the size and composition of the willow flycatcher population at the Base, (2) document nesting activities of resident flycatchers, and (3) characterize habitat used by flycatchers. These data, when combined with data for other years, will inform natural resource managers about the status of this endangered species at Camp Pendleton, and guide modification of land use and management practices as appropriate to ensure the species' continued existence.

This work was funded by the Assistant Chief of Staff, Environmental Security, Resources Management Division, Marine Corps Base Camp Pendleton, California.

STUDY AREAS AND METHODS

Field Surveys

All of Camp Pendleton's major drainages, and several minor ones supporting riparian habitat, were surveyed for flycatchers between 15 May and 31 August 2002. Field work was conducted by Lisa Christenson, Marie-France Julien, Kerry Kenwood, David Kisner, Jamie LeBrun, Bonnie Peterson, Jay Rourke, and Mike Wellik. The specific areas surveyed are as follows:

Santa Margarita River: between Interstate 5 and the confluence with De Luz Creek, including Ysidora Basin and Stagecoach Canyon (Figures 1, 2).

De Luz Creek: between the confluence with the Santa Margarita River and the Base boundary (Figure 1).

Fallbrook Creek: between Lake O'Neill and the Base boundary (Figure 1).

Las Flores Creek: between the Pacific Ocean and a point approximately 75 m upstream of Basilone Road (Figure 5).

Cockleburr Canyon: between the Pacific Ocean and Interstate 5 (Figure 2).

Horno Creek: between Old Highway 101 and the upstream limit of riparian habitat (Figure 5).

Piedra de Lumbre Canyon: between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Figure 5).

French Creek: between the Pacific Ocean and the Edson Range Impact Area (Figure 2).

Aliso Creek: between the Pacific Ocean and the electrical transmission lines (Figure 2).

Newton Canyon: between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Figure 2).

San Onofre Creek: between the Pacific Ocean and the access road to Range 219 ("south fork"), and between the north/south fork confluence and the confluence with Jardine Canyon ("north fork") (Figures 3 and 4).

San Mateo Creek: between the Pacific Ocean and the Base boundary, including habitat south of the creek, and south and east of the agricultural fields (Figures 3 and 4).

Cristianitos Creek: between the confluence with San Mateo Creek and the Base boundary (Figure 3).

Pilgrim Creek: between the Base boundary and the limit of habitat upstream of Sewage Treatment Plant 1, including two side drainages between Pilgrim Creek and the southern Base boundary (Figure 6).

Windmill Canyon: from the Base boundary to the entrance to the golf course entrance (Figure 6).

Drainages were surveyed at least once during each of four consecutive 15-day periods between 15 May and 15 July, except for French Creek, which was surveyed during the last three periods.

Investigators followed standard survey protocol (Sogge *et al.* 1997), moving slowly through the riparian habitat while searching and listening for willow flycatchers. Observers walked along the edge(s) of the riparian corridor on the upland and/or river side where habitat was narrow enough to detect a bird on the opposite edge. In wider stands, observers traversed the habitat in a way that permitted detection of all birds throughout its extent. Surveys were conducted between dawn and early afternoon, depending on wind and weather conditions.

For each bird encountered, investigators recorded age (adult or juvenile), sex, breeding status (paired, unpaired or transient), and whether the bird was banded. Flycatcher locations were mapped on 1":12,000" aerial photographs as well as 1":24,000" USGS topographic maps, using a Garmin 12 Global Positioning System (GPS) unit with 1-15 m positioning accuracy to determine geographic coordinates (WGS84). Distance to the nearest surface water was recorded for each location, and habitat type specified according to the following categories based on dominant vegetation:

Mixed willow riparian: Habitat dominated by one or more willow species including *Salix gooddingii*, *S. lasiolepis*, and *S. laevigata*, with *Baccharis glutinosa* as a frequent co-dominant.

Willow-cottonwood: Willow riparian habitat in which *Populus fremontii* is a co-dominant.

Willow-sycamore: Willow riparian habitat in which *Platanus racemosa* is a co-dominant.

Willow-sycamore-cottonwood: Willow riparian habitat in which *Platanus racemosa* and *Populus fremontii* are co-dominants.

Sycamore-oak: Woodlands in which *Platanus racemosa* and *Quercus agrifolia* occur as co-dominants.

Riparian scrub: Dry and/or sandy habitat dominated by *Salix hindsiana* or *Baccharis glutinosa*, with few other species.

Upland scrub: Disturbed coastal sage scrub adjacent to riparian habitat.

Non-native: Sites vegetated exclusively with non-native species such as *Arundo donax* and *Tamarix ramosissima*.

Percent cover of exotic vegetation at each location was estimated using cover categories of <5%, 5-50%, and > 50%, and the dominant exotic species recorded.

Nest Monitoring

Pairs were observed for evidence of nesting, and nests located and monitored following standard protocol (Rourke *et al.* 1999). Nests were visited as infrequently as possible to minimize the chances of leading predators or brown-headed cowbirds (*Molothrus ater*) to nest sites; typically, the first visit was timed to determine the number of eggs laid, the second to determine hatching, and the third to band nestlings. Characteristics of nests, including height, host species, and host height were recorded following abandonment or fledging of nests.

Banding

Nestlings were banded at 7-10 days of age. Each bird received a unique color combination including an anodized bronze-colored aluminum federal numbered band on one leg and a single bi-colored metal band on the right. Unbanded adults were captured in mist nets within their territories, and were banded with a unique combination of a numbered federal band (anodized dark green) on one leg and a bi-colored metal band on the other.

RESULTS

Population Size and Distribution

Transients

Ninety-seven willow flycatchers of unknown sub-species were observed during Base-wide surveys, and an additional five were captured in mistnets at MAPS (Monitoring Avian Productivity and Survival) stations operated at De Luz Creek and the lower Santa Margarita River (Kus and Kisner 2003; Figures 7-15). All transients were detected between 15 May and

14 June with the exception of one bird each detected on 24 June, 26 June, and 28 June. Transients occurred on every drainage surveyed except French, Aliso, and Pilgrim Creeks.

Residents

Sixteen females and 20 males remained throughout the breeding season (Figures 8-9, 16-26). Of the males, 16 were paired, two were single, and two were “floaters” with no fixed territories. Each of these latter males was observed once in late July in or near the territories of other males. With the exception of the Lake O’Neill territory on Fallbrook Creek, all territories in 2002 were on the Santa Margarita River. However, the distribution of resident flycatchers along the Santa Margarita River expanded in 2002 to include habitat adjacent to the percolation ponds west of the hospital (Figure 8), approximately 0.8 km from the Lake O’Neill site colonized in 2000, and a site downstream of the transmission lines crossing the lower Santa Margarita River 1.5 km south of the previous southern-most territories (Figure 9).

Habitat Characteristics

Sixty-seven percent (81/121, excluding floater male 89 seen within territory 63; Figure 19) of all the flycatcher sightings occurred in habitat classified as mixed willow riparian (Table 1), with a dense understory of blackberry (*Rubus ursinus*), stinging nettles (*Urtica dioica*), or poison hemlock (*Conium maculatum*) often present. Seventeen percent (21/121) of the locations were in willow-oak-sycamore dominated habitats, primarily along San Mateo, Cristianitos, and Las Flores Creeks. An additional 3% (3/121) of sites were in willow-sycamore-cottonwood habitat, while 13% (16/121) were in scrub habitats. While transients used all habitat types, resident flycatchers were found almost exclusively in mixed willow riparian, with 94% (17/18) of territories established in this habitat.

Exotic vegetation was recorded in 91% (110/121) of flycatcher locations, and was the dominant vegetation (% cover of exotics > 50; Table 1) in 10% (11/110) of sites, with no difference noted between transients and residents in this regard. The most common exotic plants in habitat used by flycatchers were giant reed (*Arundo donax*), tamarisk (*Tamarix ramosissima*), poison hemlock (*Conium maculatum*) and mustard (*Brassica nigra*).

Flycatcher locations differed widely in their proximity to surface water (Table 1). Both transient and resident flycatchers exhibited bimodal distributions with regard to distance to the nearest surface water, with 45% and 60%, respectively, within 70 m, and the rest greater than 100 m away. On average, transients were three times as far from surface water as were residents (transients: $\bar{x} = 489 \pm 603$ m, residents: $\bar{x} = 171 \pm 321$ m), the reverse of 2001, when residents were closer to water.

Table 1. Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2002.

ID	Drainage	Status	Habitat Type	% Cover Exotics^b	Dominant Exotic^c	Distance to Surface Water (m)
72	Cristianitos	T	Oak-sycamore	1	EUC	50
73	Cristianitos	T	Willow-oak-sycamore	1	TAM	20
74	Cristianitos	T	Oak-sycamore	1	NONE	100
298	Cockleburr	T	Upland scrub	1	CON	4
299	Cockleburr	T	Upland scrub	1	NIC	2
302	Cockleburr	T	Mixed willow riparian	1	NIC	2
303	Cockleburr	T	Mixed willow riparian	1	NIC	2
DL1	De Luz	T	Willow-oak-sycamore	1	BRA	1500
DL2	De Luz	T	Willow-oak-sycamore	1	BRA	15
49	Fallbrook	T	Willow-sycamore	2	TAM	50
50	Fallbrook	P	Willow-sycamore	2	TAM, ARU	0
33	Horno	T	Mixed willow riparian	2	UNK	35
10	Las Flores	T	Mixed willow riparian	1	BRA	1600
11	Las Flores	T	Mixed willow riparian	1	BRA	1600
12	Las Flores	T	Riparian scrub	1	BRA	1600
13	Las Flores	T	Riparian scrub	1	BRA	1600
43	Las Flores	T	Mixed willow riparian	1	TAM	20
44	Las Flores	T	Mixed willow riparian	1		10
52	Las Flores	T	Willow-sycamore	1		20
56	Las Flores	T	Willow-sycamore	1	BRA	2000
57	Las Flores	T	Willow-sycamore	1	CON	400
58	Las Flores	T	Mixed willow riparian	1	BRA	800
59	Las Flores	T	Mixed willow riparian	1	BRA	1250
83	Las Flores	T	Willow-sycamore	1	BRA	1350
84	Las Flores	T	Mixed willow riparian	1	BRA	0
85	Las Flores	T	Mixed willow riparian	1	BRA	1450
86	Las Flores	T	Mixed willow riparian	1	BRA	1450
87	Las Flores	T	Mixed willow riparian	1	BRA	435
88	Las Flores	T	Mixed willow riparian	1	BRA	435
03	Las Flores	T	Willow-sycamore	1	BRA	1600
04	Las Flores	T	Willow-sycamore	1	BRA	1200
05	Las Flores	T	Willow-sycamore	1	BRA	2000
06	Las Flores	T	Willow-sycamore	1	BRA	800
07	Las Flores	T	Willow-sycamore	1	CON	400
08	Las Flores	T	Mixed willow riparian	1	BRA	800
09	Las Flores	T	Mixed willow riparian	1	BRA	1200
24	Newton	T	Mixed willow riparian	3	TAM, ARU	1280

25	Newton	T	Mixed willow riparian	3	TAM, ARU	1620
20	Piedra de Lumbre	T	Riparian scrub	2	UNK	1
21	Piedra de Lumbre	T	Riparian scrub	2	UNK	1

Table 1 (continued). Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2002.

ID	Drainage	Status	Habitat Type	% Cover Exotics ^b	Dominant Exotic ^c	Distance to Surface Water (m)
22	Piedra de Lumbre	T	Riparian scrub	2	ARU, TAM	30
23	Piedra de Lumbre	T	Mixed willow riparian	2	UNK	4
37	Piedra de Lumbre	T	Upland scrub	2	CON	5
28	San Mateo	T	Upland scrub	2	UNK	
42	San Mateo	T	Mixed willow riparian			2000
53	San Mateo	T	Mixed willow riparian	1	NONE	5
54	San Mateo	T	Mixed willow riparian	1	NONE	100
55	San Mateo	T	Mixed willow riparian	3	CON	5
66	San Mateo	T	Mixed willow riparian	3	CON	5
67	San Mateo	T	Willow-sycamore	1	CON	100
68	San Mateo	T	Mixed willow riparian	1	NONE	100
69	San Mateo	T	Mixed willow riparian	1	NONE	100
70	San Mateo	T	Mixed willow riparian	1	NONE	5
71	San Mateo	T	Mixed willow riparian	1	NONE	5
	San Mateo		Willow-sycamore-			
75		T	cottonwood	1	PALM	25
76	San Mateo	T	Mixed willow riparian	1	NONE	100
77	San Mateo	T	Mixed willow riparian	2	CON	50
79	San Mateo	T	Willow-sycamore	1	CON	70
80	San Mateo	T	Mixed willow riparian	1	NONE	100
161	San Mateo	T	Riparian scrub	1	NONE	1200
162	San Mateo	T	Riparian scrub	1	NONE	1200
164	San Mateo	T	Mixed willow riparian	3	CON	50
	San Mateo		Willow-sycamore-			
165		T	cottonwood	1	PALM	60
	San Mateo		Willow-sycamore-			
167		T	cottonwood	1	PALM	60
51	San Onofre	T	Mixed willow riparian	2	CON	20
14	Santa Margarita	T	Mixed willow riparian	1	BRA	650
15	Santa Margarita	T	Mixed willow riparian	1	BRA	1120
16	Santa Margarita	P	Mixed willow riparian	2	ARU, CON	480
17	Santa Margarita	P	Mixed willow riparian	2	ARU	0
18	Santa Margarita	T	Willow-sycamore	2	ARU	130
19	Santa Margarita	P	Mixed willow riparian	3	ARU	1200
29	Santa Margarita	T	Mixed willow riparian	1	UNK	2
30	Santa Margarita	T	Mixed willow riparian	1	ARU	1
31	Santa Margarita	T	Mixed willow riparian	1	UNK	0

32	Santa Margarita	T	Mixed willow riparian	2	ARU	6
34	Santa Margarita	T	Mixed willow riparian	1	BRA	900
35	Santa Margarita	T	Mixed willow riparian	1	BRA	900

Table 1 (continued). Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2002.

ID	Drainage	Status	Habitat Type	% Cover Exotics ^b	Dominant Exotic ^c	Distance to Surface Water (m)
36	Santa Margarita	P	Mixed willow riparian	2	ARU	20
38	Santa Margarita	P	Mixed willow riparian	1	ARU	5
39	Santa Margarita	S	Mixed willow riparian	2	ARU	2
40	Santa Margarita	T	Riparian scrub	3	TAM, ARU	10
41	Santa Margarita	P	Mixed willow riparian	3	ARU	20
46	Santa Margarita	P	Mixed willow riparian	2	ARU	60
47	Santa Margarita	P	Mixed willow riparian	1	BRA	900
60	Santa Margarita	T	Mixed willow riparian	1	UNK	15
61	Santa Margarita	P	Mixed willow riparian	2	TAM, CON	100
62	Santa Margarita	P	Mixed willow riparian	2	CON, TAM	100
63	Santa Margarita	P	Mixed willow riparian	2	TAM, CON	100
64	Santa Margarita	T	Mixed willow riparian	1	UNK	10
65	Santa Margarita	T	Mixed willow riparian	1	UNK	20
78	Santa Margarita	T	Mixed willow riparian	1	CON	40
81	Santa Margarita	T	Mixed willow riparian	2	ARU	100
82	Santa Margarita	T	Mixed willow riparian	2	ARU	100
89	Santa Margarita	F	Mixed willow riparian	2	TAM, CON	100
90	Santa Margarita	F	Riparian scrub	2	BRA, EUC	100
91	Santa Margarita	P	Mixed willow riparian	2	ARU, BRA	50
92	Santa Margarita	P	Mixed willow riparian	2	ARU	50
93	Santa Margarita	P	Mixed willow riparian	2	ARU	30
94	Santa Margarita	T	Mixed willow riparian	1	BRA	5
95	Santa Margarita	T	Mixed willow riparian	1	CON	0
96	Santa Margarita	T	Mixed willow riparian	1	BRA	50
97	Santa Margarita	T	Mixed willow riparian	1	BRA	50
98	Santa Margarita	T	Mixed willow riparian	1	BRA, CON	0
99	Santa Margarita	P	Mixed willow riparian	2	ARU	50
100	Santa Margarita	T	Mixed willow riparian	2	CON	600
101	Santa Margarita	T	Mixed willow riparian	1	CON	600
102	Santa Margarita	T	Mixed willow riparian	1	CON	600
103	Santa Margarita	T	Mixed willow riparian	1	CON	600
104	Santa Margarita	T	Mixed willow riparian	1	CON	600
105	Santa Margarita	T	Mixed willow riparian	1	CON	600
106	Santa Margarita	T	Riparian scrub	1	CON	600
107	Santa Margarita	T	Mixed willow riparian	2	ARU	100
121	Santa Margarita	T	Mixed willow riparian	1	ARU	730

140	Santa Margarita	T	Mixed willow riparian	1	CON	400
163	Santa Margarita	T	Mixed willow riparian	4	ARU, TAM	50
191	Santa Margarita	S	Mixed willow riparian	2	ARU	50

Table 1 (continued). Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2002.

ID	Drainage	Status	Habitat Type	% Cover Exotics ^b	Dominant Exotic ^c	Distance to Surface Water (m)
01	Santa Margarita	T	Willow-sycamore	1	ARU	400
02	Santa Margarita	T	Willow-sycamore	2	ARU	525
SM1	Santa Margarita	T	Mixed willow riparian	1	BRA	900
SM2	Santa Margarita	T	Mixed willow riparian	1	BRA	900
26	Windmill	T	Upland scrub	3	UNK	1500
27	Windmill	T	Riparian scrub	3	UNK	1500

^aT = transient, P = breeding pair, S = single resident male, F = floater resident male.

^b1 = <5%, 2 = 5-50%, 3 = 50-95%, 4 = >95%.

^cTAM = *Tamarix* sp., CON = *Conium maculatum*, BRA = *Brassica nigra*, EUC = *Eucalyptus* sp., ARU = *Arundo donax*, NIC = *Nicotiana glauca*, PALM = *Palmaceae* sp.

Breeding Activities

Nesting was observed for all of the 16 pairs (Table 2). The earliest confirmed lay date was 12 June (although a clutch found being incubated on 14 June could have been laid a few days earlier than 12 June); however, 81% of first nests were initiated between 16-18 June. Only three pairs attempted more than one nest, each following an unsuccessful initial attempt (although not all pairs unsuccessful in their first attempt re-nested). Fledging occurred between 8 July and 13 August, with the majority of young fledged during the last two weeks of July. Sixty-three percent of pairs (10/16) fledged at least one young by the end of the season.

A total of 19 nests were produced; of these, 17 were located and monitored. Ten nests (53%) were successful, fledging 1-3 young each. Nine nests (47%) failed to fledge young. Six of the unsuccessful nests were depredated; two-thirds during the egg stage and one third during the nestling stage. Three nests failed for unknown, but similar, reasons. In all three nests (two by the same pair), eggs remained unhatched after at least 15-20 days of incubation, suggesting that infertility or inviability of eggs led to eventual nest abandonment. However, two eggs disappeared from one of the clutches during incubation, possibly the result of predation, and part or all of the clutches in the other two nests were gone by the time the nest abandonment was discovered by field investigators.

Clutch size, estimated from 13 nests containing full clutches, averaged 2.8 ± 0.4 eggs. Nineteen fledglings were produced, yielding an estimate of seasonal productivity of 1.5 young per pair (19 young/16 pairs).

Table 2. Nesting activity of southwestern willow flycatcher pairs at Marine Corps Base Camp Pendleton in 2002.

ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Comments
50	18 June	3	3	3	
38	After 5 July	3	0	0	Depredated.
19	30 June	3	0	0	Depredated.
62	17 June	3	3	3	
61	20 June ^a	2 ^b	2 ^b	2 ^b	Nest not located.
63	On or before 12 June	3	0	0	Depredated.
	28 June ^a	3	3	3	Nest too high to observe contents; exact lay date not determined.
41	20 June	2	1	1	1 egg gone.
36	22 June	2	0	0	Eggs did not hatch after ≥ 20 days; nest abandoned (1 egg gone).
	15 July	2	2	2	
17	23 June	3	2	2	1 nestling gone.
47	12 June ^a	3 ^b	3 ^b	3 ^b	Nest not located.
16	21 June	3	0	0	Eggs did not hatch after ≥ 15 days; nest abandoned (all eggs gone).
	13 July ^a	3	0	0	Eggs did not hatch after ≥ 17 days; nest abandoned (2 eggs disappear during incubation).
93	Before 22 June	3	0	0	Depredated.
46	25 June	3	3	0	Depredated.
91	20 June	2 ^c	2	0	Depredated.
92	12 June	2 ^c	2	2	
99	17 June	3	3	3	

^aDate estimated.

^bMinimum number, based on number of fledglings observed.

^cMinimum number; nest contents not seen during egg stage.

Nest Site Characteristics

Flycatchers placed nests in five species of plants (Table 3), including black willow (*Salix gooddingii*), arroyo willow (*S. lasiolepis*), giant reed, tamarisk, and virgins-bower (*Clematis ligusticifolia*). One nest constructed in giant reed was used for two successive nest attempts (Pair 16 nests 1 and 2). The majority of nests (63%) were placed in willows, with arroyo willow used over twice as often as black willow. Thirty-one percent of nests were placed in exotic species; 19% (3/16) in giant reed, and 13% (2/16) in tamarisk. Nest height averaged 2.5 ± 1.2 m (N = 16), while host height averaged 6.0 ± 2.1 m (N = 15).

Table 3. Nest site characteristics of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2002.

ID	Host Species	Host Height (m)	Nest Height (m)
50	<i>Tamarix ramosissima</i>	5.4	3.3
38	<i>Salix lasiolepis</i>	6.5	3.6
19	<i>Arundo donax</i>	2.7	2.1
62	<i>Salix gooddingii</i>	7.1	2.4
63	<i>Salix lasiolepis</i>	6.6	2.3
63	<i>Tamarix ramosissima</i>	6.7	5.9
41	<i>Salix lasiolepis</i>	6.0	1.7
36	<i>Salix lasiolepis</i>	2.7	0.6
36	<i>Salix lasiolepis</i>	8.9	1.6
17	<i>Salix lasiolepis</i>	6.3	2.0
16	<i>Arundo donax</i>	5.8	1.5 ^a
93	<i>Salix gooddingii</i>	10.0	2.6
46	<i>Clematis ligustifolia</i>	NA (vine)	1.1
91	<i>Salix gooddingii</i>	3.4	2.6
92	<i>Arundo donax</i>	4.5	3.2
99	<i>Salix lasiolepis</i>	8.0	2.8

^aNest re-used for subsequent nesting attempt.

Cowbird Parasitism

No instances of cowbird parasitism of southwestern willow flycatcher nests were observed in this study.

Banded Birds

Nineteen of the 20 resident males, and 15 of the 16 females, were observed closely enough to determine with confidence whether they were banded (Table 4). Of these, 13 males and seven females were returning banded birds banded in previous years. One male and one female were siblings, banded as nestlings off-Base near Whelan Lake in 2000, while the rest were banded as adults at Camp Pendleton in 1998 (two males), 2000 (one male, one female), and 2001 (six males, four females), or at the San Luis Rey River near Guajome Park in 2001 (one male). Two individuals, one male and one female, carried only aluminum bands and were likely originally banded at the Santa Margarita or De Luz MAPS stations in 1998 or 2000 (Kus and Beck 1998, 2001); however, attempts to recapture these birds and verify this were unsuccessful. One additional male was determined by his band combination to have been banded in Costa Rica during the winter of 2001-2002 (T. Koronkiewicz, pers. comm.). This male was one of two floaters seen at the Santa Margarita River in July 2002.

Of the adult flycatchers banded by the end of the 2001 breeding season, 64% (7/11) of males, and 67% (6/9) of females returned to breed at Camp Pendleton in 2002. Among the returning males was one (Male 61; Table 4) reported as a floater within the territory of a male in 2001 who he subsequently replaced in 2002. In addition, one male (Male 46) banded at the Base in 2000 but not seen in 2001, returned to breed in 2002. Of the adult females returning in 2002, 67% (4/6) returned to the territories they occupied in 2001, while 33% (2/6) moved to new locations. Among males, 57% returned to their 2001 territories, while the rest switched territory locations.

No banded transients were detected during surveys. Five transients captured at MAPS stations (two at the De Luz station and three at the Santa Margarita station; Kus and Kisner 2003) between 21 May and 5 June were color banded in 2002, but none were seen again.

Four adult males and four females were captured and banded in 2002 (Table 4). In addition, ten nestlings in five nests were color banded; all are believed to have fledged. None of the 24 nestlings banded in 2001 that survived to fledge were resighted in 2002.

Nine resident males and eight females were netted in 2001 and color banded (Table 4). Four of these birds were captured incidentally during operation of a MAPS (Monitoring Avian Productivity and Survival) station at the Ysidora ponds (Kus and Sharp 2002), including the pair in Territory N10, the female in Territory N2, and a male who settled in Territory PT10.

Twenty-six nestlings in 12 nests were banded. Of these, two nestlings were depredated before fledging, and the rest fledged (Table 4). By the end of the season, 71% of the fledglings produced (24/34) were banded.

Table 4. Band status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2002.

ID	Status ^a	Male Banded? ^b	Female Banded? ^b	Nestlings Banded?	Comments
50	P	M _{dg} :BKYE	BLBK:M _{dg}		Male banded in 2001. Female banded in 2002.
38	P	m:-	No		Couldn't recapture male to determine band #.
19	P	M _{dg} :PUWH	Unknown		Male banded in 2002.
62	P	Unknown	DKBL:M _{dg}	3	Female banded in 2001.
61	P	DPDB:M _{dg}	m:-		Male banded in 2001. Couldn't recapture female to determine band #.
63	P	YEPU:M _{dg}	YEBK:M _{dg}		Male and female banded in 2002.
41	P	DKPI:M _{dg}	No	1	Male banded in 2001.
36	P	YEL:M _{dg}	M _{dg} :REDB		Male banded in 2001. Female banded in 2002.
17	P	BKYE:M _{dg}	M _{br} :PUR	2	Male banded in 2001. Female banded as nestling at Whelan Lake in 2000.
47	P	PUWH:m	M _{dg} :LGWH	2	Male banded as adult near Air Station in 1998. Female banded in 2000.
16	P	WHI:M _{dg}	PUR:M _{dg}		Male and female banded in 2001.
93	P	M _{dg} :RED	No		Male banded in 2002.
46	P	ORA:M _{dg}	M _{dg} :PUR		Male banded in 2000. Female banded in 2002.
91	P	M _{br} :REWH	ORPU:M _{dg}		Male banded as nestling at Whelan Lake in 2000. Female banded in 2001.
92	P	m:REYE	DKBL:M _{dg}	2	Male banded in 1998. Female banded in 2001.
99	P	BKYE:M _{dg}	N		Male banded in 2001.
191	S	YEWB:M _{dg}	NA		Male banded in 2002.
90	F	DKBL:M _{br}	NA		Male banded in Costa Rica in January 2002. Near territory 92.
89	F	YEOB:M _{dg}	NA		Male banded in 2001 at San Luis Rey River. In territory 63.

^aP = pair, S = single male, F = floater male.

^bBand combinations: left leg:right leg; m = federal aluminum band, M_{dg} = anodized green federal band, M_{br} = anodized bronze federal band, BLK = black, WHI = white, DKPI = dark pink, DKBL = dark blue, YEL = yellow, RED = red, ORA = orange, DGLG = dark green-light green split, LGWH = light green-white split, PUWH = purple-white split, DPDB = dark pink-dark blue split, BKYE = black=yellow split, BLBK = light blue-black split, ORPU = orange-purple split, DBDP = dark blue-dark pink split, DPWH = dark pink-white split, BWST = dark blue-white striped, YEOB = yellow-orange split, YEPB = yellow-purple split, YEBK = yellow-black split, REDB = red-dark blue split, REWH = red-white split, YEWB = yellow-white split.

DISCUSSION AND RECOMMENDATIONS

Camp Pendleton continues to provide habitat for migrating and breeding willow flycatchers. The number of transients detected in 2002 (102) increased relative to 2000 (21; Kus and Ferree 2002), probably the result of increased survey intensity combined with an actual increase in the number of flycatchers moving through the Base early in the season. The results of the 2002 surveys combined with those from previous years indicate that migrating flycatchers use habitat on virtually every drainage at Camp Pendleton. Transients use a broad range of habitat types as well, and are less restricted to mixed willow riparian vegetation than are resident birds. Moreover, transients in 2002 exhibited more variability in their proximity to surface water than that measured in previous years, with birds on average four times more distant from water in 2002 than in 2001.

In contrast, the resident southwestern willow flycatcher population at the Base continues to be limited in size, with the number of territories changing little from that recorded in 2001 (19; Kus and Ferree 2002) and 2000 (18; Kus 2001). The distribution of resident flycatchers, however, expanded as birds colonized habitat along the upper Santa Margarita River near the Base hospital, and downstream of the recent historic sites along the lower Santa Margarita River.

As in the past, breeding territories were predominantly in habitat characterized as mixed willow riparian, and on average were slightly closer to surface water than in 2001.

Resident flycatchers continued to occupy sites with exotic vegetation, and 10% of territories were dominated by exotics. Poison hemlock, the dominant exotic in 74% of territories in 2001, was less robust during the dry conditions of 2002, and was the dominant or co-dominant exotic in only 28% (5/18) territories. Giant reed, in contrast, was the dominant exotic in 78% (14/18) of territories in 2002. Tamarisk was recorded as the dominant exotic in 28% (5/18) territories. As in previous years, flycatchers used exotic species for nest support, although overall fewer nests were placed in exotic vegetation in 2002 (31%) relative to 2001 (56%). This is largely the result of the comparatively low use of poison hemlock in 2002, in contrast to 2001 when it was the most commonly used nest host of all species, exotic and native. Flycatchers increased their use of giant reed slightly, from 12% in 2001 to 19% in 2002. Tamarisk supported 13% of nests in 2002. Current and future management to control invasive exotic vegetation at the Base through clearing and foliar application of herbicides should continue to consider the use of exotics by southwestern willow flycatchers and design approaches that avoid impacts to nesting birds.

Flycatcher productivity in 2002 was reduced relative to previous years, probably a response to the extreme drought conditions in southern California where annual rainfall was the lowest recorded since record-keeping began in 1860. Nesting commenced three weeks later than in 2001, when 62% of first nests were initiated by 15 June; in 2002, 81% of first nests were initiated between 16 and 30 June. Pairs exhibited lower nesting effort, and few re-nested following unsuccessful attempts, unlike in 2001, when all pairs unsuccessful in their first attempts re-nested. Average clutch size was lower in 2002, and no 4-egg clutches were

produced, in contrast to 2001 when 38% of clutches contained four eggs. Although nest success was comparable in the two years, low nesting effort and reduced clutch size in 2002 resulted in the lowest per pair productivity documented for this population since monitoring began in 1999.

For the second year in a row, a substantial fraction of flycatcher eggs in nests surviving to expected hatch date failed to hatch. Of nine unsuccessful nests in 2002, three contained inviable clutches, and overall 66% of eggs expected to hatch (i.e. survived until expected hatch date) actually did so, down from 73% in 2001. The occurrence of infertile/inviable eggs in southwestern willow flycatcher nests has been analyzed by Whitfield (2002), who suggests that declining “hatchability” over the last five years may be responsible for the recent decline in the Kern River population, formerly the largest in California. Whitfield (2002) hypothesizes that the cause of reduced hatchability may be pesticides encountered during migration and/or on the wintering grounds, which could thus affect birds breeding in populations other than the one she studied. Further monitoring of this component of flycatcher reproduction at Camp Pendleton is thus warranted.

Returns of color banded birds allowed us to document several aspects of flycatcher demography and life history essential for an understanding of the factors limiting populations. First, annual adult survival between 2001 and 2002 was documented to be relatively high, with 64-67% of males and females, respectively, returning to Camp Pendleton to breed. This rate is considerably higher than that of 25% calculated for survival between 2000 and 2001, although that estimate was based on a comparatively small sample of banded individuals (N = 8). In contrast, we detected no young banded at Camp Pendleton as nestlings in 2001, and have documented no local recruitment into the Pendleton breeding population since our studies began in 2000, despite years of high productivity. Clearly, more study is needed of juvenile survival and dispersal and its relationship to local and regional flycatcher abundance and distribution.

Immigration of flycatchers into Camp Pendleton was documented for the first time through resightings of bird originally banded off-Base. One male and one female fledged from a nest near Whelan Lake along the San Luis Rey River entered the Pendleton breeding population as second-year adults, while a third male banded as an adult at the San Luis Rey River in 2001 was detected as a floater at the Base. Because of its size, the Camp Pendleton flycatcher population has been thought to be a source of colonizers for other areas; yet thus far, the only documented exchange of birds between the Base and other monitored populations reflects immigration into the Base population rather than emigration from it. Resightings of banded birds also documented inter-annual movement of territorial birds and revealed that 33-43% of females and males, respectively, shifted territory locations between 2001 and 2002. In only one instance did this movement result in the colonization of new habitat, however, and most birds moved to territories occupied by other flycatchers in previous years. One banded male, documented as a floater in 2001, became a resident breeder in 2002, suggesting that floating may be an effective alternative strategy employed by some males for acquiring territories and mates.

Finally, the resighting of a male banded on its wintering grounds in Costa Rica is one of only three resightings of winter-banded birds on the breeding grounds (M. Sogge, pers. comm.), and represents an important step forward in efforts to link breeding and wintering populations and better understand the factors influencing flycatchers throughout their annual cycle.

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