



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

2010 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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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 July 2010. Twenty-five transient flycatchers of unknown sub-species were observed during Base-wide surveys. Transients occurred on 6 of the 16 drainages surveyed in 2010. No Willow Flycatchers were detected at Cockleburr Canyon, De Luz Creek, Fallbrook Creek, French Creek, Horno Canyon, Newton Canyon, Piedra de Lumbre Canyon, Pilgrim Creek, Roblar Creek, or Windmill Canyon. Transients occurred in a range of habitat types including mixed willow (*Salix* spp.) riparian, willow-sycamore (*Platanus racemosa*) dominated riparian, oak (*Quercus* sp.)-sycamore dominated riparian, riparian scrub, and upland scrub. The distance from transient locations to the nearest surface water or saturated soil averaged 245 ± 240 m (std, $n = 25$).

In 2010, the resident Southwestern Willow Flycatcher population on Base consisted of nine females, six males, and one non-territorial “floater” bird. Ten territories were established, consisting of nine pairs (one monogamous pairing and eight polygynous pairings consisting of four males each pairing with two different females) and one single male. In total, nine females formed pair bonds with five male Willow Flycatchers. With the exception of one territory in riparian scrub along San Mateo Creek, all territories were located in mixed willow riparian along the Santa Margarita River. Poison hemlock (*Conium maculatum*) was present in all territories. Territories were on average 86 ± 51 m (std, $n = 11$) from surface water or saturated soil, with 64% (7/11; ten territories and one floater) of resident flycatchers located within 100 m of water.

Eighty-nine percent (8/9) of Willow Flycatcher pairs successfully fledged at least one young during the 2010 breeding season. Nesting was initiated in early June and continued into August. Eleven nesting attempts were documented, of which 73% (8/11) were successful. Predation accounted for 100% of nest failures. Twenty-one fledglings were produced, yielding a seasonal productivity of 2.3 young/pair (21 young/9 pairs). No instances of Brown-headed Cowbird (*Molothrus ater*) parasitism were observed. Pairs placed nests in five species of plants, including black willow (*S. gooddingii*), arroyo willow (*S. lasiolepis*), sandbar willow (*S. exigua*), mule fat (*Baccharis salicifolia*), and poison hemlock. Ninety-one percent (10/11) of nests were placed in native plant species.

Twelve birds (four males, seven females, and one unknown sex “floater”) that were banded in previous years were present at Camp Pendleton in 2010. Of the banded adult flycatchers present during the 2009 breeding season, 14% (1/7) of males and 50% (3/6) of females returned to Camp Pendleton in 2010. Seventy-five percent (3/4) of those returned to the same breeding area. Twenty-seven percent (3/11) of nestlings banded in 2009 returned to the Base as adults in 2010, including one male and two females. All returning second-year birds paired and nested in 2010. Twenty-five nestlings from nine nests were banded in 2010. None of the transients observed during surveys were seen to carry 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, Brown-headed Cowbird (*Molothrus ater*) 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 10-fold since the mid-1980's in response to management alleviating these threats (USFWS 2006), 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 (Schuetz and Whitfield 2007), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Howell and Kus 2010), and Marine Corps Base Camp Pendleton in San Diego County (Howell and Kus 2009b). Outside of these sites, Southwestern Willow Flycatchers occur as small, isolated populations of one to half a dozen pairs. 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 (Kus *et al.* 2003, Kus and Whitfield 2005).

Male Southwestern Willow Flycatchers typically arrive in southern California at the end of April while females arrive approximately one week later. Males sing repeatedly from exposed perches while on the breeding grounds. Once the pair bond is established, the female builds an open-cup nest usually placed in a branch fork of a willow (*Salix* spp.) or plant with a similar branching structure approximately 1-3 m above the ground. The typical clutch of 3-4 eggs is laid in May-June. Females incubate for approximately 12 days and nestlings fledge within 12-15 days in early July. Adults usually depart from their breeding territory in mid-August/early September to their wintering grounds in central Mexico and northern South America.

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 survivorship and movement of resident flycatchers, (3) document nesting activities, and (4) characterize habitat used by flycatchers. These data, when combined with data from 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 July (Fig. 1, Appendix A, Figs. 5-10). Field work was conducted by Kristen Dillon, Julia Fromfeld, Aaron Gallagher, Scarlett Howell, Jennifer Kendrick, Barbara Kus, Melanie Madden-Smith, Ryan Pottinger, Michelle Rogne, and Jason Thomas. The specific areas surveyed are as follows:

Santa Margarita River: between Stuart Mesa Road and the Base boundary, including Ysidora Basin and Stagecoach Canyon (Appendix A, Figs. 5, 6).

De Luz Creek: between the confluence with the Santa Margarita River and the Base boundary (Appendix A, Fig. 5).

Roblar Creek: from the confluence with De Luz Creek to a point approximately 1.5 km upstream (Appendix A, Fig. 5).

Fallbrook Creek: around Lake O'Neill as well as along the creek between the lake and the Base boundary (Appendix A, Fig. 5).

Newton Canyon: between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Appendix A, Fig. 6).

Cockleburr Canyon: between the Pacific Ocean and 0.25 km upstream of Interstate 5 (Appendix A, Fig. 6).

French Creek: between the Pacific Ocean and the Edson Range Impact Area (Appendix A, Fig. 6).

Aliso Creek: between the Pacific Ocean and 0.5 km upstream of the electrical transmission lines (Appendix A, Fig. 6).

Cristianitos Creek: between the confluence with San Mateo Creek and the Base boundary (Appendix A, Fig. 7).

San Mateo Creek: between the Pacific Ocean and the Base boundary, including habitat south of the creek and south of the agricultural fields (Appendix A, Figs. 7, 8).

San Onofre Creek: between the Pacific Ocean and the access road to Range 219 (Appendix A, Figs. 7, 9).

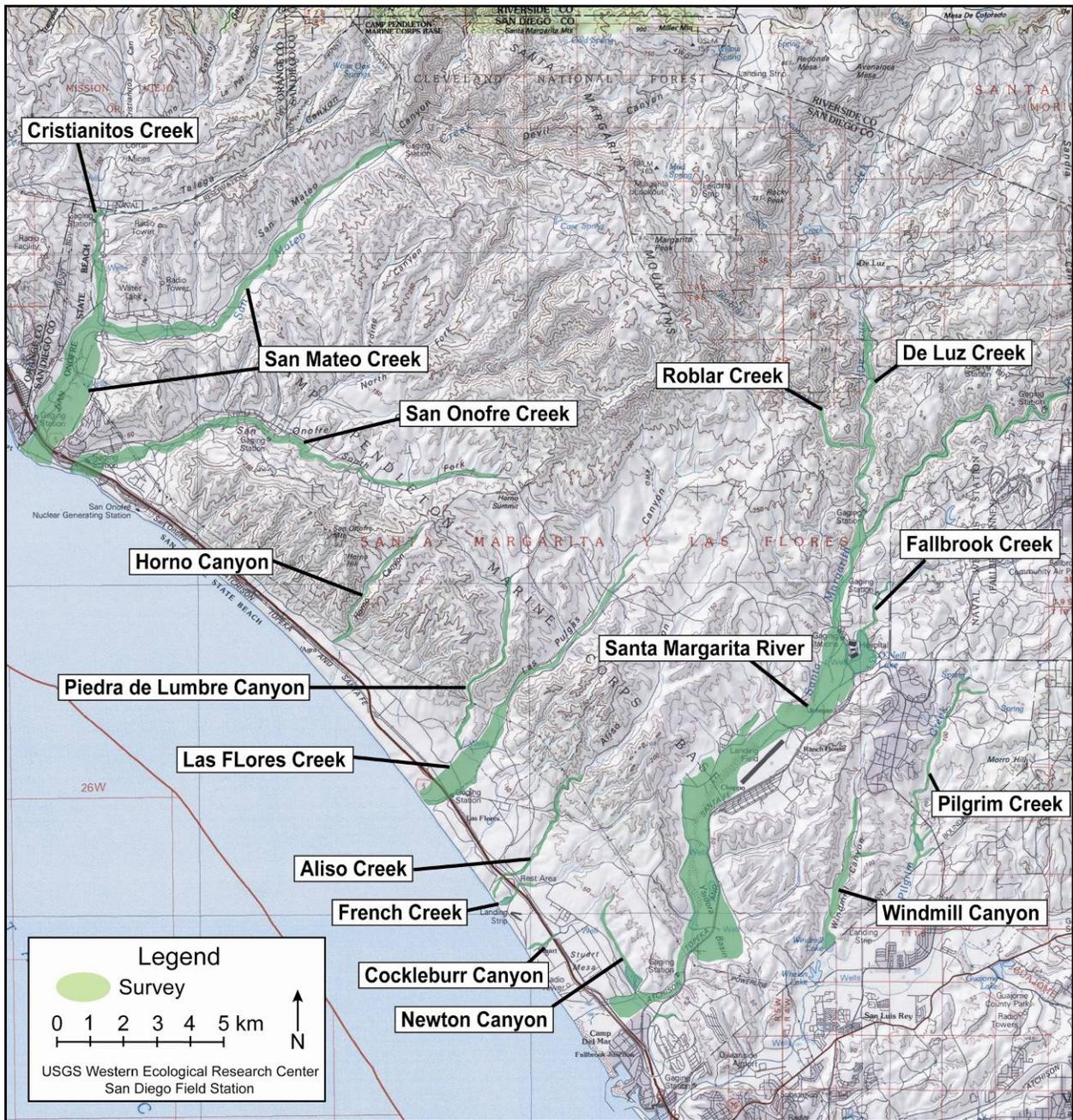


Fig. 1. Southwestern Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2010.

Las Flores Creek: between the Pacific Ocean and a point approximately 800 m upstream of Basilone Road (Appendix A, Fig. 9).

Piedra de Lumbre Canyon: between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Appendix A, Fig. 9).

Horno Canyon: between Old Highway 101 and the upstream limit of riparian habitat (Appendix A, Fig. 9).

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 (Appendix A, Fig. 10).

Windmill Canyon: from the Base boundary to the golf course entrance (Appendix A, Fig. 10).

Drainages were surveyed at least once during each of four consecutive survey periods between 15 May and 31 July. The first period extended from 15 May through 31 May, the second period from 1 June through 21 June, the third from 22 June through 11 July, and the fourth from 12 July through 31 July.

Investigators followed standard survey protocol (Sogge *et al.* 2010), moving slowly (approximately 2 km/hour) 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, choosing routes 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), 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). For all resident flycatchers, territory boundaries were approximated by mapping singing perches and the extent of the male and female's use area on 1":12,000" aerial photographs. Distance to the nearest surface water was recorded for each location, and habitat type was specified according to the following categories based on dominant vegetation:

Mixed willow riparian: Habitat dominated by one or more willow species including black willow (*S. gooddingii*), arroyo willow (*S. lasiolepis*), and red willow (*S. laevigata*), with mule fat (*Baccharis salicifolia*) as a frequent co-dominant.

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

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

Sycamore-oak: Woodlands in which sycamore and oak (*Quercus agrifolia*) occur as co-dominants.

Riparian scrub: Dry and/or sandy habitat dominated by sandbar willow (*S. exigua*) or mule fat, with few other woody species.

Upland scrub: Coastal sage scrub adjacent to riparian habitat.

Non-native: Sites vegetated exclusively with non-native species such as giant reed (*Arundo donax*) and salt-cedar (*Tamarix ramosissima*).

Percent cover of exotic vegetation at each location was estimated using cover categories of <5%, 5-50%, 51-95% and > 95%, and the dominant exotic species recorded.

Nest Monitoring

Pairs were observed for evidence of nesting and nests were 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 to nest sites; typically, there were 3-4 visits/nest. The first visit was timed to determine the number of eggs laid, the next to confirm hatching and age of young, and the last to band nestlings. After a nest became inactive, six possible nest fates were assigned based on the following parameters:

(SUC) Successful: Nest fledged at least one young. Fledging was confirmed by detection of young outside the nest.

(PRE) Nest failed as a result of predation: This includes (1) nests seen in the process of ant or other predation, (2) nests found with evidence such as eggshell fragments, feathers, or partially consumed nestlings in or below the nest, (3) nests with eggs or nestlings later found empty and torn from supporting branch, either partially or completely, typically indicative of mammal predation (Peterson *et al.* 2004), and (4) nests with eggs or nestlings later found intact but empty before the expected fledge date with no evidence of eggs or nestlings on the ground, consistent with snake and bird predation which typically leave no sign (Peterson *et al.* 2004).

(PAR) Nest failed as a result of parasitism: This includes (1) nests that were abandoned with one or more cowbird eggs in the nest, and (2) nests that were tended by the host but contained only cowbird eggs.

(INC) Incomplete: Nests that were seen under construction, but were never completed.

(OTH) Nest failed for other reasons that are known: This includes nests that failed for reasons such as host plant failure, surrounding vegetation falling and crushing a nest, inviable eggs that did not hatch after more than 2 weeks, and human disturbance such as mowing or weed-whacking. This category also includes nests that appeared to have failed as a result of cowbird

“predation” such as (1) abandoned nests containing punctured eggs in or below the nest, (2) nests where nestlings were killed by a puncture wound to the skull, or (3) nests where nestlings were ejected from the nest and found on the ground.

(UNK) Nest failed for unknown reasons: This designation is used when no other reason could be confirmed. In many instances, the fate “UNK” was assigned to nests that were likely depredated, but because we could not confirm egg-laying did not fit the criteria of the “PRE” fate (above). These are explained more fully in results.

Nest site characteristics were recorded following the abandonment or fledging of nests. Measurements included nest height, host species, host height, distance from the nest to the edge of the host species, and distance from the nest to the edge of the clump of riparian vegetation. Distance to edge of clump is expressed as a negative number if the nest is not located in a clump of riparian vegetation. For example, if the nest is located in a field of poison hemlock (*Conium maculatum*) without any other non-hemlock vegetation present, the distance to the nearest clump of riparian vegetation is measured, and the value is expressed as a negative number.

Precipitation Data

Precipitation has been associated with bird population dynamics, especially in arid environments (Boag and Grant 1984; Rotenberry and Wiens 1989, 1991; Chase *et al.* 2005), primarily through its influence on primary productivity (Cody 1981, Grant and Grant 1987). We used Pearson’s correlations to investigate the potential effects of annual precipitation on total number of resident flycatcher territories, average clutch size, and number of young fledged/pair. We also looked at the potential influence of annual precipitation on the number of transient flycatcher detections. We examined precipitation data from three weather stations on Camp Pendleton: Las Flores, Target Range, and Lake O’Neill (OWR 2010). For comparison with resident flycatchers, we chose to use precipitation data from the Lake O’Neill weather station because (1) the Lake O’Neill weather station is located closest to the majority of breeding Willow Flycatchers on Base and (2) the data correlated well with the Target Range data set that was used in previous years (Lake O’Neill x Target Range $r = 0.87$, $P < 0.001$, $n = 11$). Annual precipitation was compiled for each rainfall year (July through June), which measures precipitation during the winter prior to the year of associated flycatcher demographic data (e.g., precipitation from July 2009 through June 2010 is associated with flycatcher data from 2010). Tests were considered significant if $P < 0.10$.

Banding

Nestlings were banded at 7-10 days of age. Each bird received a silver aluminum federal numbered band on the left leg. Unbanded adults were captured in mist nets within their territories and were banded with a numbered federal band on one leg and a solid or bi-colored metal band on the other. Returning second-year birds banded as nestlings in 2009, with a single silver aluminum federal numbered band on the right leg, were recaptured in their territories and banded with a colored metal band on the left leg to yield a full, unique combination.

RESULTS

Population Size and Distribution

Transients

Twenty-five Willow Flycatchers of unknown sub-species were observed during Base-wide surveys (Appendix B, Figs. 12-17). All transients were detected between 17 May and 17 June. Transients occurred on 6 of the 16 drainages surveyed in 2010. No Willow Flycatchers were detected at Cocklebur Canyon, De Luz Creek, Fallbrook Creek, French Creek, Horno Canyon, Newton Canyon, Piedra de Lumbre Canyon, Pilgrim Creek, Roblar Creek, or Windmill Canyon.

Residents

Sixteen Willow Flycatchers, including six males, nine females, and one non-territorial “floater” bird of unknown sex were detected throughout the 2010 breeding season (Appendix B, Figs. 12, 17; Appendix C, Figs. 18-21). Five of the territorial males were paired while one remained single. Four of the five paired males were polygynous with two females each. The non-territorial floater bird was detected on 21 June, in a historical breeding territory (Appendix C, Fig. 20). Although the bird was only seen once, it was determined to be a floater rather than a transient because it was detected after the majority of northbound migrants have already passed through (June 15; Unitt 1987, Sogge *et al.* 2010) and it was banded. In total, ten territories (i.e., one unpaired male and nine female nesting locations) were established in 2010, with nine females forming pair bonds with five male Willow Flycatchers. Overall, the flycatcher population on Base decreased 5.9% from 2009 to 2010 (Fig. 2).

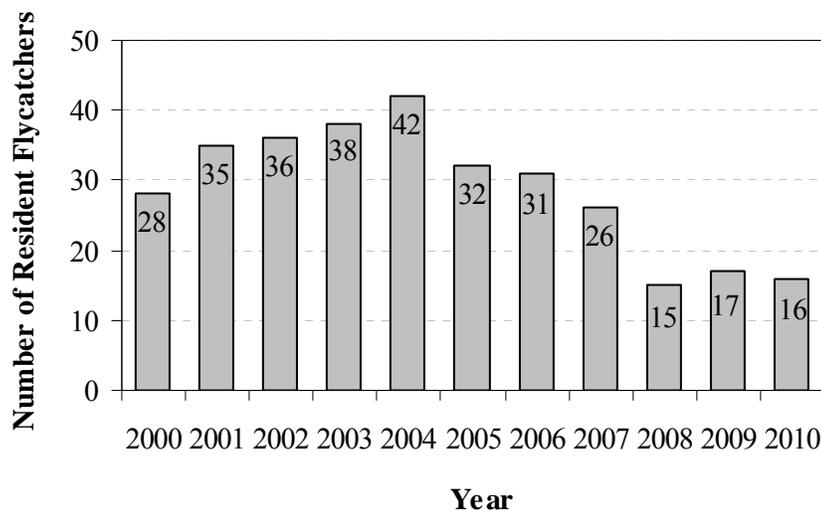


Fig. 2. Southwestern Willow Flycatcher population estimates for Marine Corps Base Camp Pendleton, 2000-2010

Resident flycatchers were restricted to the Santa Margarita River (Appendix B, Fig. 17; Appendix C, Figs. 19-21) and lower San Mateo Creek (Appendix B, Fig. 12; Appendix C, Fig. 18). Along the Santa Margarita River, four core flycatcher breeding areas (those annually supporting multiple flycatcher territories) were occupied in 2010: Air Station, Treatment Ponds, northern Pueblitos, and Pump Road. The Air Station site supported the largest concentration of breeding flycatchers with four pairs. The Treatment Ponds and Pump Road areas each supported two breeding pairs, while the northern portion of Pueblitos hosted a single nesting pair. Overall, flycatcher distribution on the Santa Margarita River remained contracted relative to previous years, with portions of the Santa Margarita River that historically supported resident flycatchers (Vine, Bell, Ysidora Ponds, and the southern portion of Pueblitos breeding areas) was devoid of flycatcher territories in 2010 (Table 1). Flycatcher distribution away from the Santa Margarita River was limited to one single male detected at San Mateo Creek.

Table 1. Distribution of territorial Willow Flycatchers at Marine Corps Base Camp Pendleton, 2000-2010.

		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		
Santa Margarita River		M ^a	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
SWFL Breeding Areas	Above Hospital	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	
	Below Hospital	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Air Station	3	3	2	3	1	1	-	-	1	1	-	-	-	-	2	2	2	2	1	4	2	4	
	Rifle Range	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	
	Pump Road	1	1	3	3	3	3	2	3	5	6	3	6	2	4	3	5	2	1	2	1	1	2	
	Treatment Ponds	1	-	1	-	-	-	-	-	-	-	-	1	-	1	4	2	2	1	1	2	2	2	2
	Pueblitos	4	-	3	4	3	3	4	5	4	4	1	3	3	6	1	1	2	3	2	1	^b	1	
	Ysidora Ponds	4	2	4	4	2	2	2	2	2	4	4	5	2	3	2	1	-	-	-	-	-	-	-
	Bell	2	1	2	2	3	3	1	2	4	6	2	3	1	1	-	-	-	-	-	-	-	-	-
	Vine	2	2	1	1	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Stuart Mesa	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lake O'Neill	1	1	1	1	1	1	2	1	1	1	1	-	2	-	-	-	-	-	-	-	-	-	-	
Las Flores Creek	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
San Mateo Creek	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	1	
Total		18	10	17	18	17	16	16	16	18	22	12	17	12	19	12	14	7	7	8	8	6	9	

^aSex: M = male, F = female. ^bOne males territory spanned two breeding areas; included in Treatment Ponds total

Sources: Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009a, b

Habitat Characteristics

Fifty-three percent (19/36) of all flycatcher sightings occurred in habitat classified as mixed willow riparian, 68% (13/19) of which occurred along the Santa Margarita River (Table 2). Thirty-six percent (13/36) of locations were in riparian scrub dominated by mule fat and/or sandbar willow. An additional 6% (2/36) of birds occupied willow habitat co-dominated by sycamore. The remaining flycatcher detections were in more arid habitats including areas dominated by a mix of sycamores and oaks or upland vegetation. No flycatchers were documented in habitat consisting solely of non-native vegetation. While transients used all habitat types, resident flycatchers were found almost exclusively (10/11) in mixed willow riparian.

Table 2. Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2010.

Bird ID	Drainage	Status ^a	Habitat Type ^b	Exotic Cover Class ^c	Dominant Exotics ^d	Distance to Surface Water (m)
AL01F	Aliso Creek	T	Upland Scrub	3	BRA	500
AL02F	Aliso Creek	T	Riparian Scrub	2	FOE	100
AL03F	Aliso Creek	T	Riparian Scrub	2	BRA	100
CS01F	Cristianitos Creek	T	Mixed Willow	2	BRA	400
CS02F	Cristianitos Creek	T	Riparian Scrub	3	BRA	350
CS03F	Cristianitos Creek	T	Mixed Willow	2	BRA	400
FS01F	Las Flores Creek	T	Mixed Willow	1	-	0
LL01F	Las Flores Creek	T	Oak/Sycamore	3	BRA, CON	375
LL02F	Las Flores Creek	T	Riparian Scrub	3	BRA, CON	375
MAT	San Mateo Canyon	S	Riparian Scrub	1	-	0
MB03F	San Mateo Canyon	T	Riparian Scrub	3	BRA, CON	600
MB04F	San Mateo Canyon	T	Riparian Scrub	2	BRA, CON	930
MT03F	San Mateo Canyon	T	Mixed Willow	2	BRA, CON	10
MU01F	San Mateo Canyon	T	Willow/Sycamore	2	BRA	8
MU02F	San Mateo Canyon	T	Willow/Sycamore	1	-	2
OE01F	San Onofre Creek	T	Riparian Scrub	3	BRA	500
OE02F	San Onofre Creek	T	Riparian Scrub	2	BRA	265
OE03F	San Onofre Creek	T	Mixed Willow	2	BRA, SIL	5
OW01F	San Onofre Creek	T	Mixed Willow	2	BRA	500
APL	Santa Margarita River	P	Mixed Willow	2	CON	50
APR	Santa Margarita River	P	Mixed Willow	2	CON	110
ARC	Santa Margarita River	P	Mixed Willow	2	CON	50
ASA	Santa Margarita River	P	Mixed Willow	2	CON	110
AW01F	Santa Margarita River	T	Mixed Willow	3	BRA, CON	10
BN01F	Santa Margarita River	T	Riparian Scrub	3	CON	40
BN02F	Santa Margarita River	T	Riparian Scrub	2	CON	0
ES99F	Santa Margarita River	T	Mixed Willow	3	CON	250
ETC	Santa Margarita River	P	Mixed Willow	2	CON	98
MYS	Santa Margarita River	T	Riparian Scrub	2	BRA, CON	130
PNB	Santa Margarita River	P	Mixed Willow	2	BRA	154
PRM	Santa Margarita River	P	Mixed Willow	2	CON	175
PRN	Santa Margarita River	F	Mixed Willow	2	CON	130
RR01F	Santa Margarita River	T	Riparian Scrub	2	BRA	10
SG01F	Santa Margarita River	T	Mixed Willow	2	CON, FOE	275
TAR	Santa Margarita River	P	Mixed Willow	2	CON	40
TLM	Santa Margarita River	P	Mixed Willow	1	-	64

^a F = floater resident bird, P = breeding pair, S = single resident male, T = transient.

^b For paired birds, habitat type is assessed within the male's territory boundary, except for those pairs that include polygynous males, in which case habitat type is assessed within the females' use areas.

^c 1 = <5%, 2 = 5-50%, 3 = 51-95%.

^d BRA = black mustard (*Brassica nigra*), CON = poison hemlock, FOE = fennel (*Foeniculum vulgare*), SIL = milk thistle (*Silybum* sp.).

Exotic vegetation was considered the dominant vegetation (percent cover of exotics >50; Table 2) in 22% (8/36) of the sites. All of the exotic-dominated sites were occupied by transient flycatchers (8/8). The most common exotic plants in habitat used by transient flycatchers in 2010 were black mustard and poison hemlock. Within resident flycatcher territories, 82% (9/11) were composed of 5-50% exotic vegetation, primarily poison hemlock.

Flycatcher locations differed in their proximity to surface water (Table 2). On average, transients were almost three times farther from surface water (245 ± 240 m [std]) as were resident flycatchers (86 ± 51 m [std]). All resident flycatchers were located within 200 m of water. In contrast, just 48% (12/25) of transient birds were located within 200 m of water. This is similar to previous years (excluding the wet year of 2005), when transients were typically 2-5 times as far from water as were residents (Kus and Kenwood 2003, 2005, 2006a, b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009a, b).

Annual Effects of Precipitation on Population Size and Productivity

The number of resident Southwestern Willow Flycatcher territories detected on an annual basis showed no correlation with precipitation ($r = 0.14$, $P = 0.68$), however; a comparison between transient Willow Flycatchers and annual precipitation levels was marginally significant ($r = 0.56$, $P = 0.12$; Fig 3). Comparisons between annual precipitation and flycatcher productivity yielded mixed results; we found no significant relationship between precipitation and young/pr on Camp Pendleton ($r = 0.29$, $P = 0.39$); however, we found that average clutch size was positively correlated with annual precipitation ($r = 0.55$; $P = 0.08$; Fig. 4).

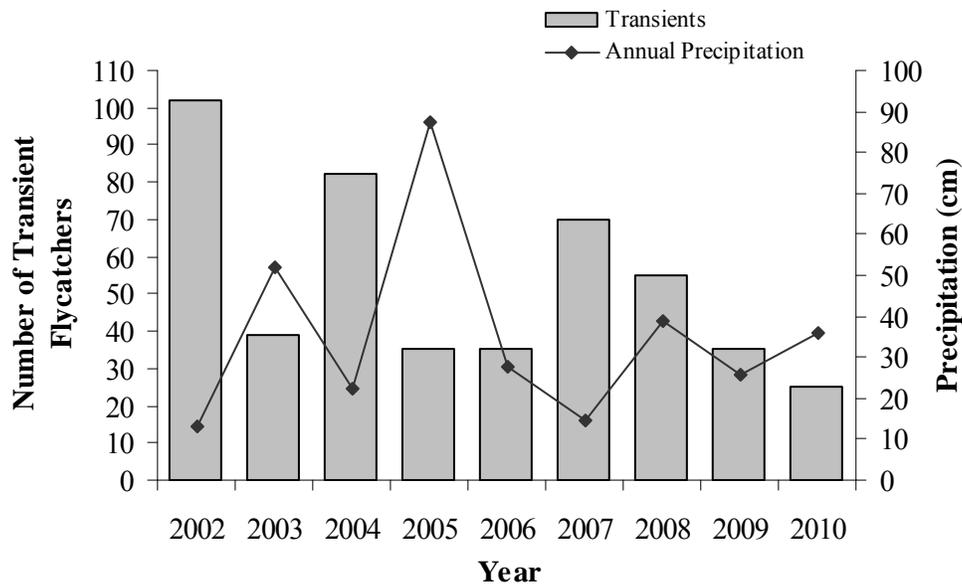


Fig. 3. Number of Transient Willow Flycatchers in relation to total precipitation in the preceding rainfall year (July – June), 2002-2010.

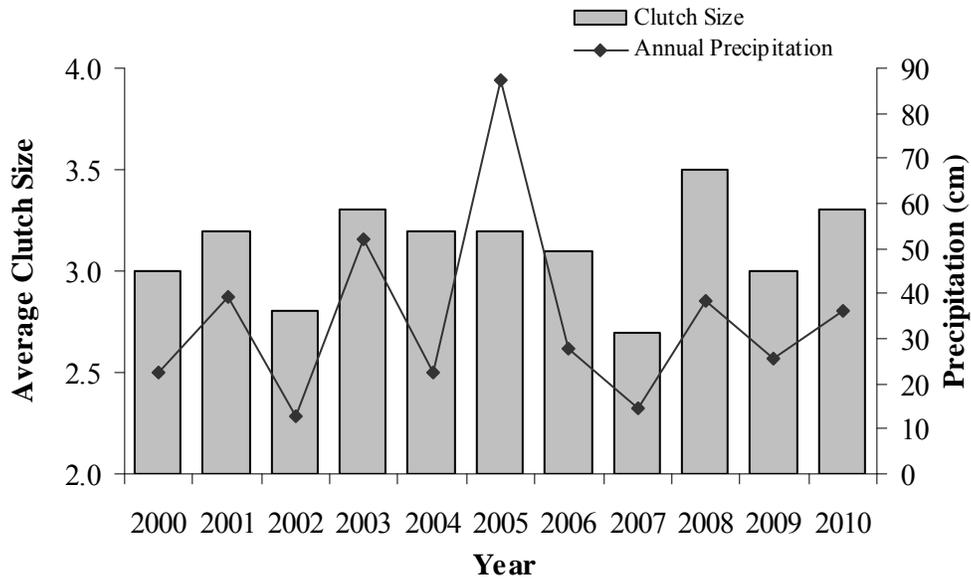


Fig. 4. Average clutch size of Southwestern Willow Flycatchers in relation to total precipitation in the preceding rainfall year (July – June), 2000-2010.

Breeding Activities

Nesting was observed for all of the nine pairs (Table 3). Nesting was initiated in early June. The earliest confirmed lay date was 2 June and the latest was 13 July. Two pairs attempted a second nest, both following an unsuccessful initial attempt. Nesting continued into August, with the last young fledging on 12 August. Of the nine breeding pairs, 89% (8/9) fledged young during the 2010 breeding season.

Eleven nesting attempts by Willow Flycatchers were documented during the 2010 breeding season. Seventy-three percent (8/11) of nests successfully fledged at least one flycatcher young. Although no predation events were witnessed, predation was believed to be the primary source of nest failure, accounting for 100% of nest failures. All predation events took place during the nestling stage. Of the three pairs whose nests were depredated, two re-nested successfully. The female from the third pair disappeared after her nest failed.

Mean clutch size, estimated from ten nests known to have full clutches, was 3.3 ± 0.7 eggs. One nest contained three eggs that did not hatch. Twenty-one fledglings were produced, yielding a seasonal productivity of 2.3 young/pair (21 young/9 pairs).

Table 3. Nesting activity of Southwestern Willow Flycatcher pairs at Marine Corps Base Camp Pendleton in 2010.

Pair ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Nest Fate ^a	Comments
APL	12-Jun-10	4	4	0	PRE	Nest on the ground, appeared to have been ripped from supporting branch.
	13-Jul-10	3	3	3	SUC	
APR	10-Jun-10	3 ^b	3 ^b	3	SUC	Nest found at fledgling stage.
ARC	14-Jun-10	3	3	3	SUC	
ASA	19-Jun-10	3	3	3	SUC	
ETC	25-Jun-10	3	3	3	SUC	
PNB	12-Jul-10	2	2	2	SUC	
PRN	12-Jun-10	4	1	1	SUC	Three eggs did not hatch.
TAR	14-Jun-10	4	4	0	PRE	Nest intact but empty.
TLM	02-Jun-10	4	4	0	PRE	Nest intact but empty.
	06-Jul-10	3	3	3	SUC	

^a PRE = Nest failed as a result of predation, SUC = Nest fledged at least one young.

^b Minimum number, based on number of fledglings observed.

Nest Site Characteristics

Flycatchers placed nests in five species of plants (Table 4), including arroyo willow, black willow, sandbar willow, mule fat, and poison hemlock. Ninety-one percent of nests were placed in native species: 82% (9/11) in willow and 9% (1/11) in mule fat. The remaining nest (9%, 1/11) was placed in the exotic species poison hemlock. Nest height averaged 2.0 ± 0.9 m, while host height averaged 4.6 ± 3.3 m.

Table 4. Nest site characteristics of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2010. All measurements are in meters.

Pair ID	Nest ID	Host Species	Host Height	Nest Height	Distance to the edge of:	
					Host Plant	Clump
APL	1	Sandbar willow	3.5	1.6	0.5	3.0
APL	2	Sandbar willow	3.7	1.9	0.3	5.0
APR	1	Sandbar willow	2.4	1.4	0.5	6.0
ARC	1	Arroyo willow	4.1	2.4	0.9	1.0
ASA	1	Sandbar willow	2.6	1.8	0.1	6.2
ETC	1	Black willow	7.8	4.0	2.0	6.2
TAR	1	Arroyo willow	13.0	1.4	1.0	2.5
TLM	1	Mule fat	2.0	1.3	0.2	2.5
TLM	2	Sandbar willow	5.6	3.0	1.2	1.5
PNB	1	Poison hemlock	2.6	1.5	0.1	5.0
PRM	1	Sandbar willow	2.9	1.2	0.2	3.2

Cowbird Parasitism

All nests were checked for the presence of cowbird eggs. No nest parasitism of Southwestern Willow Flycatcher nests by Brown-headed Cowbirds was documented in 2010.

Banded Birds

All resident Willow Flycatchers were observed closely enough to determine with confidence whether they were banded (Table 5). Sixty-seven percent (4/6) of males, 78% (7/9) of females, and the unknown sex floater were banded in previous years. Of these, two second-year females and one second-year male that were banded with a single federal band as nestlings in 2009 were recaptured and banded with a second band to provide unique combinations. Additionally, one male and one female originally banded as nestlings in 2008 were recaptured and given unique combinations. All birds whose band combination could be determined were originally banded on Camp Pendleton.

Four unbanded adults, two male and two female, were captured and banded with a unique combination. Twenty-five nestlings from nine nests were banded (Appendix D). All except three nestlings from TLM and four nestlings from TAR are believed to have fledged.

The colored pin-striping on the MAT male's band appeared to have partially peeled off, rendering identification impossible. The male was unresponsive to target-netting and could not be recaptured to confirm his identity.

No banded transients were detected during surveys.

Table 5. Band status of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2010.

Territory / Bird ID	Status ^a	Male Banded? ^b	Female Banded? ^b	Nestlings Banded?	Comments ^c
APL	P	Msi : puor	Msi : yedb	3	Male banded in 2010. Female banded in 2008 as a nestling at Treatment Ponds and color-banded in 2010. Male polygynous with one other female (ASA).
ASA	P	Msi : puor	bkwh : Msi	3	Female banded in 2009 as a nestling at Pueblitos and color-banded in 2010. Male polygynous with one other female (APL).
APR	P	Msi : orbk	Msi : orye		Male banded in 2008 as a nestling at Pueblitos and color-banded in 2010. Female banded in 2008 as a nestling at Treatment Ponds. Male polygynous with one other female (ARC).
ARC	P	Msi : orbk	Msi : bkpu	3	Female banded in 2010. Male polygynous with one other female (APR).
ETC	P	Msi : yewh	Msi : reor	3	Male banded in 2008 as an adult at Pueblitos. Female banded in 2008 as a nestling at Pump Road. Male polygynous with one other female (TLM).
TLM	P	Msi : yewh	bkpu : Msi	6	Female banded in 2007 as a nestling at Air Station. The female's band was changed; originally banded redg : Msi. Male polygynous with one other female (ETC).
PNB	P	whpu : Msi	rewh : Msi	2	Male banded in 2009 as a nestling at Air Station and color-banded in 2010. Female banded in 2009 as a nestling at Pueblitos and color-banded in 2010. Male polygynous with one other female (PRM).
PRM	P	whpu : Msi	Msi : orpu	1	Female banded in 2010. Male polygynous with one other female (PNB).
TAR	P	Msi : pure	Msi : whwh	4	Male banded in 2010. Female banded in 2008 as a nestling at Air Station.

^a F = floater resident bird, P = breeding pair, S = single resident male.

^b Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands*: bkpu = black-purple split, bkwh = black-white split, orbk = orange-black split, orpu = orange-purple split, orye = orange-yellow split, puor = purple-orange split, pure = purple-red split, redg = red-dark green split, reor = red-orange split, rewh = red-white split, sire = blank silver-red split, whpu = white-purple split, whwh = white, yedb = yellow-dark blue split, yewh = yellow-white split.

^c See Fig. 5; Appendix B, Figs. 12, 17; Appendix C, Figs. 18-21 for breeding area and territory locations.

Table 5 (*continued*). Band status of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2010.

Territory / Bird ID	Status ^a	Male Banded? ^b	Female Banded? ^b	Nestlings Banded?	Comments ^c
MAT	S	Msi : sire	N/A		Male was banded, but colored pin-striping on top of band appears to have peeled off. Identity could not be confirmed, but the remaining combination matches male occupying this territory in 2009.
PRN	F		? : Msi		Unknown sex bird, only right leg seen. Could not be recaptured to confirm identity.

^a F = floater resident bird, P = breeding pair, S = single resident male.

^b Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands*: bkpu = black-purple split, bkwh = black-white split, orbk = orange-black split, orpu = orange-purple split, orye = orange-yellow split, puor = purple-orange split, pure = purple-red split, redg = red-dark green split, reor = red-orange split, rewh = red-white split, sire = blank silver-red split, whpu = white-purple split, whwh = white, yedb = yellow-dark blue split, yewh = yellow-white split.

^c See Fig. 5; Appendix B, Figs. 12, 17; Appendix C, Figs. 18-21 for breeding area and territory locations.

Survivorship, Site Fidelity, and Movement

The recapture and resighting of banded birds allowed us to determine the proportion of flycatchers previously documented on Base that returned to hold territories in 2010. Although this is the minimum number of flycatchers known to survive, and does not include birds that dispersed off Base or that we may have failed to detect/resight, it can be used as an inference to calculate minimum annual survivorship for the flycatcher population on Base. Of the uniquely banded adult flycatchers present during the 2009 breeding season, 14% (1/7) of males and 50% (3/6) of females returned to Camp Pendleton in 2010. Overall, adult survivorship from 2009 on Camp Pendleton was 31% (4/13). Return rates were calculated based on banded birds with confirmed, unique color-band combinations, and do not include the MAT male whose original band combination could not be confirmed. However, the partial combination (Msi: blank silver/red) matched the male that occupied the same territory in 2009 (Msi: dark blue/red). The return rate also excludes the TLM female who possessed a blank color combination (blank silver: Msi) at the beginning of the 2010 breeding season. A female with the same blank combination nested in the TLM territory in 2009, but avoided recapture. The bird was recaptured in 2010 and was determined to be a bird last seen in 2008. Because adult flycatchers exhibit high site fidelity, it is likely that both the MAT male and TLM female were present during the 2009 breeding season. If these birds are incorporated into the survivorship calculations, the estimate of total adult survivorship from 2009 on Camp Pendleton increases to 43% (6/14), with revised male and female return rates of 29% (2/7) and 57% (4/7), respectively.

Three of the 11 nestlings banded in 2009 that survived to fledge were resighted and recaptured at Camp Pendleton in 2010, and 1 additional 2009 nestling was captured off-Base, yielding a first-year survivorship estimate of 36% (4/11). The three birds returning to Camp Pendleton included two females and one male (Table 6). All returning second-year birds paired and successfully nested in 2010. Two birds last seen as nestlings in 2008 reappeared in 2010,

increasing the first-year survivorship estimate of the 2009 population from 25% (Howell and Kus 2009b) to 35% (7/20).

Willow Flycatchers at Camp Pendleton generally settle into breeding concentrations or areas where groups of birds establish territories (Fig. 5). Resighting banded birds allowed us to identify individuals that returned to the same area they used the previous year. In 2010, five of the six banded returning adults (83%, including MAT and TLM) returned to the breeding area they occupied in 2009 (Table 6). Of these five, two were male and three were female. Three of the five birds, one male and two females, either returned to the same territories they previously occupied, or occupied a territory that encompassed a portion of the area they previously defended. The other two birds, one male and one female, moved a short distance within the same breeding area they occupied in 2009. One of the six banded returning adults (17%) moved to a different breeding area within the Santa Margarita River in 2010 (Table 6, Fig. 4). The female flycatcher moved from the Air Station area to the Pueblitos area, approximately 1.6 km away. The average distance moved by adult flycatchers between the 2009 and 2010 breeding seasons was 0.4 ± 0.6 km.

In contrast to returning adults, none of the three returning second-year birds banded as nestlings in 2009 returned to their natal areas to breed. The second-year male, banded as a nestling in the Air Station area, dispersed to the Pump Road area, approximately 1.4 km away (Table 6, Fig. 4). The two second-year females were siblings from the Pueblitos area; one dispersed to the Air Station area and one dispersed to the Pump Road area, approximately 1.8 and 0.6 km away, respectively (Table 6, Fig. 4). Additionally, the two birds last seen as nestlings in 2008, but were known to breed for the first time on Camp Pendleton in 2010, also dispersed away from their natal areas. The average distance that second-year birds and first time breeders dispersed from their natal areas was 1.4 ± 0.5 km.

Two instances of emigration occurred during the 2010 breeding season. The first instance involved a single male, originally banded as a nestling in 2009 in the Air Station area, which was detected 62 km south of the Base on the San Diego River (Lynn and Kus 2010). The second instance involved a female originally banded as an adult on Base in 2009 in the Air Station area. The female paired with a male on the San Luis Rey River near Bonsall, approximately 13 km away (Lynn *et al.* 2010a). No instances of immigration were seen in 2010.

No instances of movement by adult Willow Flycatchers within the 2010 season were observed.

Table 6. Between-year, between-area movement of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2010.

Year Last Detected	Breeding Area ^a (Territory Last Detected)	Breeding Area (Territory in 2010)	Dispersal Distance (km)	Band Combination ^b	Age in 2010	Sex ^c
2009	Pueblitos (ETA)	Pueblitos/Treatment Ponds (ETC/TLM)	0.2	Msi : yewh	≥ 3 yrs	M
2009	San Mateo Creek (MB05F) ^d	San Mateo Creek (MAT)	0.0	Msi : sire	2 yrs	M
2008	Pueblitos (ETC)	Treatment Ponds (TLM)	0.1	bkpu : Msi	3 yrs	F
2009	Air Station (APL)	Pueblitos (ETC)	1.6	Msi : reor	2 yrs	F
2009	Air Station (ASA)	Air Station (APR)	0.2	Msi : orye	2 yrs	F
2009	Treatment Ponds (TAR)	Treatment Ponds (TAR)	0.0	Msi : whwh	2 yrs	F
2008	Pueblitos (ETA)	Air Station (APR/ARC)	1.6	Msi : orbk	2 yrs	M
2008	Treatment Ponds (TAR)	Air Station (APL)	1.4	Msi : yedb	2 yrs	F
2009	Air Station (ASA)	Pump Road (PNB/PRM)	1.4	whpu : Msi	1 yr	M
2009	Pueblitos (ETA)	Air Station (ASA)	1.8	bkwh : Msi	1 yr	F
2009	Pueblitos (ETA)	Pump Road (PNB)	0.6	rewh : Msi	1 yr	F

^a See Fig. 5, Appendix B, Figs. 12, 17; Appendix C, Figs. 18-21 for breeding area and territory locations.

^b Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands*: bkpu = black-purple split, bkwh = black-white split, orbk = orange-black split, orye = orange-yellow split, reor = red-orange split, rewh = red-white split, sire = blank silver-red split, whpu = white-purple split, whwh = white, yedb = yellow-dark blue split, yewh = yellow-white split.

^c Sex: M = male, F = female.

^d Most likely this individual, but band combination not 100% confirmed.

Human Activities in Riparian Habitat

No evidence of human activities in riparian habitat occupied by Willow Flycatchers was witnessed during the 2010 breeding season. However, prior to the breeding season, a large swath of riparian vegetation was removed for power line maintenance in the Northern Pueblitos breeding area. The area where the removal took place has had at least one occupied flycatcher territory in 9 of the last 10 years since monitoring began in 2000 (Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009a, b); however, the area was unoccupied in 2010.

Removal of exotic vegetation including giant reed and salt-cedar took place along the downstream portion of Santa Margarita River during the preceding winter in many areas that were once occupied by resident Willow Flycatchers.

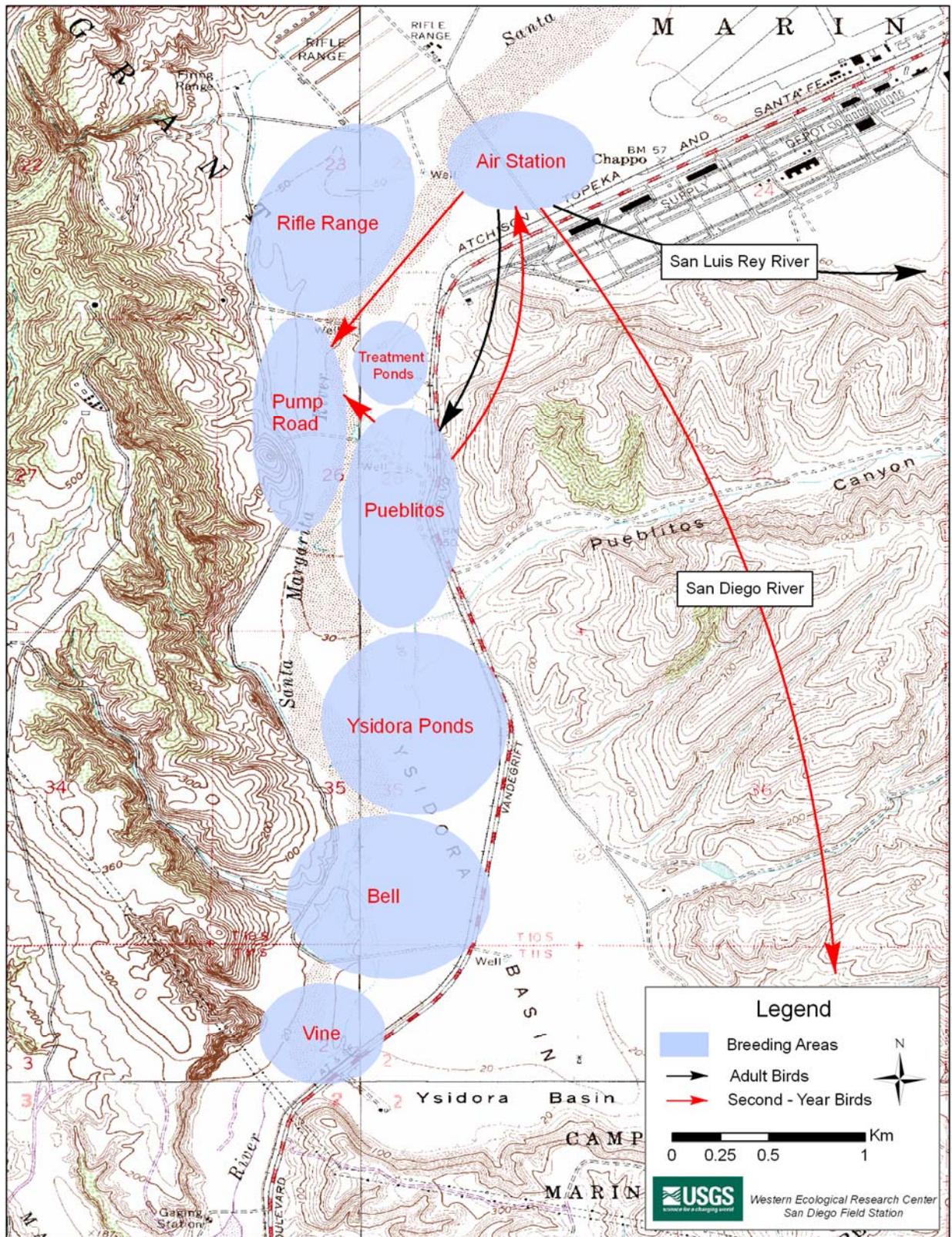


Fig. 5. Between-year, between-area movement by adult and second-year Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton, 2010.

DISCUSSION

Camp Pendleton continues to provide important habitat for both migrating and breeding Willow Flycatchers. The number of transient flycatchers detected in 2010 (25) was down from 2009 (35; Howell and Kus 2009b). Prior to 2010, the number of transients detected annually from 2002-2009 ranged from 35-102, despite consistent survey scope and efforts (Kus and Kenwood 2003, 2005, 2006a, b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009a, b). Although factors influencing the migratory route of transient Willow Flycatchers are unclear, it is possible that they are responding to ecological variables such as precipitation when choosing a migration route. In years with low rainfall, it appears that more Willow Flycatchers migrate through Camp Pendleton, whereas fewer birds were detected in years with higher precipitation. This may be related to differences in food availability in coastal environments; it is possible that coastal vegetation is less affected by fluctuations in precipitation and supports a more reliable prey base for migrating flycatchers. A Willow Flycatcher diet study in Arizona found a five-fold difference in arthropod biomass collected during a drought year (2002) compared to the following higher precipitation year (Durst 2004). Effects from low precipitation may be more pronounced along inland migration routes.

The resident population of Southwestern Willow Flycatchers on Camp Pendleton in 2010 (16 individuals) declined slightly compared to 2009 (17, Howell and Kus 2009b). In 2010, the sex ratio was once again skewed towards females following 2 years (2008-2009) of an equal sex ratio. Females (nine) outnumbered males (six), and the high degree of polygyny in the population reflects this. The number of paired males with multiple females hit a record high of 80%, compared to 20% in 2009, although in 2009, one male was polygynous with four females (Howell and Kus 2009b). The rate of male polygyny has ranged from 0-75% since monitoring began in 2000 (Kus 2001; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009a, b). The rate of female polygyny was also at a record high with 89% of females sharing mates, compared to 57% (2008) and 50% (2009) when the number of males and females on Base was equal (Howell and Kus 2009a, b). Continued monitoring at Camp Pendleton, combined with information from other polygynous populations of Willow Flycatchers (Davidson and Allison 2003; Pearson *et al.* 2006), should enhance our understanding of the basis for polygyny in this species, and its implications for genetic viability of the population.

As in previous years, resident flycatchers were largely distributed among historic breeding locations, although the number of territories in each location differed compared to previous years. Breeding flycatchers on the Santa Margarita River in 2010 increased slightly (nine pairs) compared to 2009 (eight pairs; Howell and Kus 2009b). The number of resident flycatcher territories at one of the four core breeding areas increased, one remained the same, and the remaining two decreased. Most of the change in distribution resulted from a lack of single males; there were none present on the Santa Margarita River in 2010. The Pump Road area increased relative to 2009, supporting two breeding pairs and a non-territorial floater, up from one breeding pair and one single male. The Treatment Ponds area remained the same as in 2009, hosting two breeding pairs. Four resident pairs were documented within the Air Station site, down from four pairs and a single male in 2009. Resident flycatchers in the Pueblitos area decreased to one breeding pair, down from one pair and a single male in 2009. While three

single males were present in 2009, in 2010 all males present on the Santa Margarita River were paired. One explanation for the lack of single males may be that many experienced males did not return in 2010, opening up multiple areas of high quality habitat for new males to occupy, rather than being pushed into areas of less optimal habitat where they may remain single. Factors influencing territory selection from year to year are poorly understood and continued research may contribute to a better understanding of habitat selection in flycatchers. The distribution of resident flycatchers away from the Santa Margarita River was limited to a single male near San Mateo Creek. San Mateo Creek was initially colonized by a nesting pair in 2007 (Rourke *et al.* 2008), was devoid of resident flycatchers in 2008 (Howell and Kus 2009a), and hosted a single male in 2009 (Howell and Kus 2009b).

The proximity of the breeding sites on the Santa Margarita River allows movement between locations annually, and often within breeding seasons. In 2010, the majority (83%; 5/6) of adult flycatchers returned to the breeding area they occupied in 2009. Between-year site fidelity is highly variable from year to year, ranging from a low of 40% in 2008 (Howell and Kus 2009a) to a high of 88% in 2009 (Howell and Kus 2009b). Habitat condition and suitability are likely important factors in annual flycatcher movement between breeding sites. It is possible that flycatchers may be evaluating the habitat within the matrix of breeding sites on the Santa Margarita River each year in an attempt to maximize their fitness. High site fidelity in 2009 and 2010 suggests that the areas being occupied represent the most suitable habitat currently available on Base. In contrast to adults, all returning 2009 nestlings dispersed to areas away from their natal territories.

Nest success remained high during the 2010 breeding season, with 73% of nests fledging at least one flycatcher young, down from a high of 88% in 2008, but still above the 2001-2009 annual mean (59%; Kus and Ferree 2002; Kus and Kenwood 2003, 2005, 2006a, b; Kenwood and Kus 2007; Rourke *et al.* 2008; Howell and Kus 2009a, b). In addition, seasonal productivity was high at 2.3 young/pair, up from 1.4 young/pair in 2009. While we found no relationship between annual precipitation and young/pair, we did find a significant relationship between annual precipitation and average clutch size. Average clutch size (3.3 eggs/nest) was higher than in 2009 (3.0 eggs/nest; Howell and Kus 2009b) and slightly above the 2001-2009 annual mean (3.1 eggs/nest). Twenty-one young were fledged in 2010, almost double the number fledged in 2009 (11; Howell and Kus 2009b).

The return rate of banded adults between 2009 and 2010 (31%) was extremely low and matched the rate seen in 2005 when only 31% of banded birds from the previous year returned (Kus and Kenwood 2006b). Only one banded male from 2009 (1/7) returned in 2010 (excluding the MAT male, whose identity could not be confirmed), while 50% of females seen in 2009 were present in 2010. The low return rate of males was somewhat expected, as a large percentage (71%) of banded males present in 2009 were ≥ 4 years old. None of the older birds returned and two new unbanded males and two second-year males established territories in 2010. The return of second-year birds (27%) to Camp Pendleton in 2010 was just below the adjusted rate for 2009 (30%; 6/20), and well above the mean (15.6%) from 2000-2009. The total percentage of adults within the breeding population that were banded as nestlings tends to increase annually. In 2010, 67% (10/15; including the MAT male) of the adult flycatchers on Base were originally banded as nestlings, compared to 53% (9/17) in 2009 (Howell and Kus 2009b), 40% (6/15) in 2008

(Howell and Kus 2009a), and 31% (8/26) in 2007 (Rourke *et al.* 2008). The presence of such a large percentage of natal banded birds creates the opportunity to collect life-time reproductive data for a growing segment of the population, which will facilitate identification of age- and sex-specific patterns in life history characteristics that influence population size, productivity, and genetic structure.

As the flycatcher population on Camp Pendleton decreases, the risk of inbreeding will likely increase (Meffe and Carroll 1997). At least one case of inbreeding has been documented on Base; in 2006, a male bred with one of his offspring from the prior year (Kenwood and Kus 2007). However, the potential for inbreeding is reduced through immigration and emigration, which has been documented on Base 11 times since 2002, with eight individuals immigrating from the nearby population on the San Luis Rey River (9-24 km distance; Kus and Kenwood 2003, 2006a, b; Kenwood and Kus 2007; Howell and Kus 2009a), and three birds emigrating off Base, two to Guajome Regional Park on the San Luis Rey River (Kus and Kenwood 2005), and one to the San Diego River (Lynn *et al.* 2010b).

In addition to the banded birds that immigrate onto Camp Pendleton, each year unbanded flycatchers are detected on Base. These unbanded flycatchers could be moving onto Base from other nearby populations, such as the population on the upper San Luis Rey River. While no immigration of banded birds onto Base was seen in 2010, four unbanded flycatchers entered the breeding population; all established territories and bred successfully.

Two instances of emigration off Base were observed in 2010. A female that bred unsuccessfully in the Air Station area in 2009 moved to the San Luis Rey River near Bonsall. Whether her unsuccessful attempt in 2009 precipitated her move is unclear. A second-year male dispersed from his natal site in the Air Station breeding area to the San Diego River, a distance of 62 km. This is the second year in a row that a Camp Pendleton natal bird has been detected on the San Diego River. These detections are an encouraging sign that movement between regional flycatcher populations may not be limited to sources close to Camp Pendleton. With historical sources such as Whelan Lake and Guajome Regional Park on the San Luis Rey River now defunct, long distance dispersal will become increasingly important in maintaining genetic diversity in the Camp Pendleton population. Further banding and resighting of flycatchers throughout their range will allow a better determination of the extent of movement between populations and the role such movement plays in maintaining genetic diversity and persistence in these populations.

With the continued decline of Southwestern Willow Flycatchers on Base, communication between AC/S, Environmental Security and other military departments will become increasingly important. Coordination of maintenance activities such as vegetation clearing through AC/S, Environmental Security will minimize impacts in active territories. Coordination and cooperation among the various departments will help maintain a balance between the sometimes competing land uses on Base including military activities, recreation, habitat protection, and endangered species management.

CONCLUSIONS

The Southwestern Willow Flycatcher population in California appears to be experiencing a statewide decline, rather than one isolated to Camp Pendleton. Populations on the Kern River (Schuetz *et al.* 2008) and the lower San Luis Rey River (Ferree and Kus 2008) have experienced steep declines or been eradicated in recent years. The exception appears to be the upper San Luis Rey population, where the number of territories declined only slightly between 1999 (18; Kus *et al.* 1999) and 2009 (15; Howell and Kus 2010). It is encouraging that four unbanded flycatchers were detected on Base in 2010, suggesting that there are still viable breeding populations in the region from which emigration can occur. This also suggests that the habitat on Camp Pendleton is still suitable for flycatchers. This may be in part a result of management actions on Base, specifically the restoration of riparian habitat, including the removal and treatment of invasive exotics such as giant reed. The flycatcher population on Base has contracted to the midstream portions of the Santa Margarita River, bypassing areas further south that were historically occupied, but until recently still contained giant reed. The removal of invasive exotics from the final stretch of the Santa Margarita River during the winter of 2010 provides an opportunity for re-colonization. As the native vegetation recovers, there is hope that Southwestern Willow Flycatchers will re-colonize these areas, leading to an increase in the population and enhancing recovery of flycatchers on Base and in the region.

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APPENDIX A

**SOUTHWESTERN WILLOW FLYCATCHER SURVEY AREAS AT MARINE CORPS
BASE CAMP PENDLETON, 2010**

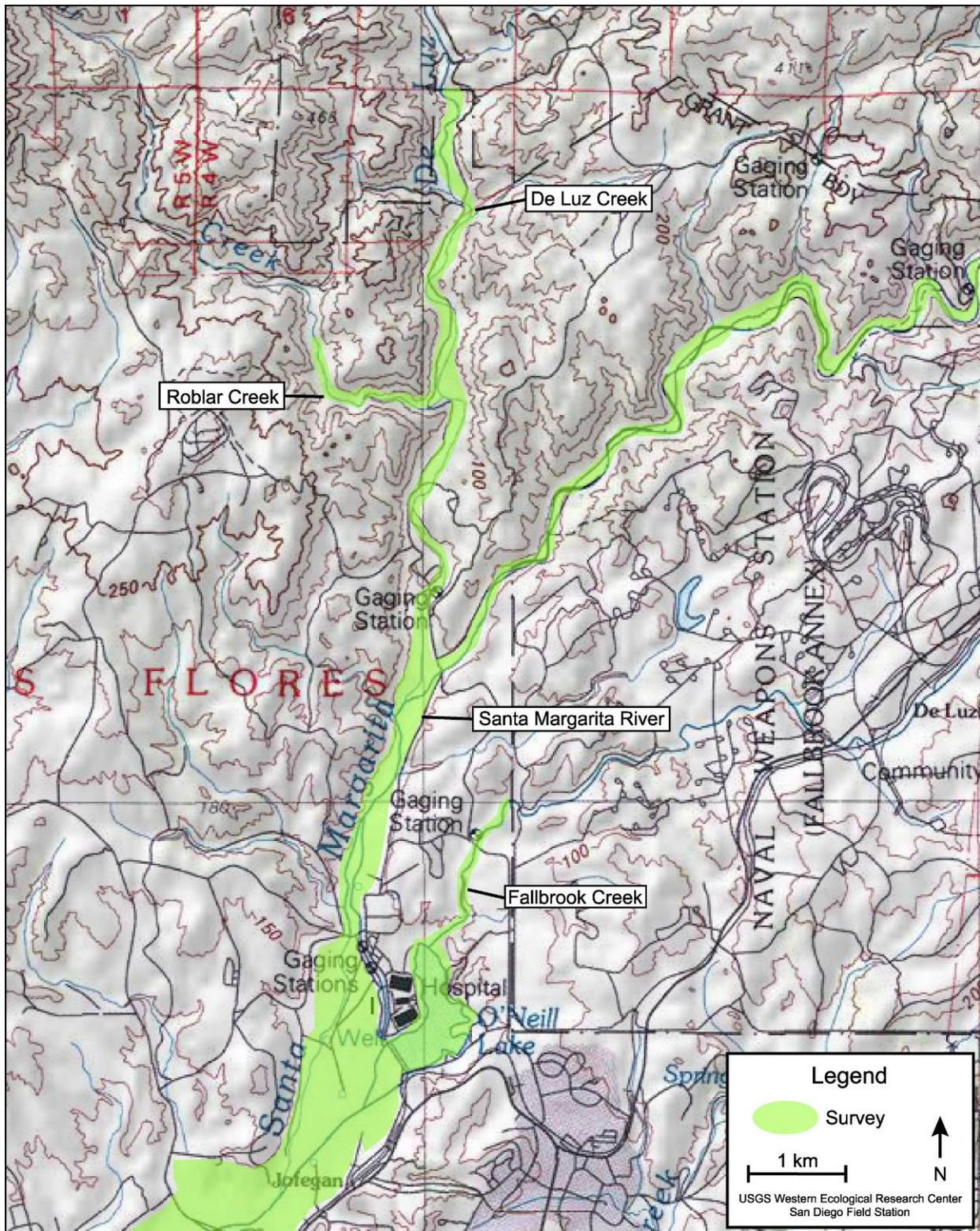


Fig. 6. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2010: Santa Margarita River, Fallbrook Creek, De Luz Creek and Roblar Creek.

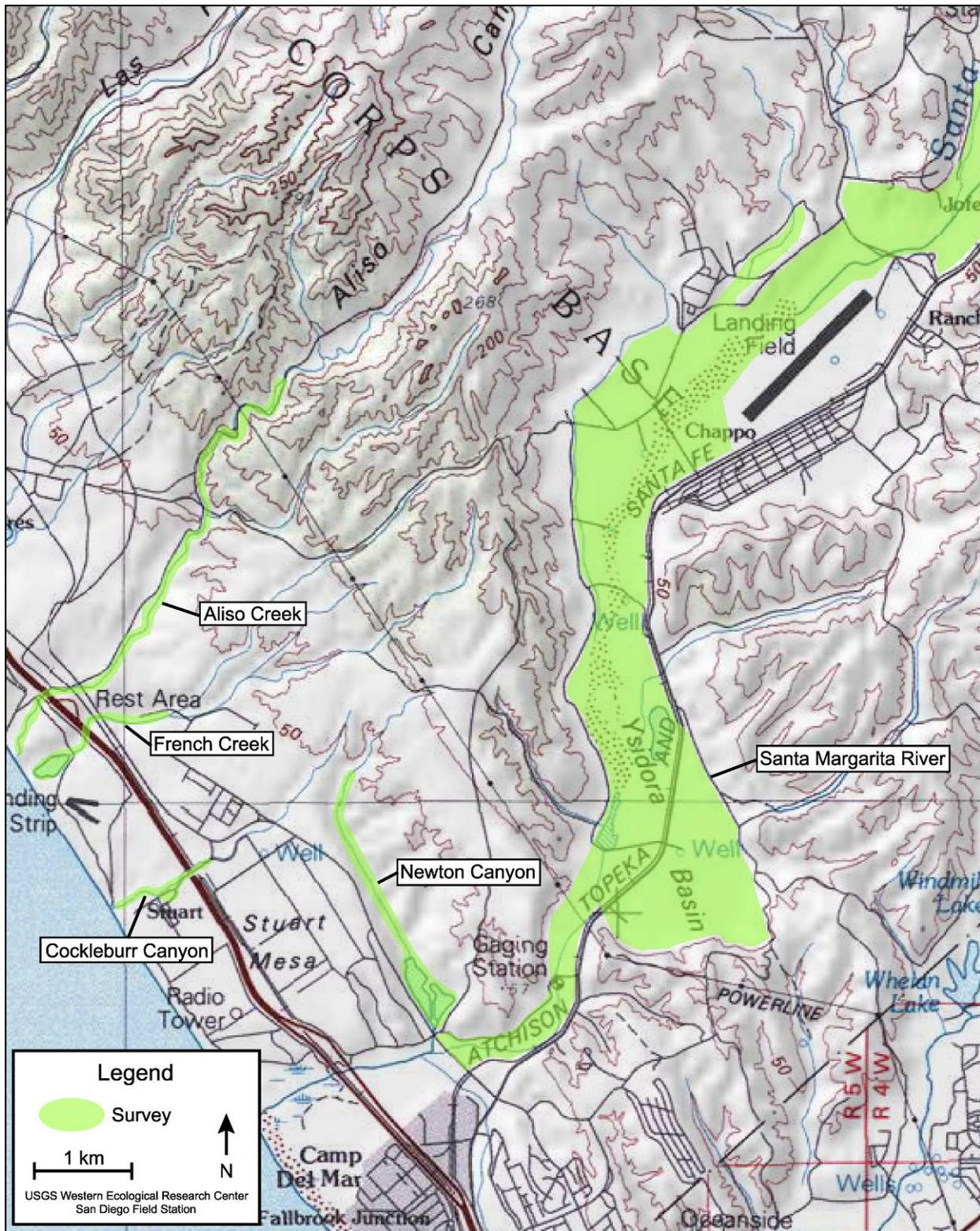


Fig. 7. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2010: Santa Margarita River, Newton Canyon, Cocklebur Canyon, French Creek, and Aliso Creek.

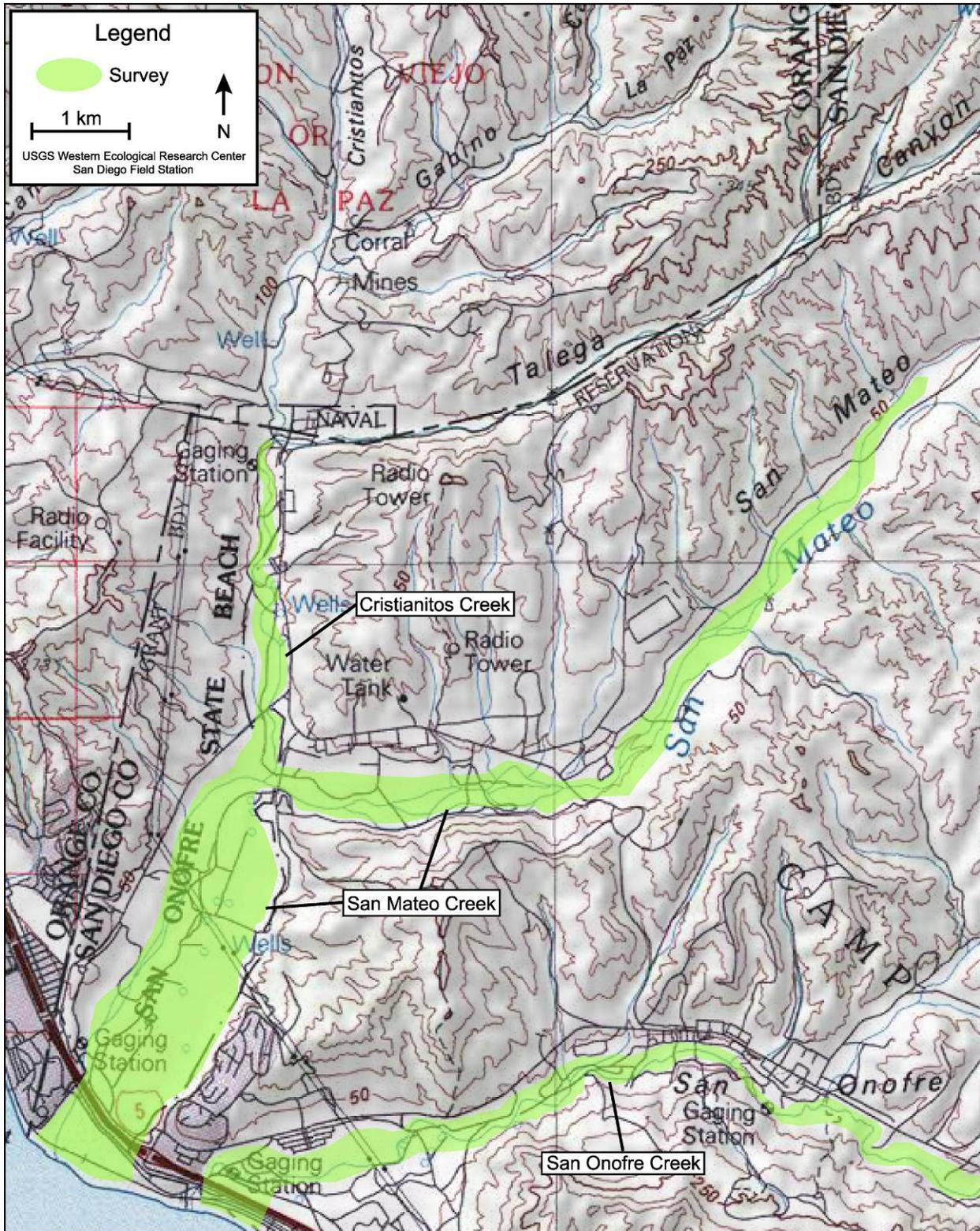


Fig. 8. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2010: Cristianitos Creek, San Mateo Creek and San Onofre Creek.

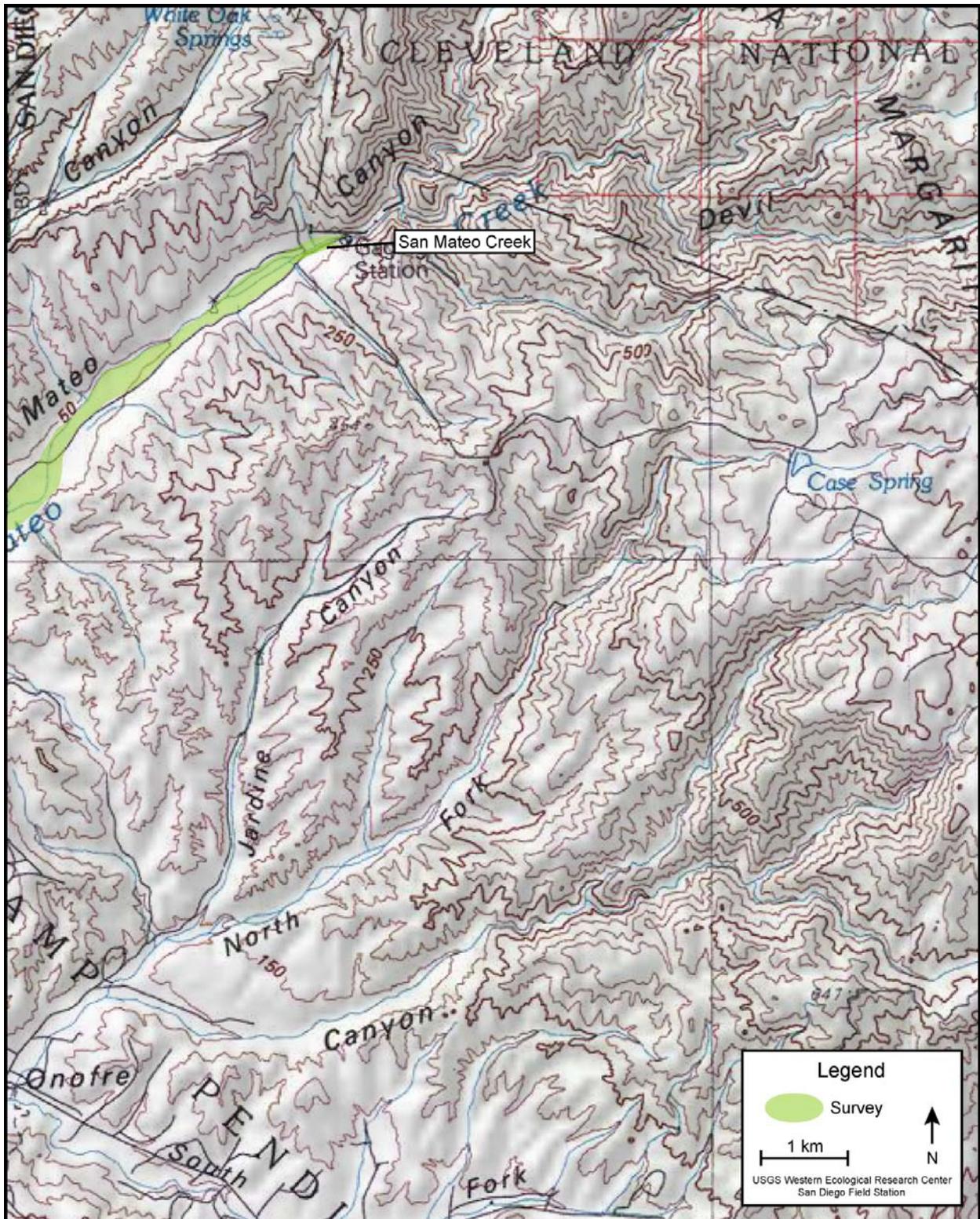


Fig. 9. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2010: San Mateo Creek.

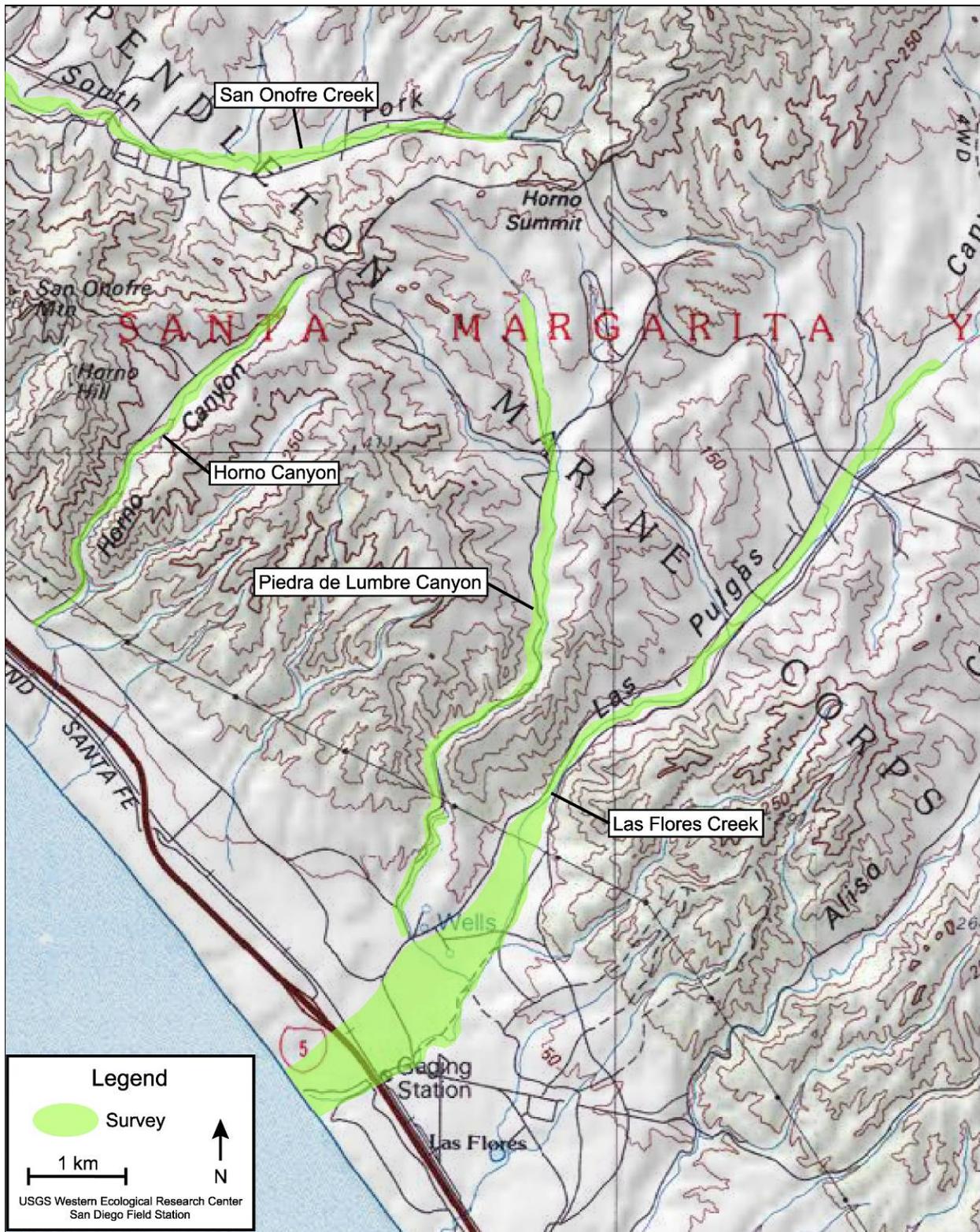


Fig. 10. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2010:
 Las Flores Creek, Piedra de Lumbre Canyon, Horno Canyon, and San Onofre Creek.

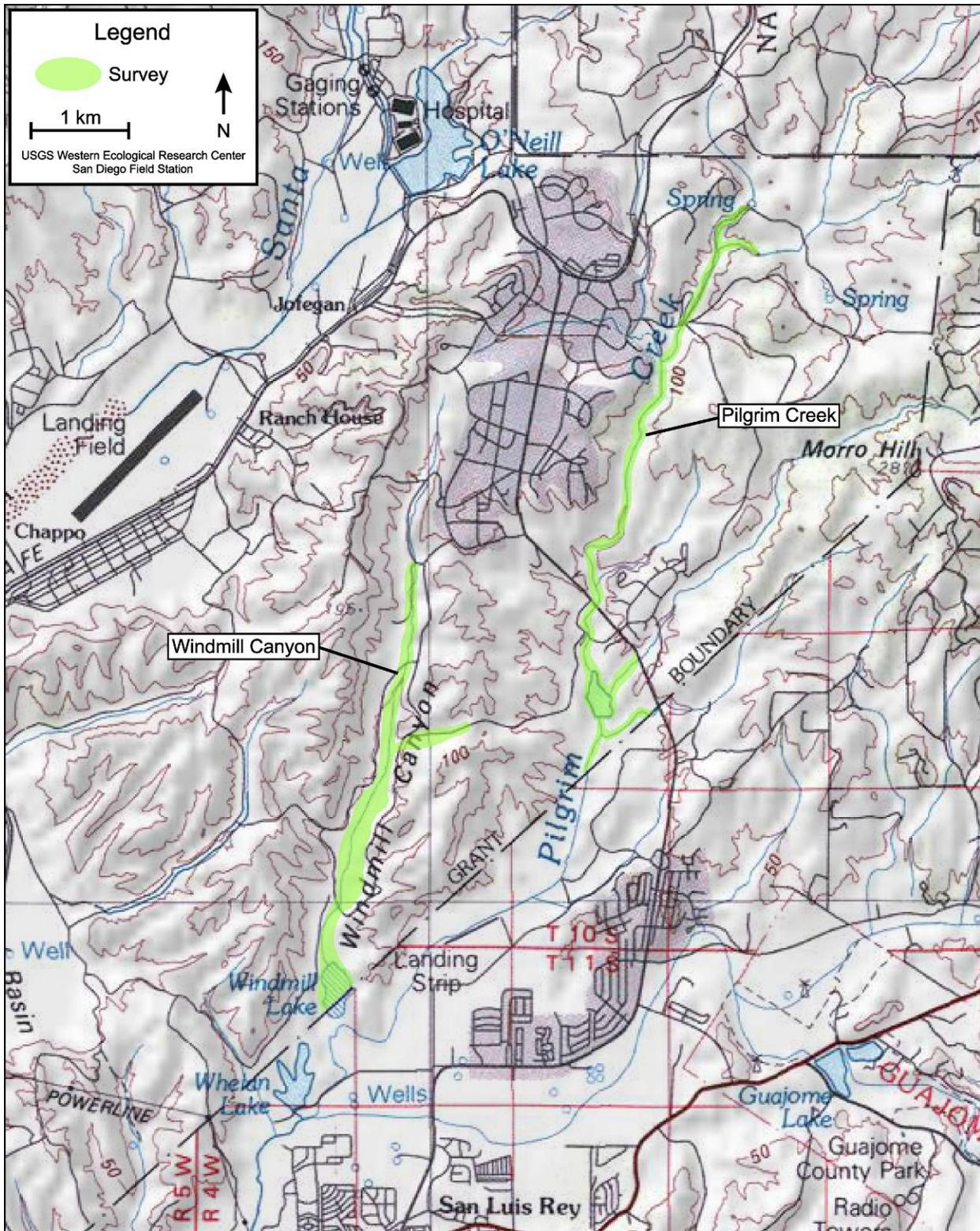


Fig. 11. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2010: Windmill Canyon and Pilgrim Creek.

APPENDIX B

**LOCATIONS OF SOUTHWESTERN WILLOW FLYCATCHERS AT MARINE CORPS
BASE CAMP PENDLETON, 2010**

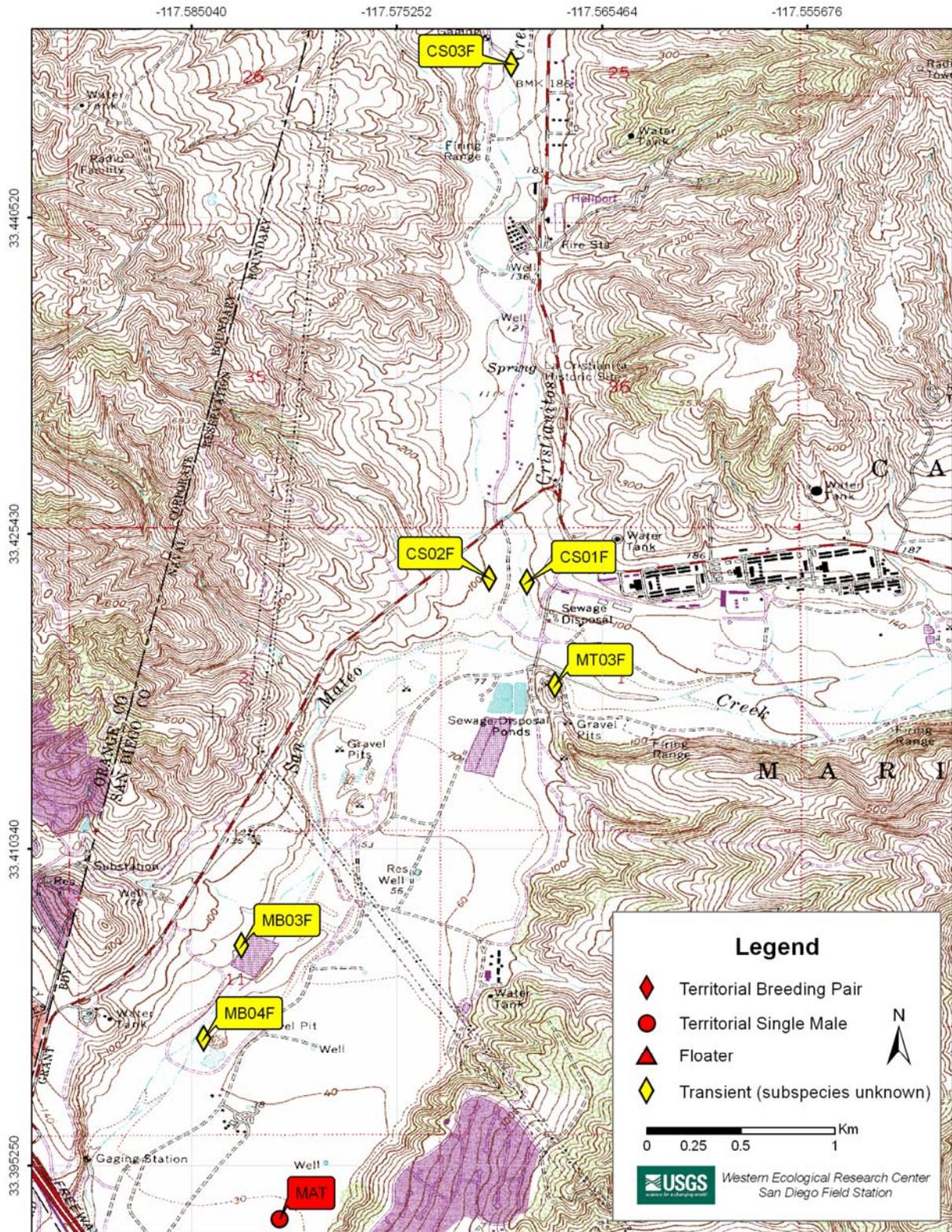


Fig. 12. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2010: San Mateo Creek (downstream) and Cristianitos Creek.

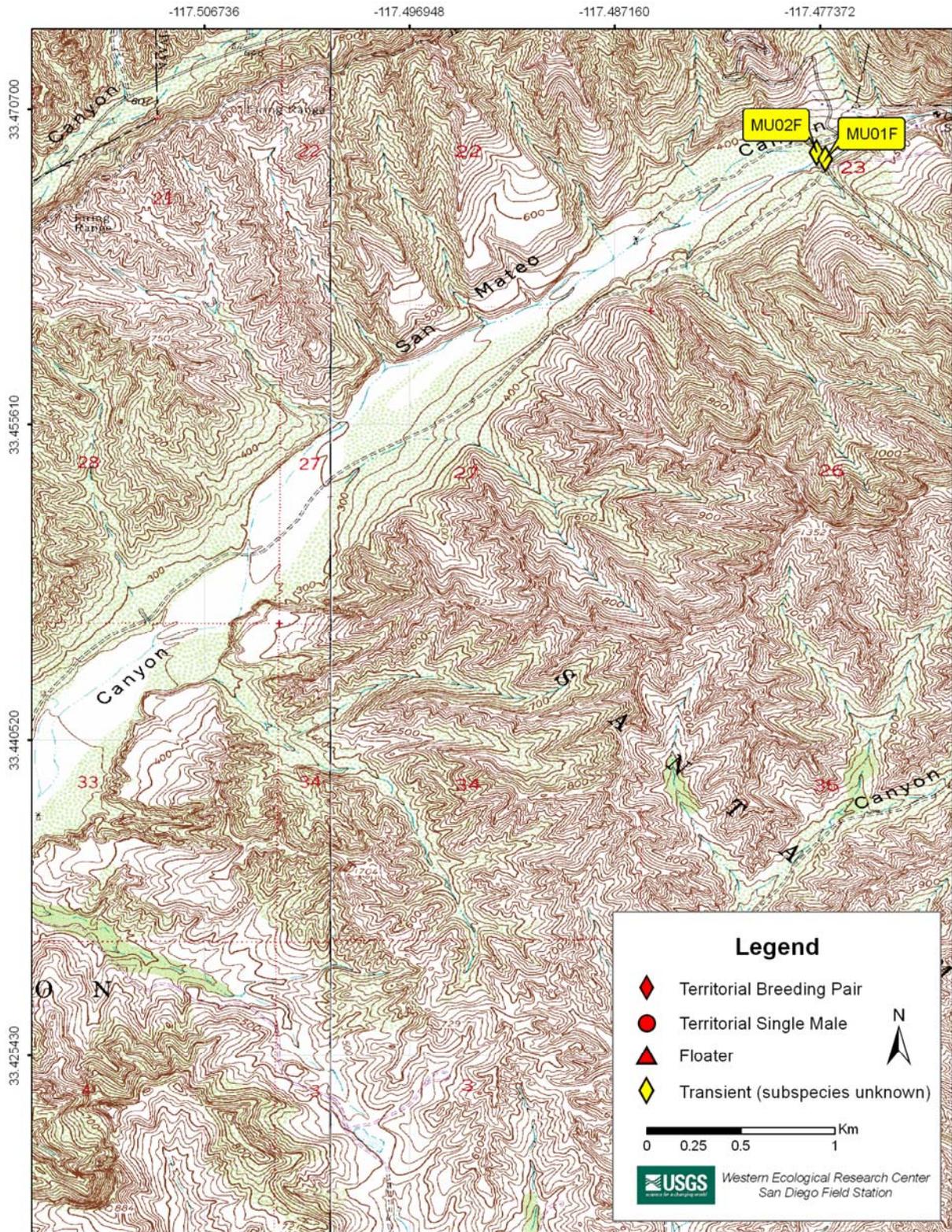


Fig. 13. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2010: San Mateo Creek (upstream).

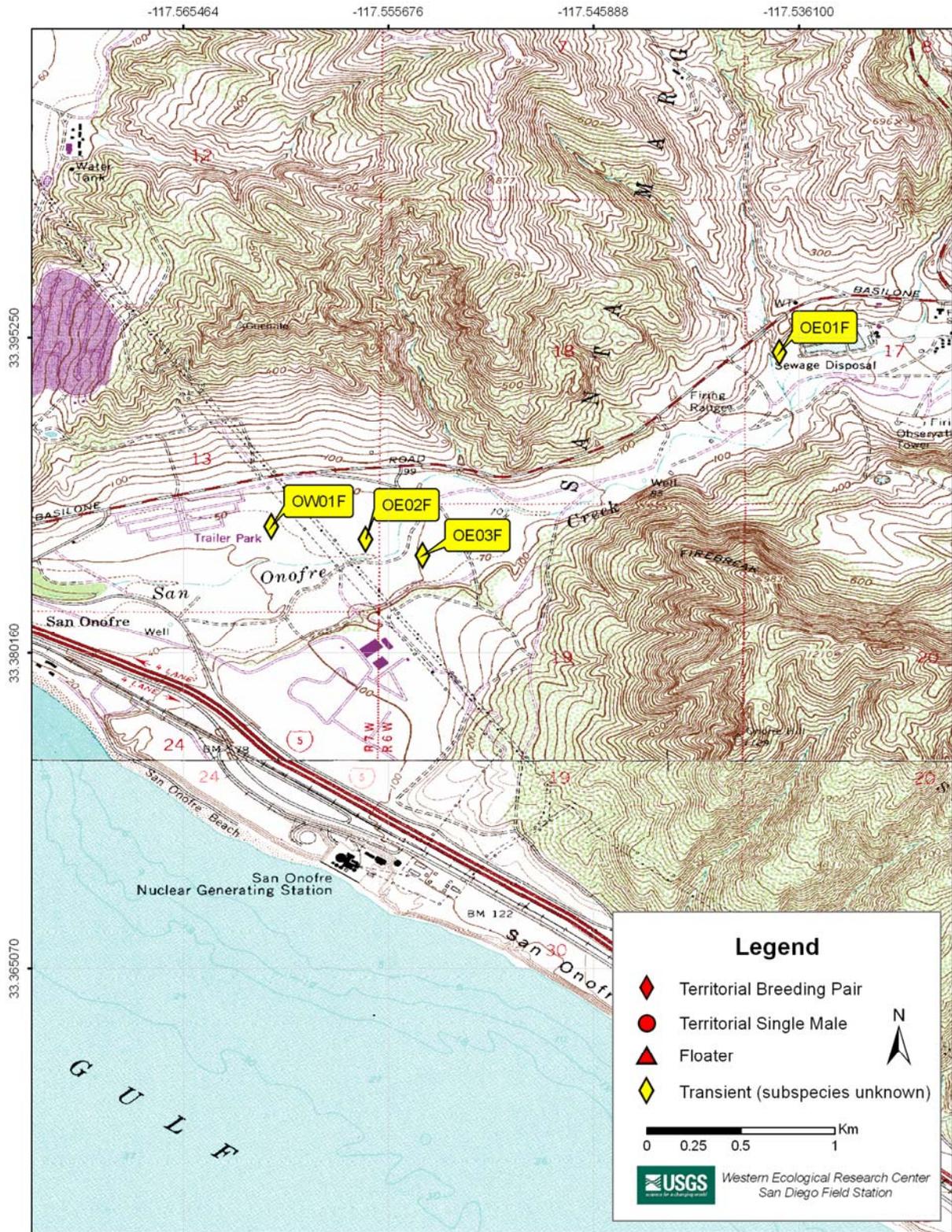


Fig. 14. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2010: San Onofre Creek.

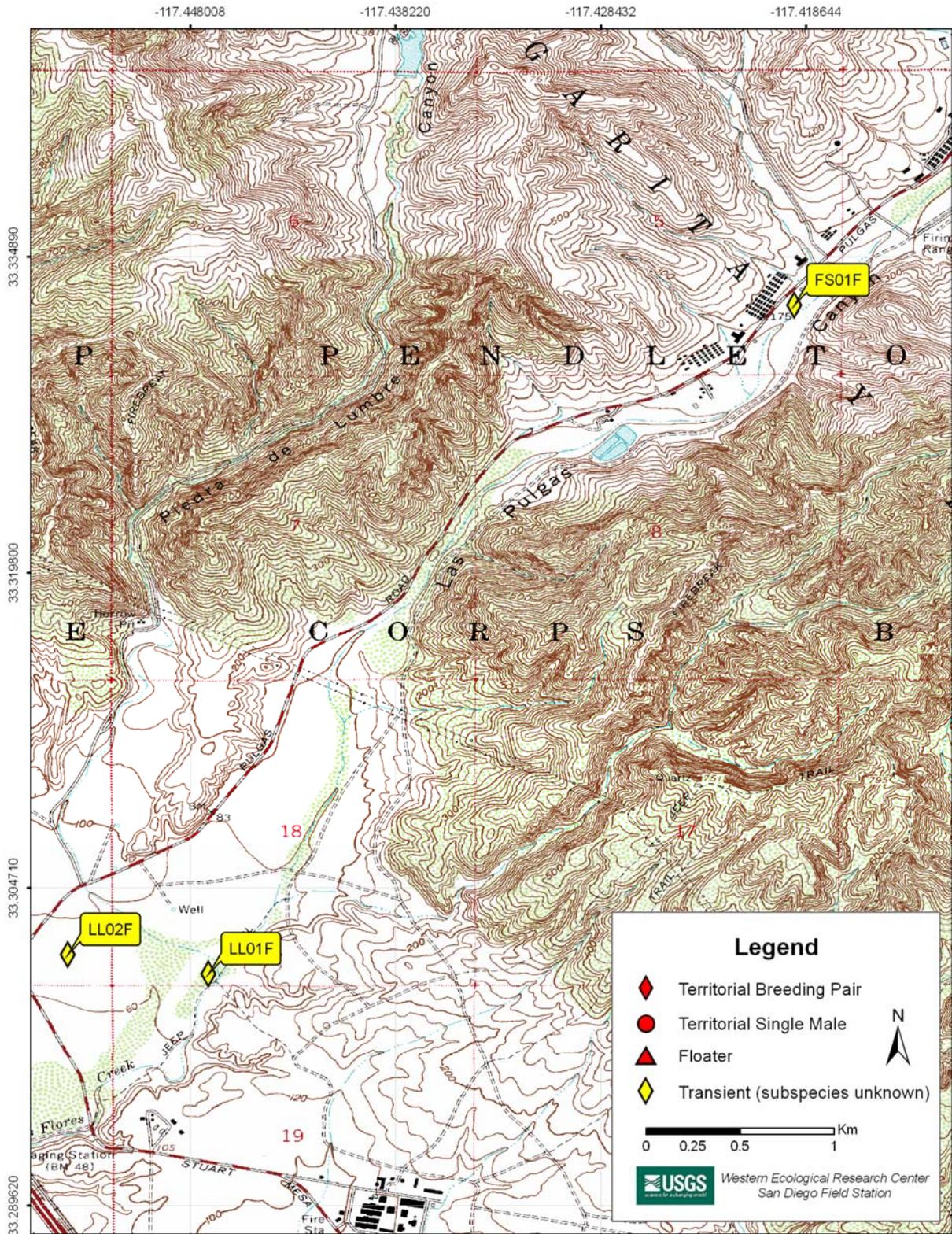


Fig. 15. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2010: Las Flores Creek.

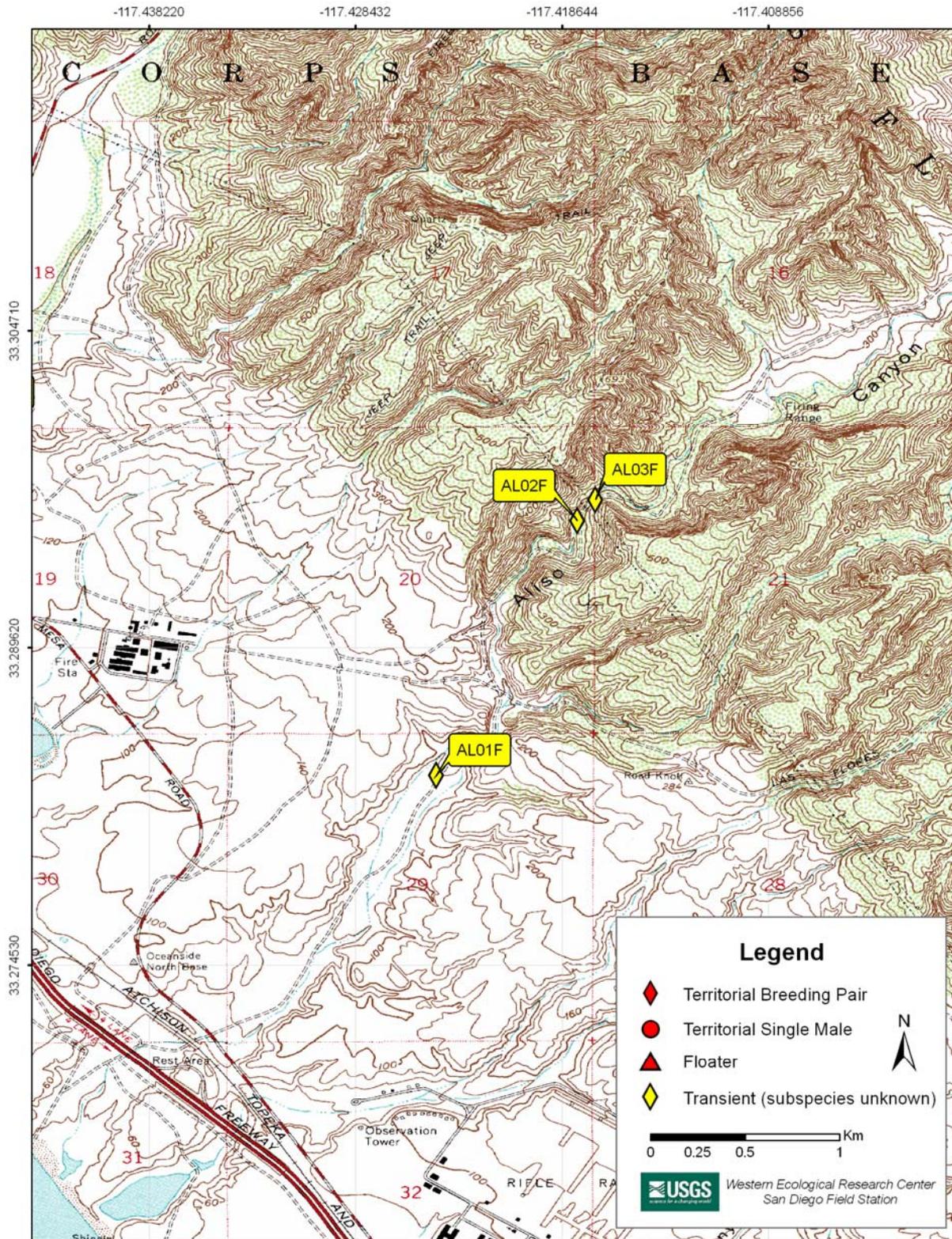


Fig. 16. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2010: Aliso Creek.

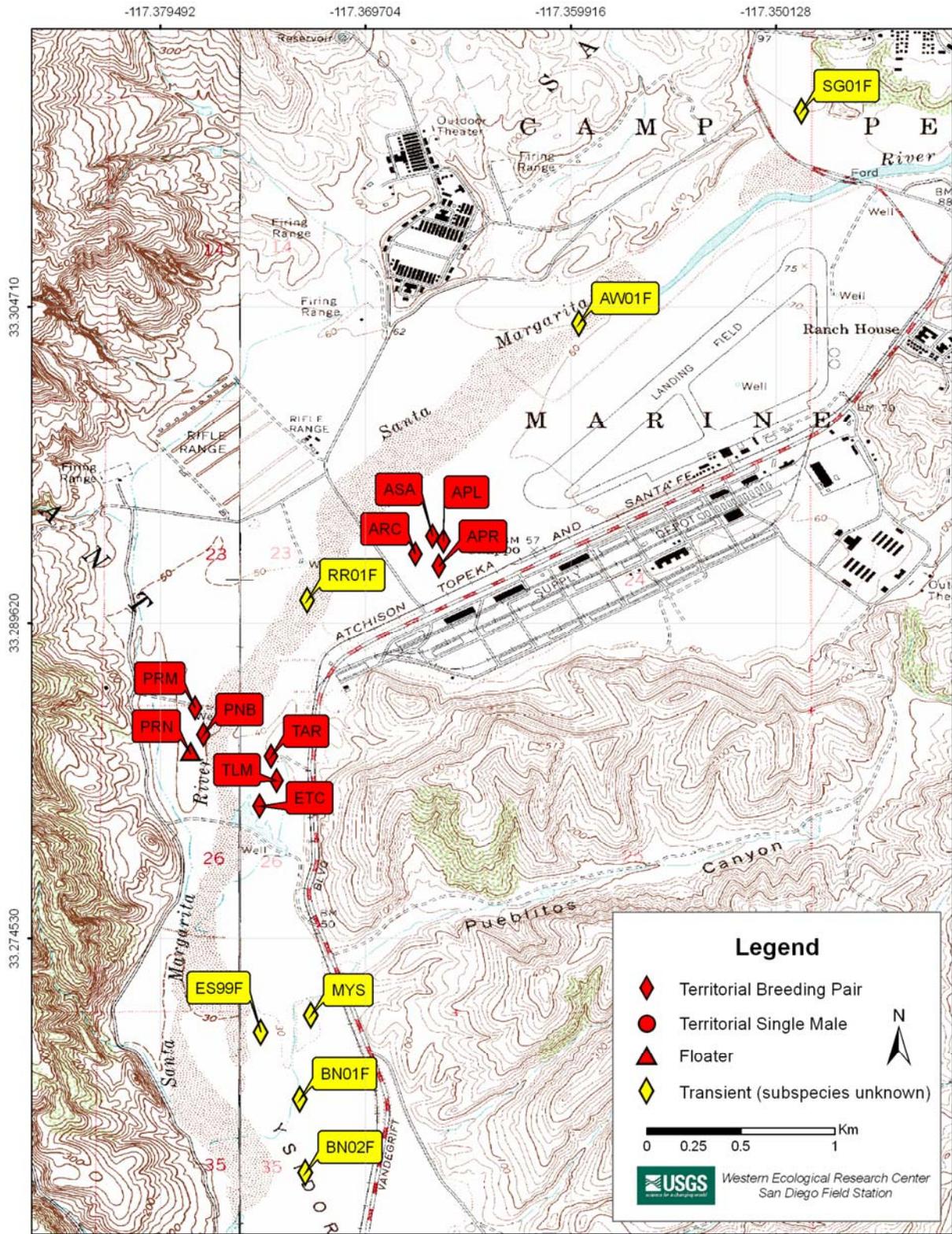


Fig. 17. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2010: Santa Margarita River (midstream).

APPENDIX C

**SOUTHWESTERN WILLOW FLYCATCHER TERRITORY LOCATIONS AT
MARINE CORPS BASE CAMP PENDLETON, 2010**



Fig. 18. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2010: San Mateo Creek.

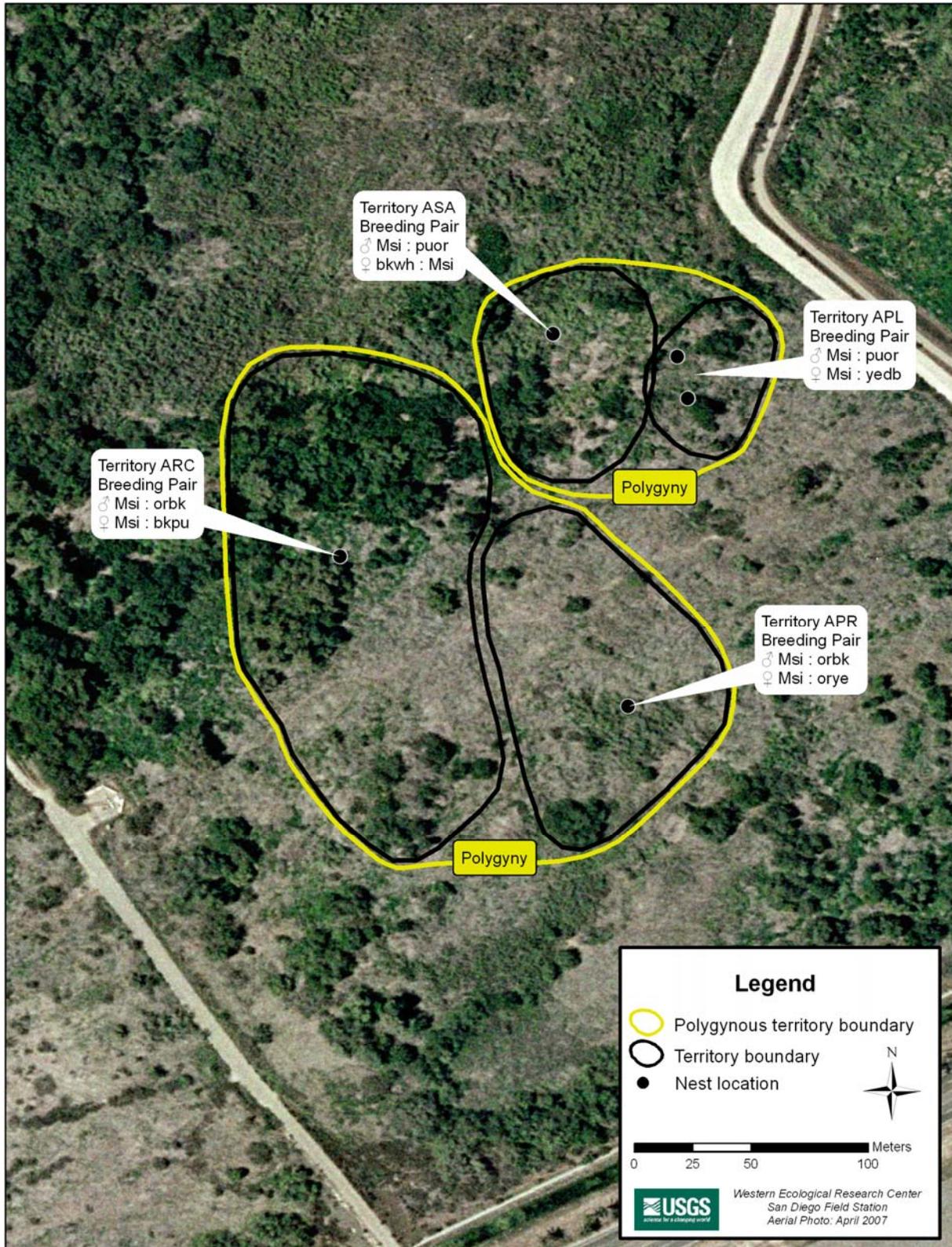


Fig. 19. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2010: Air Station Breeding Area, Santa Margarita River.

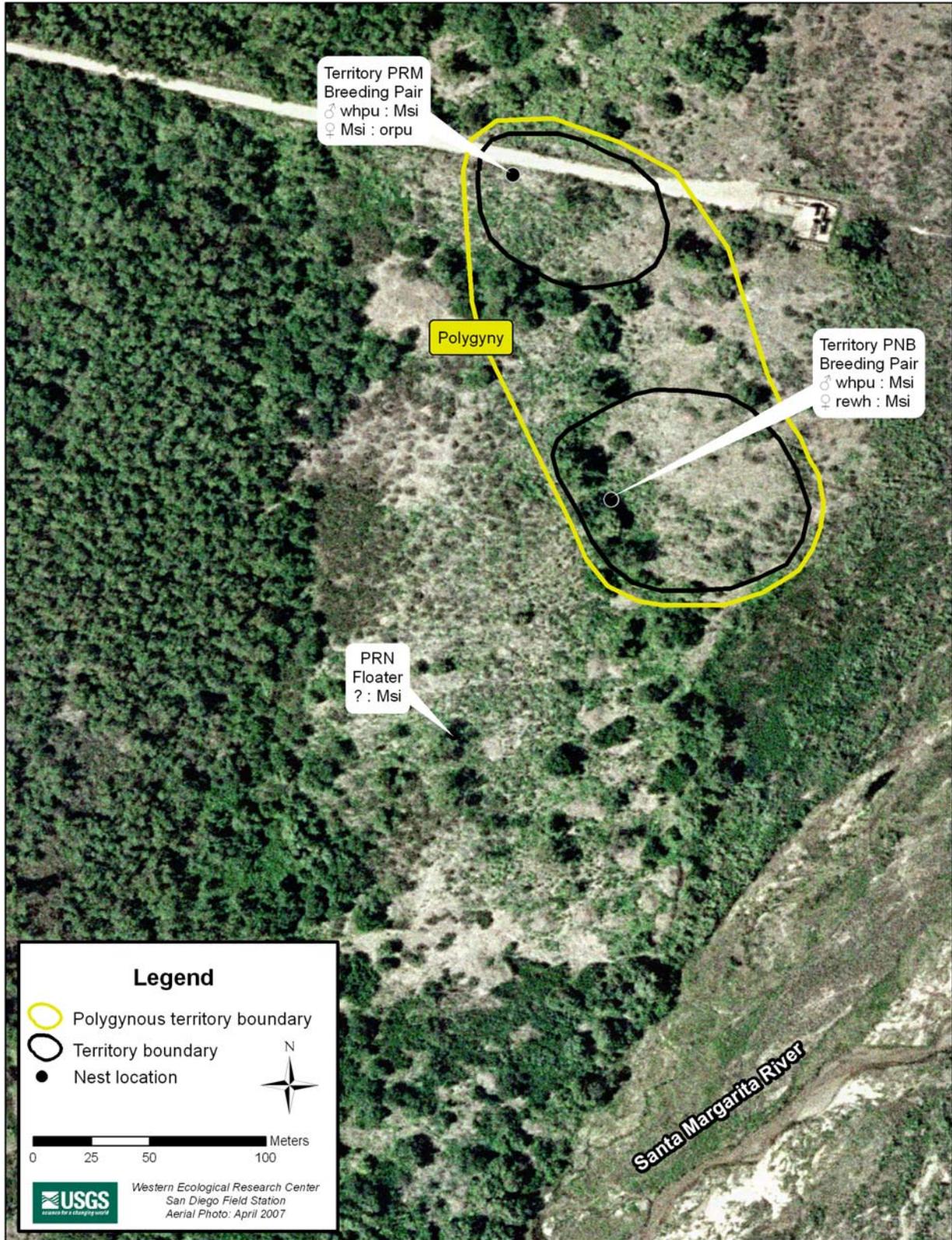


Fig. 20. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2010: Pump Road Breeding Area, Santa Margarita River.

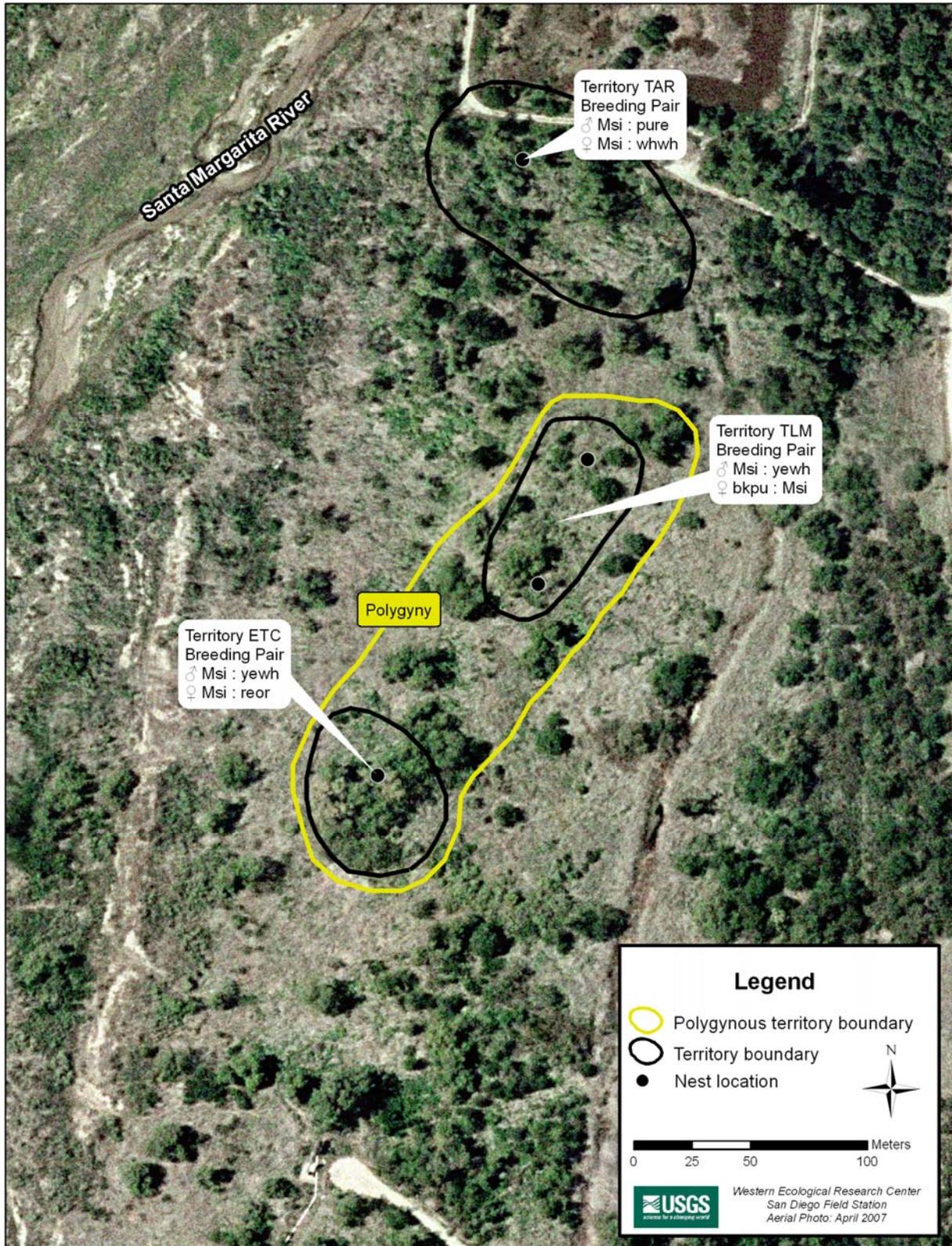


Fig. 21. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2010: Treatment Ponds and Pueblitos Breeding Areas, Santa Margarita River.

APPENDIX D

**BAND COMBINATIONS AND IDENTIFICATION OF SOUTHWESTERN WILLOW
FLYCATCHER NESTLINGS BANDED ON MARINE CORPS BASE CAMP
PENDLETON, 2010**

Band combinations and identification of Southwestern Willow Flycatcher nestlings banded on Marine Corps Base Camp Pendleton in 2010.

Territory ID	Nest ID	Nestling Band Combination^a	Federal Band Number
TLM	1	Msi : none	254083430
TLM	1	Msi : none	254083431
TLM	1	Msi : none	254083432
PRM	1	Msi : none	254083435
ARC	1	Msi : none	254083437
ARC	1	Msi : none	254083438
ARC	1	Msi : none	254083439
TAR	1	Msi : none	254083440
TAR	1	Msi : none	254083441
TAR	1	Msi : none	254083442
TAR	1	Msi : none	254083443
ASA	1	Msi : none	254083444
ASA	1	Msi : none	254083445
ASA	1	Msi : none	254083446
ETC	1	Msi : none	254083447
ETC	1	Msi : none	254083448
ETC	1	Msi : none	254083449
TLM	2	Msi : none	254083450
TLM	2	Msi : none	245087049
TLM	2	Msi : none	245087050
PNB	1	Msi : none	245087051
PNB	1	Msi : none	245087052
APL	2	Msi : none	245087053
APL	2	Msi : none	245087054
APL	2	Msi : none	245087056

^a Band combinations: left leg : right leg, Msi = federal aluminum band, none = no bands present