

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

2011 Annual Data Summary



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 eximius*) were conducted at Marine Corps Base Camp Pendleton, California, between 24 June and 12 August 2011. Surveys in 2011 began later than usual (late June vs. 15 May) because of contract delays. Consequently, data collected in 2011 may not be directly comparable to other years and represents a minimum population estimate. Drainages containing riparian habitat suitable for flycatchers were surveyed one to three times.

No transient flycatchers of unknown sub-species were observed during Base-wide surveys.

In 2011, the resident Southwestern Willow Flycatcher population on Base consisted of six males, six females, and one bird of unknown sex. Eight territories were established, consisting of six pairs (two monogamous pairings and four polygynous pairings consisting of two males each pairing with two different females), one single male, and one male of unknown status. In total, six females formed pair bonds with four male Willow Flycatchers.

With the exception of one territory at the Sierra percolation ponds near San Mateo Creek, all territories were located along the Santa Margarita River. All territories were located in mixed willow riparian habitat. Poison hemlock (*Conium maculatum*) was present in all territories.

One hundred percent of Willow Flycatcher pairs successfully fledged at least one young during the 2011 breeding season. Nesting was initiated in late May and continued into August. Seven nesting attempts were documented (6 physical locations and 1 identified by the presence of fledglings), of which 100% were successful. Caution should be used when interpreting this number, as it is probable that some failed nesting attempts occurred prior to the date USGS gained Base access. Seventeen fledglings were produced, yielding a seasonal productivity of 2.8 young/pair (17 young/6 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*), stinging nettle (*Urtica dioica*), and poison hemlock. Eighty-three percent (5/6) of located nests were placed in native plant species.

Ten birds (five males and five females) that were banded in previous years were present at Camp Pendleton in 2011. Of the banded adult flycatchers present during the 2010 breeding season, 33% (2/6) of males and 44% (4/9) of females returned to Camp Pendleton in 2011. Eighty-three percent (5/6) of those returned to the same breeding area. Six percent (1/18) of nestlings banded in 2010 returned to the Base as adults in 2011. The one returning bird, a male, established a territory but remained unpaired in 2011. Fifteen nestlings from six nests were banded in 2011.

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 2010b), and Marine Corps Base Camp Pendleton in San Diego County (Howell and Kus 2010a). 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 24 June and 12 August (Fig. 1, Appendix A, Figs. 4-9). Field work was conducted by Lisa Allen, Tom Dixon, Karl Fairchild, Patience Falatek, Aaron Gallagher, Alex Houston, Scarlett Howell, Barbara Kus, Suellen Lynn, Melanie Madden-Smith, and Ryan Pottinger. 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. 4, 5).

De Luz Creek: between the confluence with the Santa Margarita River and the Base boundary (Appendix A, Fig. 4).

Roblar Creek: from the confluence with De Luz Creek to a point approximately 1.5 km upstream (Appendix A, Fig. 4).

Fallbrook Creek: around Lake O'Neill as well as along the creek between the lake and the Base boundary (Appendix A, Fig. 4).

Newton Canyon: between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Appendix A, Fig. 5).

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

French Creek: between the Pacific Ocean and the Edson Range Impact Area (Appendix A, Fig. 5).

Aliso Creek: between the Pacific Ocean and 0.5 km upstream of the electrical transmission lines (Appendix A, Fig. 5).

Cristianitos Creek: between the confluence with San Mateo Creek and the Base boundary (Appendix A, Fig. 6).

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. 6, 7).

San Onofre Creek: between the Pacific Ocean and the access road to Range 219 (Appendix A, Figs. 6, 8).

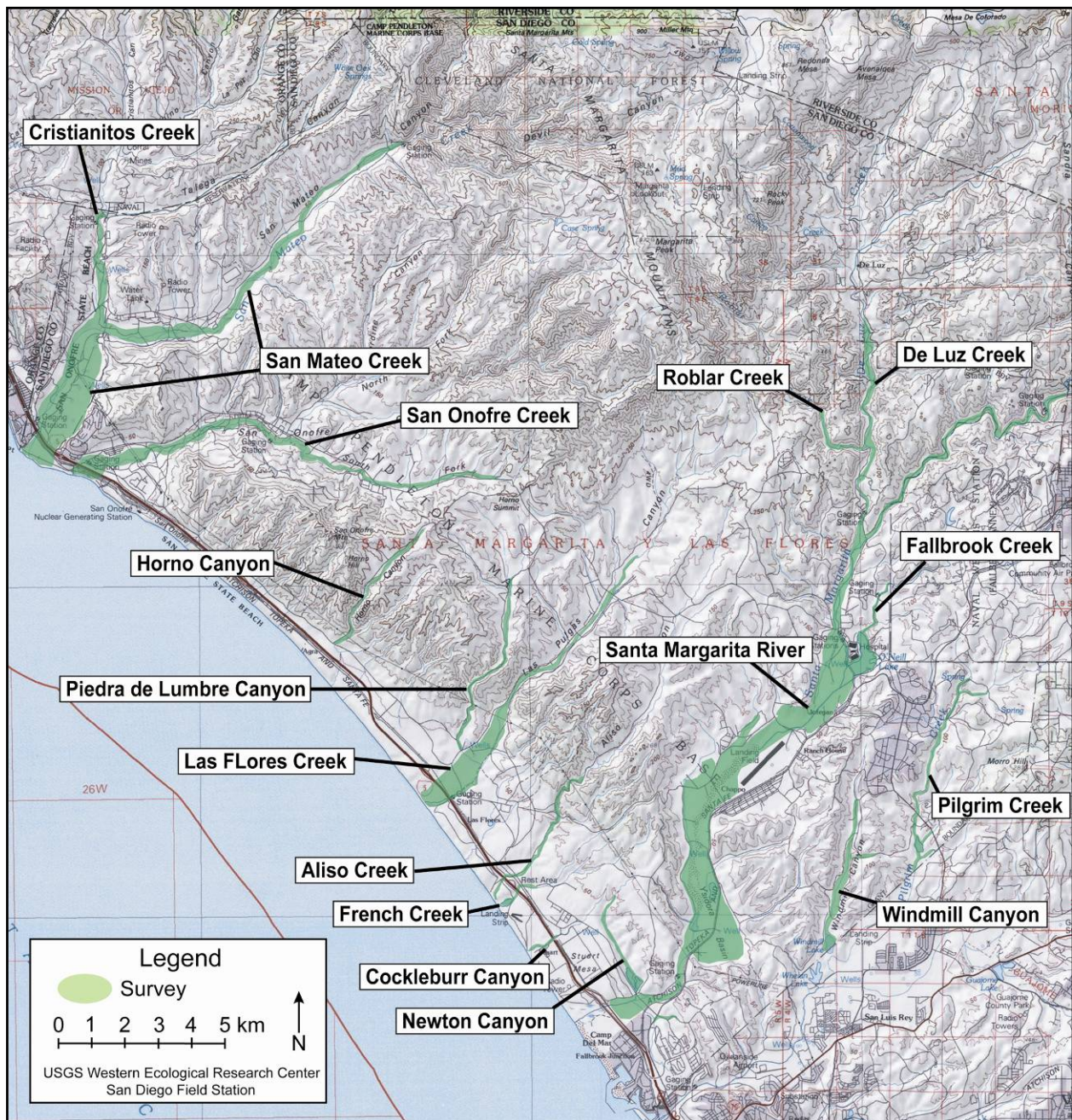


Fig. 1. Southwestern Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2011.

Las Flores Creek: between the Pacific Ocean and a point approximately 800 m upstream of Basilone Road (Appendix A, Fig. 8).

Piedra de Lumbre Canyon: between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Appendix A, Fig. 8).

Horno Canyon: between Old Highway 101 and the upstream limit of riparian habitat (Appendix A, Fig. 8).

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. 9).

Windmill Canyon: from the Base boundary to the golf course entrance (Appendix A, Fig. 9).

Drainages were surveyed one to three times at least seven days apart. The majority of drainages were surveyed three times. The upper portion of the Santa Margarita River and the upper portion of San Mateo Creek were surveyed twice. Because of range access restrictions, Roblar Creek was surveyed one time in 2011.

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's and female's use area on 1":12,000" aerial photographs. Habitat type was recorded for each location 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 that had eggs or nestlings but were later found intact and 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.

Banding

Nestlings were banded at 7-10 days of age. Each bird received a silver aluminum federal numbered band on the right 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 2010, with a single silver aluminum federal numbered band on the left leg, were recaptured in their territories and banded with a colored metal band on the right leg to yield a full, unique combination.

RESULTS

Population Size and Distribution

Transients

No transient Willow Flycatchers of unknown sub-species were observed during Base-wide surveys.

Residents

Thirteen Willow Flycatchers, including six males, six females, and one bird of unknown sex, were detected throughout the 2011 breeding season (Appendix B, Figs. 10-11; Appendix C, Figs. 12-14). Four of the males were paired, one remained single, and one male's breeding status was undetermined. Two of the four paired males were polygynous with two females each. The unknown sex bird was detected on 28 July, in a historical breeding territory (Appendix C, Fig. 14) adjacent to an occupied territory. It is possible that this bird was a quiet breeding individual that was not detected prior to 28 July, or was a non-territorial floater. Alternatively, this bird may have been an early southbound migrant. In total, eight known territories (i.e., one unpaired male, one unknown male, and six female nesting locations) were established in 2011, with six females forming pair bonds with four male Willow Flycatchers. Overall, the flycatcher population on Base decreased 18.8% from 2010 to 2011 (Fig. 2).

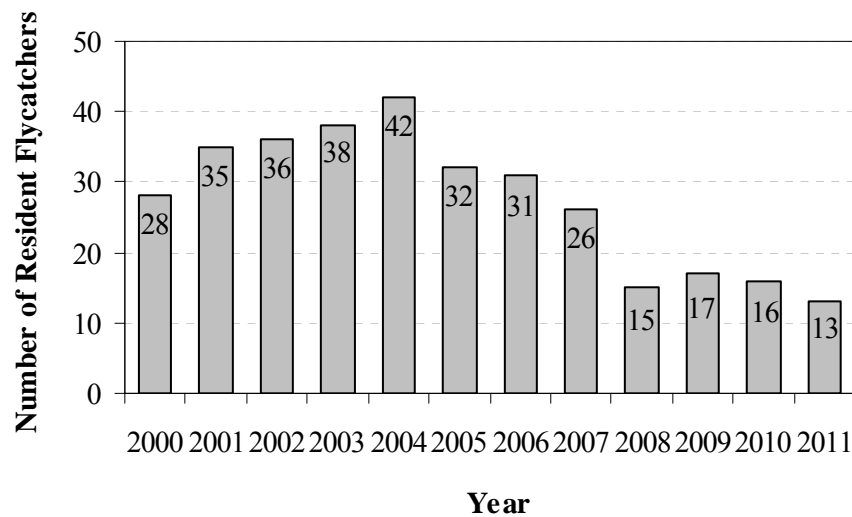


Fig. 2. Southwestern Willow Flycatcher population estimates for Marine Corps Base Camp Pendleton, 2000-2011

Resident flycatchers were restricted to the Santa Margarita River (Appendix B, Fig. 11; Appendix C, Figs. 13-15) and lower San Mateo Creek (Appendix B, Fig. 10; Appendix C, Fig. 12). Along the Santa Margarita River, four core flycatcher breeding areas (those annually supporting multiple flycatcher territories) were occupied in 2011: Air Station, Treatment Ponds, Pump Road, and northern Pueblitos. The Air Station area supported the largest concentration of

breeding flycatchers with three pairs, the Treatment Ponds area supported two breeding pairs, and the Pump Road area supported one pair. While the northern portion of Pueblitos did not have any breeding pairs, a single male occupied the area. 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) devoid of flycatcher territories in 2011 (Table 1). Flycatcher distribution away from the Santa Margarita River was limited to one territorial male detected at San Mateo Creek.

Table 1. Distribution of territorial Willow Flycatchers at Marine Corps Base Camp Pendleton, 2000-2011.

| | | 2000 | | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | |
|-----------------------|-----------------|----------------|----|------|----|------|----|------|----|------|----|------|----|------|----|------|----|------|---|------|---|----------------|---|------|---|
| 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 | M | F |
| SWEL 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 | 2 | 3 |
| | 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 | 1 | 1 |
| | Treatment Ponds | 1 | - | 1 | - | - | - | - | - | - | - | 1 | - | 1 | 4 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 |
| | Pueblitos | 4 | - | 3 | 4 | 3 | 3 | 4 | 5 | 4 | 4 | 1 | 3 | 3 | 6 | 1 | 1 | 2 | 3 | 2 | 1 | - ^b | 1 | 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 | - | 1 | - |
| Total | | 18 | 10 | 17 | 18 | 17 | 16 | 16 | 16 | 18 | 22 | 12 | 17 | 12 | 19 | 12 | 14 | 7 | 7 | 8 | 8 | 6 | 9 | 6 | 6 |

^a Sex: M = male, F = female. ^b One male's 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, 2010a.

Habitat Characteristics

All flycatcher sightings occurred in habitat classified as mixed willow riparian, 89% (8/9) of which occurred along the Santa Margarita River (Table 2).

The most common exotic plant in habitat used by flycatchers in 2011 was poison hemlock. Seventy-eight percent (7/9) of flycatcher locations were composed of 5-50% exotic vegetation, primarily poison hemlock. Poison hemlock was considered the dominant vegetation (percent cover of exotics >50; Table 2) in 11% (1/9) of the sites.

Table 2. Habitat characteristics of Willow Flycatcher locations at Marine Corps Base Camp Pendleton in 2011.

| Bird ID | Drainage | Status ^a | Habitat Type ^b | Exotic Cover Class ^c | Dominant Exotics ^d |
|---------|-----------------------|---------------------|---------------------------|---------------------------------|-------------------------------|
| MAT | San Mateo Creek | U | Mixed Willow | 1 | - |
| AEO | Santa Margarita River | P | Mixed Willow | 2 | CON |
| APL | Santa Margarita River | P | Mixed Willow | 2 | CON |
| APR | Santa Margarita River | P | Mixed Willow | 2 | CON |
| ETC | Santa Margarita River | S | Mixed Willow | 2 | CON |
| PNB | Santa Margarita River | P | Mixed Willow | 2 | CON |
| RIF | Santa Margarita River | U | Mixed Willow | 3 | CON |
| TLM | Santa Margarita River | P | Mixed Willow | 2 | CON |
| TWI | Santa Margarita River | P | Mixed Willow | 2 | CON |

^a P = breeding pair, S = single resident male, U = unknown status bird.

^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 CON = poison hemlock

Breeding Activities

All Willow Flycatcher territories were considered “partially monitored” because nest monitoring activities did not begin until 27 June; therefore, any nests that failed or fledged prior to this date were not confirmed. Nesting was observed for all of the six pairs (Table 3). Nesting was initiated in late May (based on back-dating from known nesting stages). The earliest confirmed lay date was 3 June and the latest was 20 July. One pair attempted a second nest, following a successful initial attempt. Nesting continued into August, with the last young fledging on 20 August. All six of the breeding pairs fledged young during the 2011 breeding season.

Seven nesting attempts by Willow Flycatchers were documented during the 2011 breeding season and all but one of these nests were located and monitored throughout the period they were active (one nesting attempt by pair APR was not discovered until the pair was seen with fledglings; Table 3). No failed nesting attempts were observed.

Mean clutch size, estimated from five nests known to have full clutches, was 3.0 ± 0.7 eggs. Three eggs from two different nests did not hatch (Table 3). Seventeen fledglings were produced, yielding a seasonal productivity of 2.8 young/pair (17 young/6 pairs).

Table 3. Nesting activity of Southwestern Willow Flycatcher pairs at Marine Corps Base Camp Pendleton in 2011.

| Pair ID | Lay Date | # Eggs | # Nestlings | # Fledglings | Nest Fate ^a | Comments |
|---------|-----------|----------------|----------------|--------------|------------------------|--|
| AEO | 30-Jun-11 | 3 | 3 | 3 | SUC | |
| APL | 20-Jun-11 | 4 | 2 | 2 | SUC | Two eggs did not hatch and were removed when nestlings banded. |
| APR | 03-Jun-11 | 2 ^b | 2 ^b | 2 | SUC | Nest not located, territory found at fledgling stage. |
| | 20-Jul-11 | 2 | 2 | 2 | SUC | |
| PNB | 13-Jun-11 | 3 ^c | 3 | 3 | SUC | |
| TLM | 16-Jun-11 | 3 | 3 | 3 | SUC | |
| TWI | 30-Jun-11 | 3 | 2 | 2 | SUC | One egg did not hatch and was removed when nestlings banded. |

^a SUC = Nest fledged at least one young.

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

^c Minimum number, nest contents not seen during incubation.

Nest Site Characteristics

Flycatchers placed nests in five species of plants (Table 4), including arroyo willow, black willow, sandbar willow, stinging nettle, and poison hemlock. Eighty-three percent of nests were placed in native species: 67% (4/6) in willow and 17% (1/6) in stinging nettle. The remaining nest was placed in the exotic species poison hemlock. Nest height averaged 1.9 ± 0.5 m, while host height averaged 4.5 ± 2.2 m.

Table 4. Nest site characteristics of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2011. All measurements are in meters.

| Pair ID | Nest ID | Host Species | Host Height | Nest Height | Distance to the edge of: | |
|---------|---------|-----------------|-------------|-------------|--------------------------|-------|
| | | | | | Host Plant | Clump |
| AEO | 1 | Sandbar willow | 4.0 | 2.2 | 0.1 | 2.8 |
| APL | 1 | Sandbar willow | 3.0 | 1.5 | 0.2 | 4.0 |
| APR | 2 | Arroyo willow | 8.3 | 2.6 | 1.0 | 1.0 |
| PNB | 1 | Poison hemlock | 3.0 | 1.4 | 0.1 | 1.8 |
| TLM | 1 | Black willow | 5.9 | 1.7 | 1.2 | 2.5 |
| TWI | 1 | Stinging Nettle | 2.9 | 1.9 | 0.1 | 2.5 |

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 2011.

Banded Birds

All resident Willow Flycatchers were observed closely enough to determine with confidence whether they were banded (Table 5). Eighty-three percent (5/6) of males and 83% (5/6) of females were banded in previous years. Of these, one second-year male that was banded with a single federal band as a nestling in 2010 was recaptured and banded with a second band to provide a unique combination. The flycatcher of unknown sex was unbanded. All birds whose band combination could be determined were originally banded on Camp Pendleton.

Two unbanded adults, one male and one female, were captured and banded with a unique combination. Fifteen nestlings from six nests were banded (Appendix D); all are believed to have fledged.

Only the left leg was seen on the male in the MAT territory, rendering identification impossible. The male disappeared before an attempt could be made to confirm his identity.

Table 5. Band status of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2011.

| Territory / Bird ID | Status ^a | Male Banded? ^b | Female Banded? ^b | Nestlings Banded? | Comments ^c |
|---------------------|---------------------|---------------------------|-----------------------------|-------------------|--|
| AEO | P | Msi : puor | Msi : bkpu | 3 | Male banded in 2010 as an adult at Air Station. Female banded in 2010 as an adult at Air Station. |
| APL | P | Msi : orbk | rewh : Msi | 2 | Male banded in 2008 as a nestling at Pueblitos. Female banded in 2009 as a nestling at Pueblitos. Male polygynous with one other female (APR). |
| APR | P | Msi : orbk | Msi : yedb | 2 | Female banded in 2008 as a nestling at Treatment Ponds. Male polygynous with one other female (APL). |
| ETC | S | Msi : bkor | N/A | | Male banded in 2010 as a nestling at Pump Road. |

^a P = breeding pair, S = single resident male, U = unknown breeding status.

^b Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands*: bkbk = black, bkor = black-orange split, bkpu = black-purple split, dbwh = dark blue-white split, orbk = orange-black split, orpu = orange-purple split, puor = purple-orange split, rewh = red-white split, yebk = yellow-black split, yedb = yellow-dark blue split, yere = yellow-red split.

^c See Fig. 3, Appendix B, Figs. 10-11; Appendix C, Figs. 12-15 for breeding area and territory locations.

Table 5 (*continued*). Band status of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2011.

| Territory / Bird ID | Status ^a | Male Banded? ^b | Female Banded? ^b | Nestlings Banded? | Comments ^c |
|---------------------|---------------------|---------------------------|-----------------------------|-------------------|--|
| PNB | P | yebk : Msi | Msi : orpu | 3 | Male banded in 2011. Female banded in 2010 as an adult at Pump Road. |
| RIF | U | Unbanded | | | Unknown sex bird. |
| TLM | P | dbwh : Msi | bkbk : Msi | 3 | Male banded in 2009 as a nestling at Air Station. Female banded in 2009 as an adult at Air Station. Male polygynous with one other female (TWI). |
| TWI | P | dbwh : Msi | yere : Msi | 2 | Female banded in 2011. Male polygynous with one other female (TLM). |
| MAT | U | Msi : ?? | N/A | | Only left leg seen. |

^a P = breeding pair, S = single resident male, U = unknown breeding status.

^b Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands*: bkbk = black, bkor = black-orange split, bkpu = black-purple split, dbwh = dark blue-white split, orbk = orange-black split, orpu = orange-purple split, puor = purple-orange split, rewh = red-white split, yebk = yellow-black split, yedb = yellow-dark blue split, yere = yellow-red split.

^c See Fig. 3, Appendix B, Figs. 10-11; Appendix C, Figs. 12-15 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 2011. 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 2010 breeding season, 33% (2/6) of males and 44% (4/9) of females returned to Camp Pendleton in 2011. Overall, adult survivorship from 2010 on Camp Pendleton was 40% (6/15). Return rates were calculated based on banded birds with confirmed, unique color-band combinations, and do not include the MAT male whose band combination could not be confirmed.

One of the 18 nestlings banded in 2010 that survived to fledge was resighted and recaptured at Camp Pendleton in 2011, yielding a first-year survivorship estimate of 6% (1/18). The returning second-year bird established a territory in northern Pueblitos, but remained single in 2011 (Table 6). One bird last seen as nestling in 2009 reappeared in 2011, establishing a breeding territory at Bonsall along the San Luis Rey River, increasing the first-year survivorship estimate of the 2009 population from 36% (Howell and Kus 2010a) to 45% (5/11).

Willow Flycatchers at Camp Pendleton generally settle into breeding concentrations or areas where groups of birds establish territories (Fig. 3). Resighting banded birds allowed us to identify individuals that returned to the same area they used the previous year. In 2011, five of the six banded returning adults (83%) returned to the breeding area they occupied in 2010 (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 2010. One of the six banded returning adults (17%) moved to a different breeding area within the Santa Margarita River in 2011 (Table 6, Fig. 3). The female flycatcher moved from the Pump Road area to the Air Station area, approximately 1.4 km away. The average distance moved by adult flycatchers between the 2010 and 2011 breeding seasons was 0.4 ± 0.5 km. The returning second-year male, banded as a nestling in the Pump Road area, dispersed to the northern Pueblitos area, approximately 0.6 km away (Table 6, Fig. 3).

Table 6. Between-year, between-area movement of Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton in 2011.

| Year Last Detected | Breeding Area ^a (Territory Last Detected) | Breeding Area (Territory in 2011) | Dispersal Distance (km) | Band Combination ^b | Age in 2011 | Sex ^c |
|--------------------|---|--------------------------------------|----------------------------|-------------------------------|-------------|------------------|
| 2010 | Air Station (APR/ARC) | Air Station (APL/APR) | 0.1 | Msi : orbk | 3 yr | M |
| 2010 | Air Station (APL/ASA) | Air Station (AEO) | 0.2 | Msi : puor | ≥ 2 yrs | M |
| 2010 | Mission Valley, San Diego River | Treatment Ponds (TLM/TWI) | 62.0 | dbwh : Msi | 2 yr | M |
| 2010 | Bonsall, San Luis Rey River | Treatment Ponds (TLM) | 14.3 | bkbk : Msi | ≥ 3 yrs | F |
| 2010 | Air Station (APL) | Air Station (APR) | 0.1 | Msi : yedb | 3 yr | F |
| 2010 | Pump Road (PRM) | Pump Road (PNB) | 0.1 | Msi : orpu | ≥ 2 yrs | F |
| 2010 | Air Station (ARC) | Air Station (AEO) | 0.2 | Msi : bkpu | ≥ 2 yrs | F |
| 2010 | Pump Road (PNB) | Air Station (APL) | 1.4 | rewh : Msi | ≥ 2 yrs | F |
| 2010 | Pump Road (PRM) | Pueblitos (ETC) | 0.6 | Msi : bkor | 1 yr | M |

^a See Fig. 3, Appendix B, Figs. 10-11; Appendix C, Figs. 12-15 for breeding area and territory locations.

^b Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands*: bkbk = black, bkor = black-orange split, bkpu = black-purple split, dbwh = dark blue-white split, orbk = orange-black split, orpu = orange-purple split, puor = purple-orange split, rewh = red-white split, yedb = yellow-dark blue split.

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

Two instances of immigration occurred during the 2011 breeding season, both involving birds that emigrated off Base in 2010. The first instance involved a male, originally banded as a nestling in 2009 in the Air Station area, who returned to breed in the Treatment Ponds area after

being detected on the San Diego River in 2010 (Lynn and Kus 2010). The second instance involved a female originally banded as an adult on Base in 2009 in the Air Station area, who returned to breed in the Treatment Ponds area after an unsuccessful breeding attempt on the San Luis Rey River near Bonsall in 2010 (Lynn *et al.* 2010a).

One instance of emigration was seen in 2011. A male originally banded as a nestling in 2009 in the Pump Road area established a breeding territory on the San Luis Rey River near Bonsall, approximately 14.6 km away (USGS Western Ecological Research Center, San Diego Field Station unpubl.data).

No instances of movement by adult Willow Flycatchers within the 2011 season were observed.

Human Activities in Riparian Habitat

No evidence of human activities in riparian habitat occupied by Willow Flycatchers was witnessed during the 2011 breeding season.

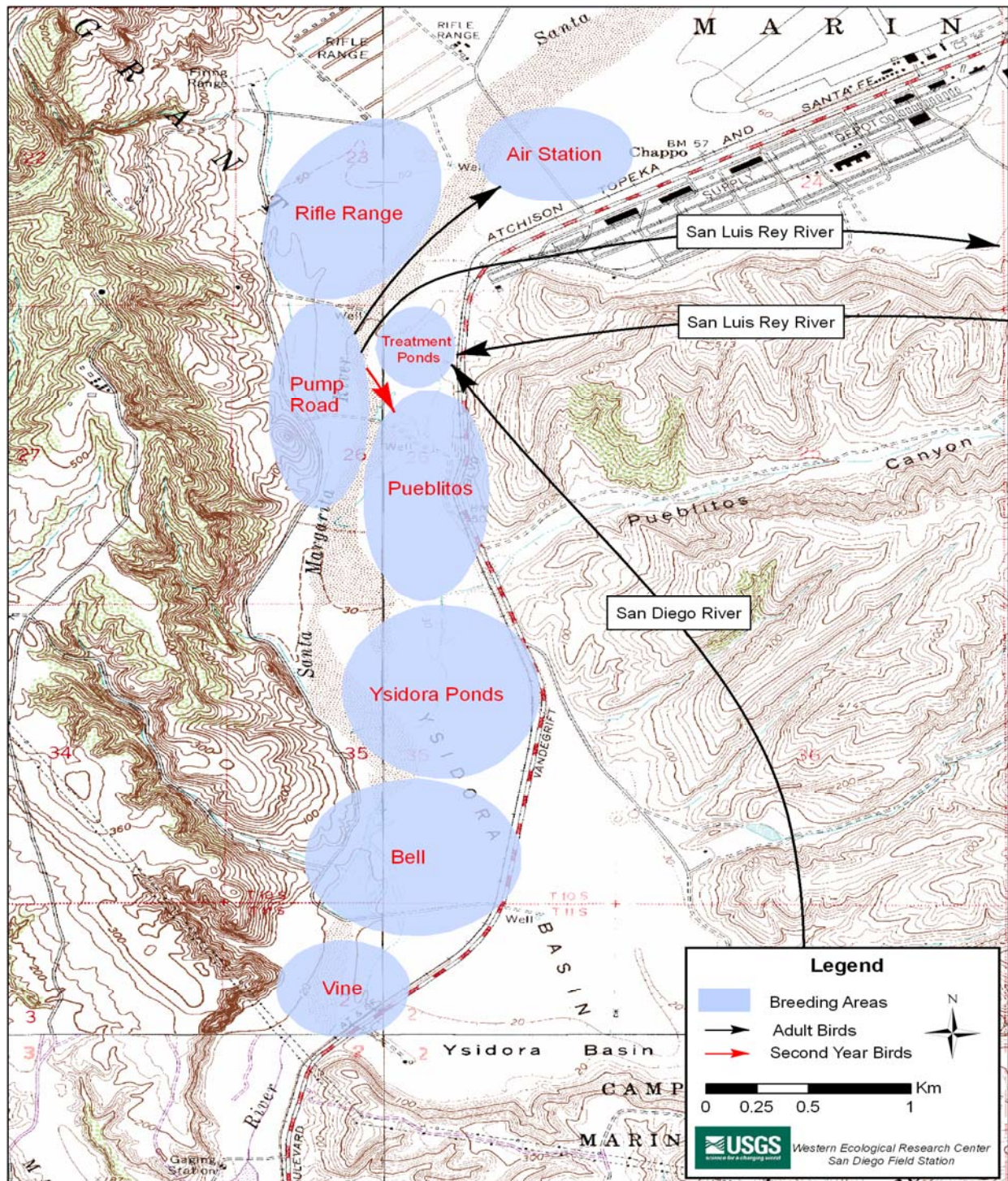


Fig. 3. Between-year, between-area movement by adult and second-year Southwestern Willow Flycatchers at Marine Corps Base Camp Pendleton, 2011.

DISCUSSION

The resident population of Southwestern Willow Flycatchers on Camp Pendleton in 2011 (13 individuals) declined 18.8% relative to 2010 (16 individuals, Howell and Kus 2010a). It is possible that this decline is over-estimated, as surveys and monitoring were not conducted during the early part of the season when flycatchers are most detectable (Sogge *et al.* 2010). In 2011, the sex ratio was once again equal, after females outnumbered males in 2010. The number of paired males with multiple females dropped to 50%, after a record high of 80% in 2010 (Howell and Kus 2010a). The rate of male polygyny has ranged from 0-80% 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, 2010a), and seems to fluctuate based on the number of females present in the breeding population. The number of females sharing males also dropped to 67%, after a record high of 89% in 2010, returning to numbers more comparable to 2008 (57%) and 2009 (50%) when the number of males and females on Base was equal (Howell and Kus 2009a, b). As in previous years, single males were present during the breeding season, but the majority of females opted to pair with polygynous birds. 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 expected, no transient Willow Flycatchers were detected on Base as surveys commenced after the date that the majority of northbound migrants had passed through southern California (15 June; Unitt 1987, Sogge *et al.* 2010).

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 2011 decreased (six pairs) relative to 2010 (nine pairs; Howell and Kus 2010a), which corresponded directly to the reduction in the number of females present in the breeding population. The number of resident flycatcher territories decreased at all but one of the core breeding areas (Treatment Ponds). 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 territorial male of unknown breeding status 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 and 2010 (Howell and Kus 2009b, 2010a).

The proximity of the breeding sites on the Santa Margarita River allows movement between locations annually, and often within breeding seasons. In 2011, the majority of adult flycatchers returned to the breeding area they occupied in 2010. Only one adult flycatcher (a

female) failed to return to its 2010 breeding area. Between-year site fidelity is highly variable, 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, 2010 (83%; Howell and Kus 2010a), and 2011 suggests that the areas being occupied represent the most suitable habitat currently available on Base.

Nest success reached a record high during the 2011 breeding season, with 100% of located nests fledging at least one flycatcher young, up from 73% in 2010 (Howell and Kus 2010a), although this number should be interpreted with caution, as it is likely inflated since no early season failures were documented. Since monitoring began in 2000, 43% (37/86) of all nest failures occurred before 27 June (USGS Western Ecological Research Center, San Diego Field Station unpubl.data). Seasonal productivity was high at 2.8 young/pair, up from 2.3 young/pair in 2010. Average clutch size (3.0 eggs/nest) was lower than in 2010 (3.3 eggs/nest; Howell and Kus 2010a), although this number was also likely affected by the lack of early season data, as the first nests of the season tend to have larger clutch sizes (Rourke *et al.* 1999, Sogge *et al.* 2010).

The return rate of banded adults between 2010 and 2011 (40%) was up from 2010 (31%, Howell and Kus 2010a), just below the average return rate between 2001 and 2010 (45%; 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, 2010a). The return rate has fluctuated from a low of 25% in 2001 to a high of 70% in 2002. The male return rate (33%) was lower than the female return rate (44%). The male return rate may be artificially low because we were not able to identify the male at San Mateo (MAT). Because Willow Flycatchers tend to exhibit high site fidelity, it is likely that the same male that has occupied the area since 2009 was present again in 2011. Unfortunately, the male left the area before USGS biologists could verify his identity. The male was last seen on 30 June, after which he most likely departed for the wintering grounds, as late June/early July departures are common in unpaired males (Sogge *et al.* 2010). This early departure behavior is consistent with the male's behavior in 2009 and 2010, when he was last seen on 30 June and 7 July, respectively. If the MAT male is included in the return rate, the number of banded males returning in 2011 increases to 50%, compared to 14% in 2010. The female return rate was similar to that in 2010 (44% vs. 50%; Howell and Kus 2010a). In 2011, the return rate of second-year birds (6%) was just above the record low from 2001 (4%; Kus and Ferree 2002). The total percentage of adults within the breeding population that were banded as nestlings tends to increase annually; however, in 2011 this number declined to 38% (5/13). The inability to identify the MAT male and the low return rate of 2010 nestlings contributed to this decrease. In 2010, 67% (10/15) 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). In 2011, inbreeding was documented within the Willow Flycatcher population on Camp Pendleton when two full siblings (male natal territory ETA 2008; female natal territory ETA 2009) paired and successfully produced offspring. At least one other 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 13 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 five birds emigrating off Base, two to Guajome Regional Park on the San Luis Rey River (Kus and Kenwood 2005), one to Bonsall on the San Luis Rey River (Howell and Kus 2010a), and two to the San Diego River (Lynn and Kus 2010, Lynn *et al.* 2010b). In 2011, the flycatcher that emigrated to Bonsall on the San Luis Rey River in 2010 returned to Camp Pendleton to breed. The female was originally detected as an unbanded adult breeding in the Air Station area on Camp Pendleton in 2009. Additionally, the Camp Pendleton natal male detected on the San Diego River in 2010 (Lynn and Kus 2010) returned to Camp Pendleton and successfully bred in 2011. One instance of emigration off Base was observed in 2011. A natal male hatched in the Pump Road breeding area in 2009 dispersed to Bonsall on the San Luis Rey River, a distance of 14.6 km. The bird was not seen in 2010.

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. In 2011, two unbanded flycatchers, one male and one female, entered the breeding population; both established territories and bred successfully. 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.

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 have 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 2010b). It is encouraging that two unbanded flycatchers were detected on Base in 2011, 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.

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.

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APPENDIX A

SOUTHWESTERN WILLOW FLYCATCHER SURVEY AREAS AT MARINE CORPS BASE CAMP PENDLETON, 2011

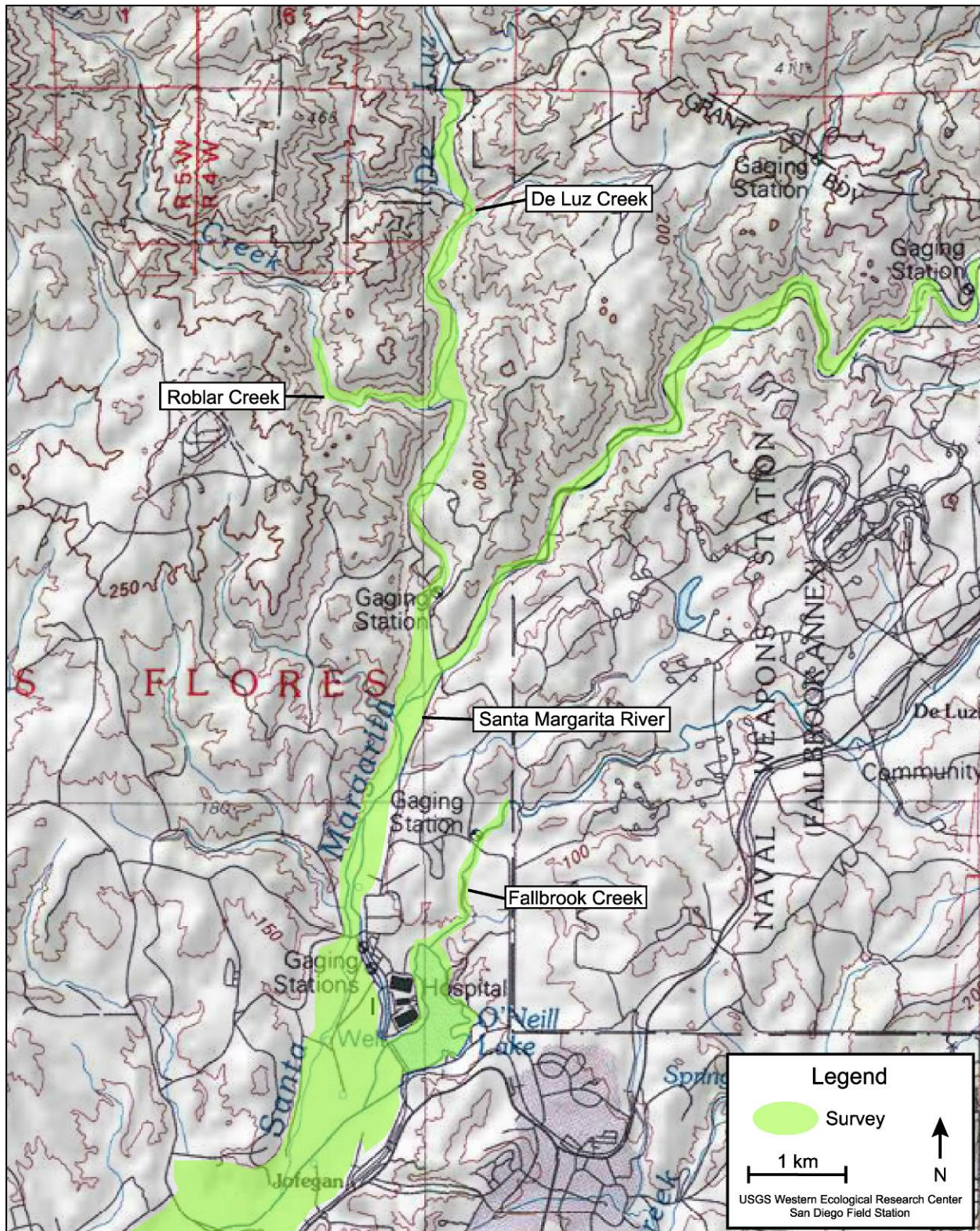


Fig. 4. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2011: Santa Margarita River, Fallbrook Creek, De Luz Creek and Roblar Creek.

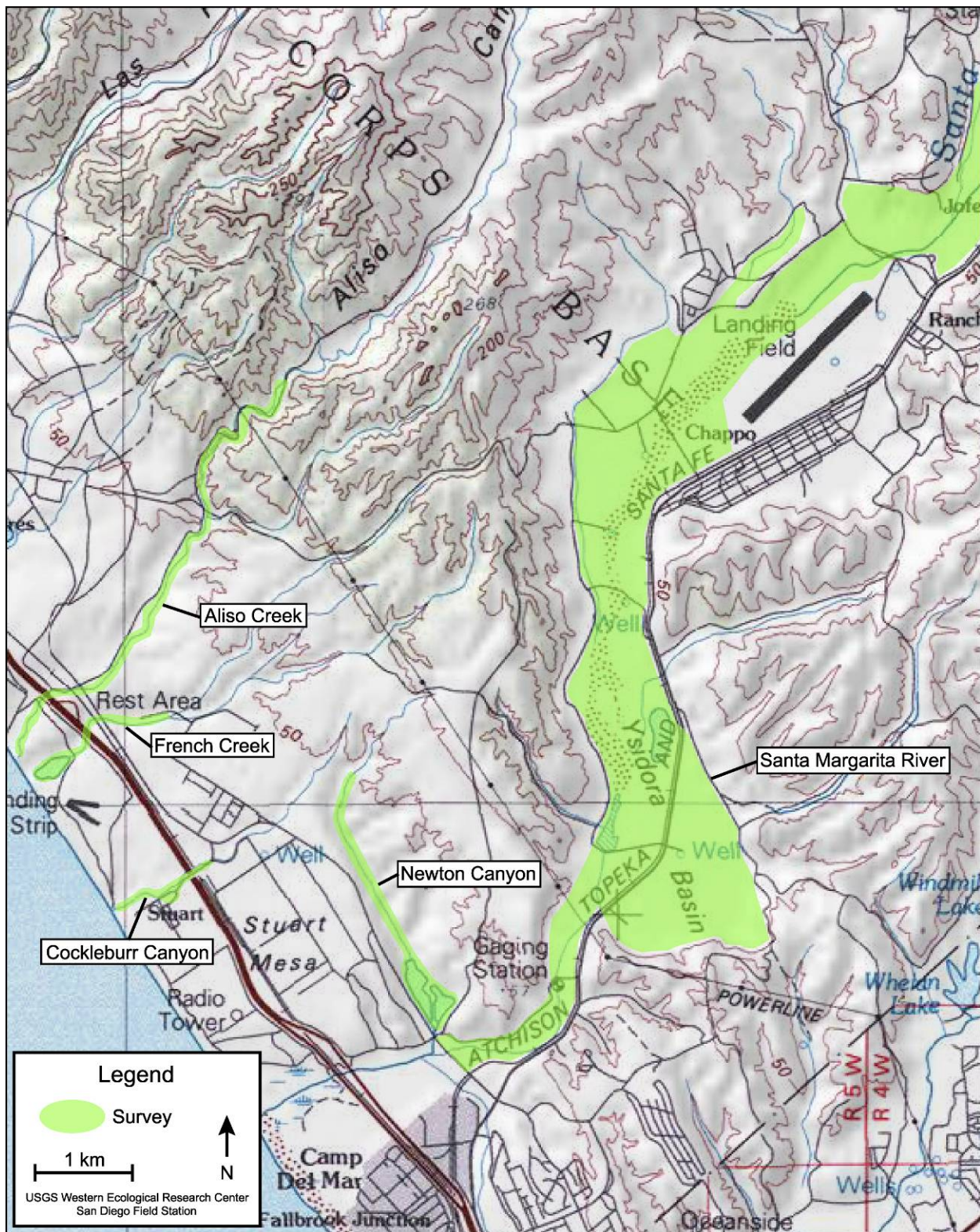


Fig. 5. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2011: Santa Margarita River, Newton Canyon, Cocklebur Canyon, French Creek, and Aliso Creek.

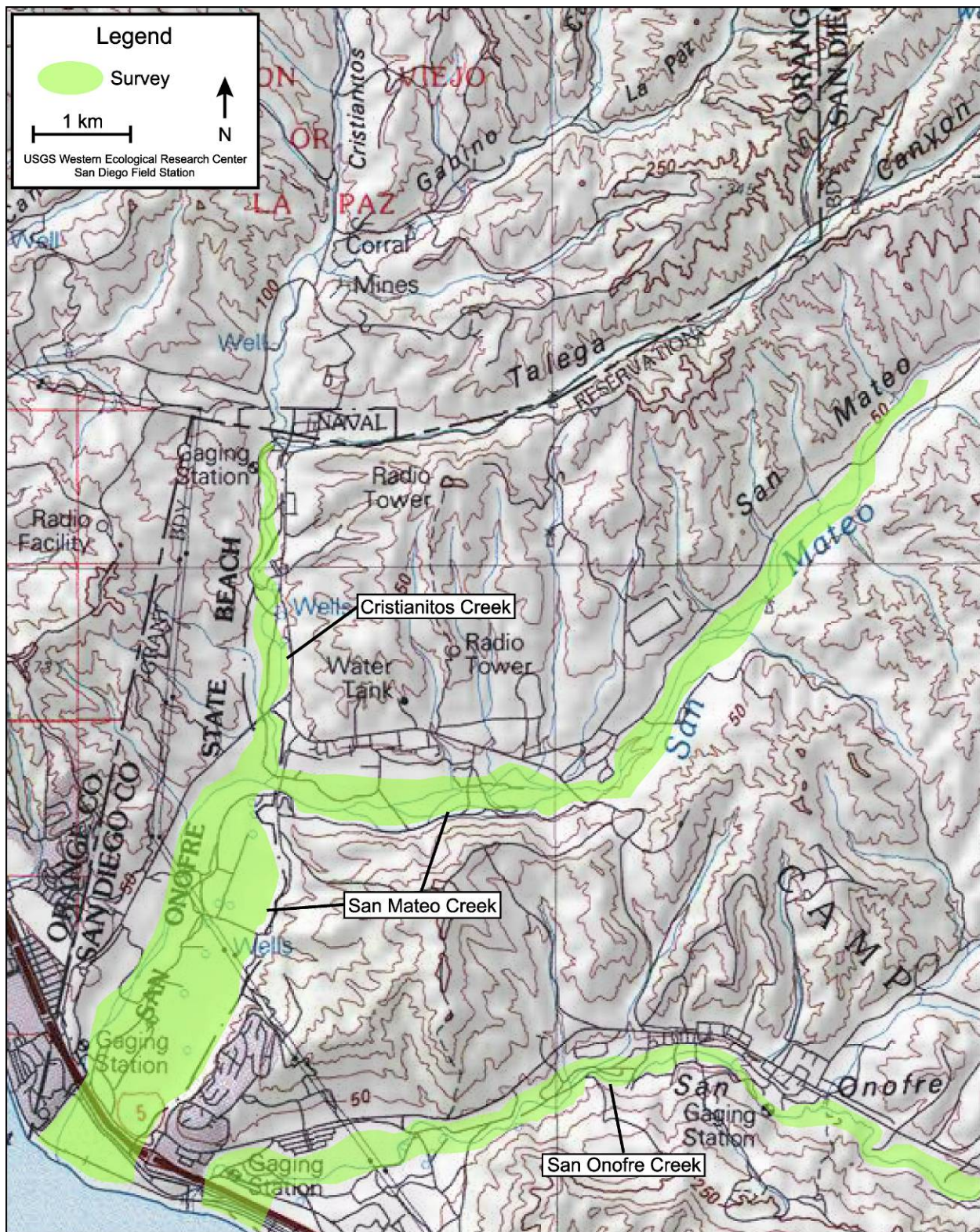


Fig. 6. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2011: Cristianitos Creek, San Mateo Creek and San Onofre Creek.

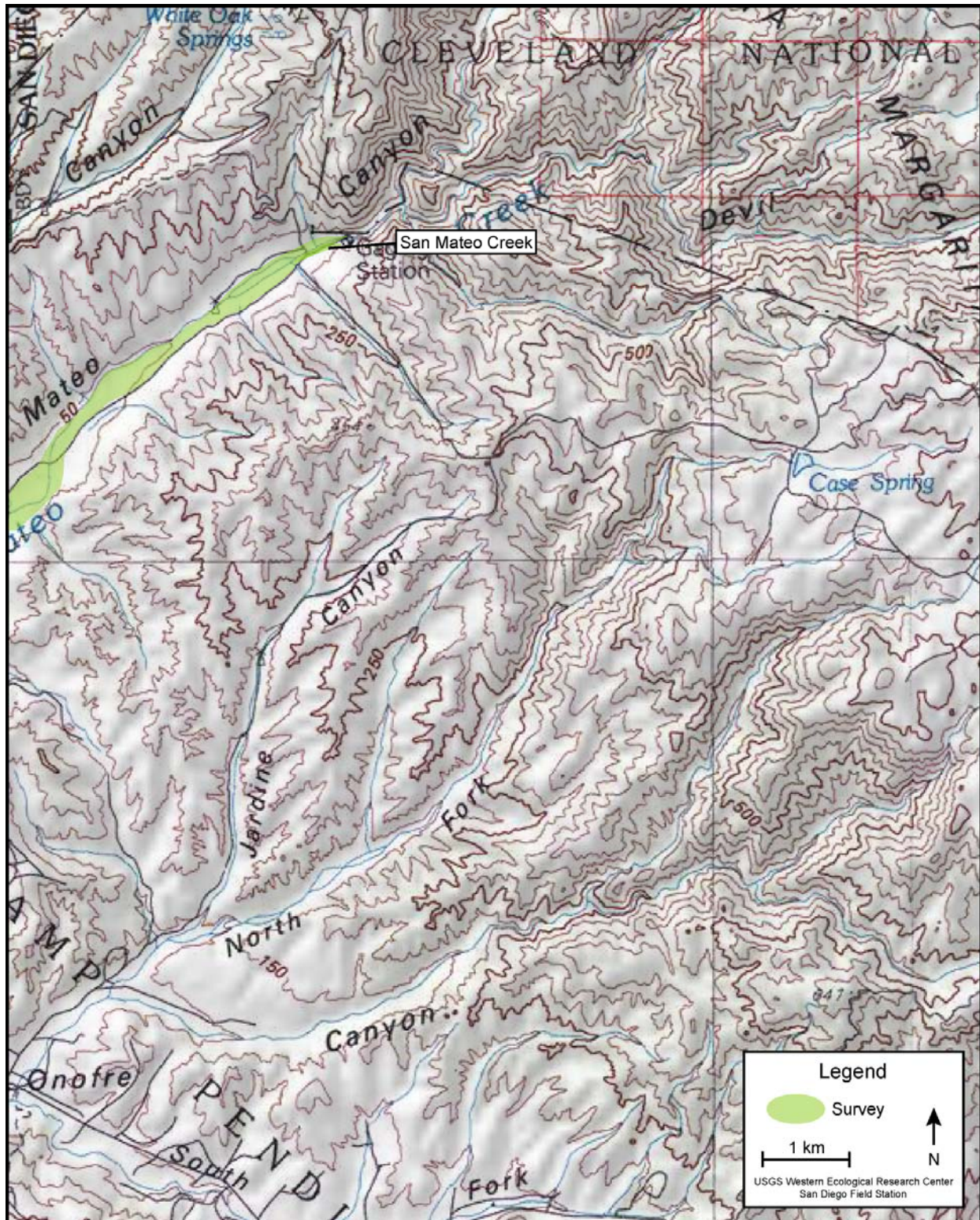


Fig. 7. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2011: San Mateo Creek.

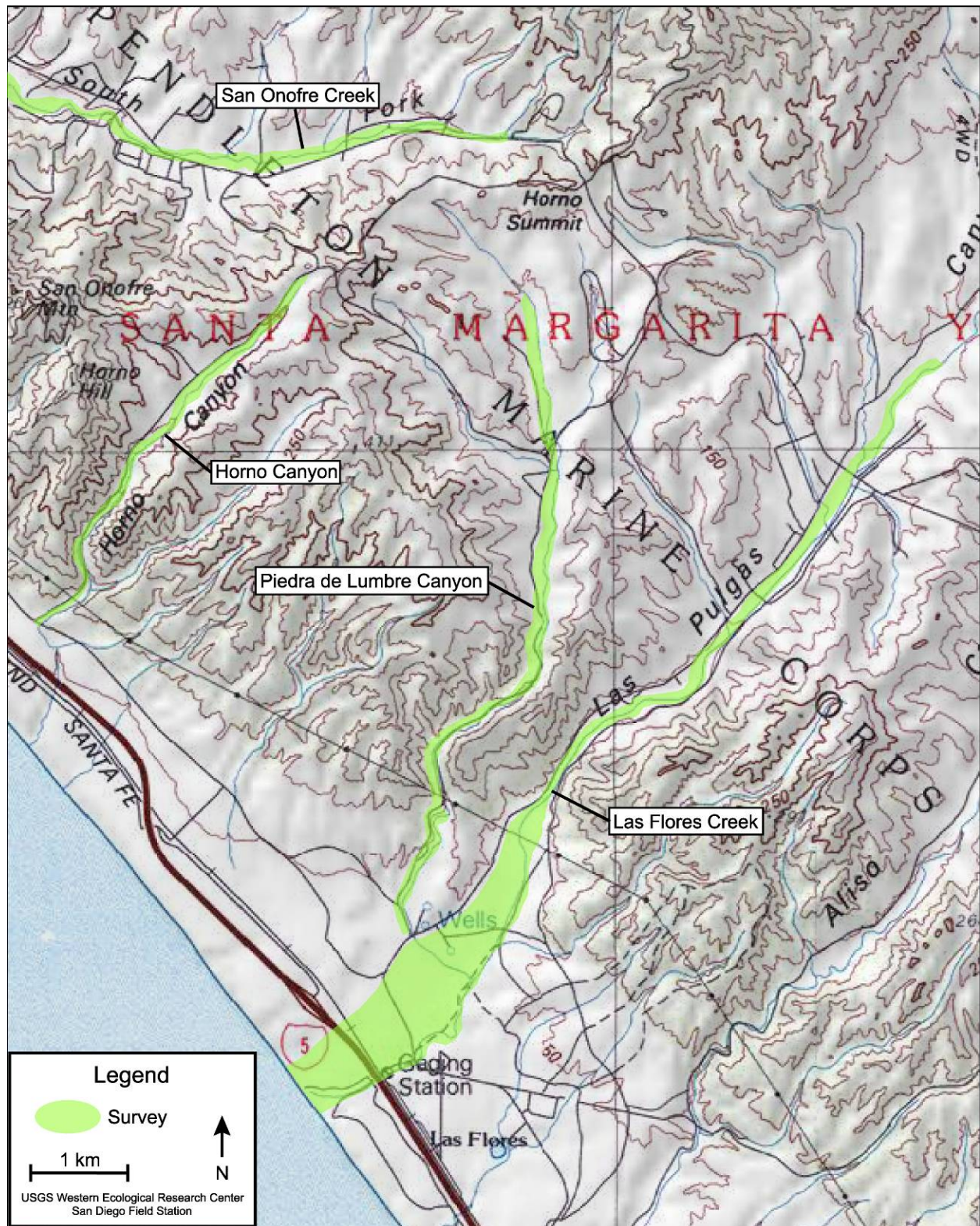


Fig. 8. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2011:
Las Flores Creek, Piedra de Lumbre Canyon, Horno Canyon, and San Onofre Creek.

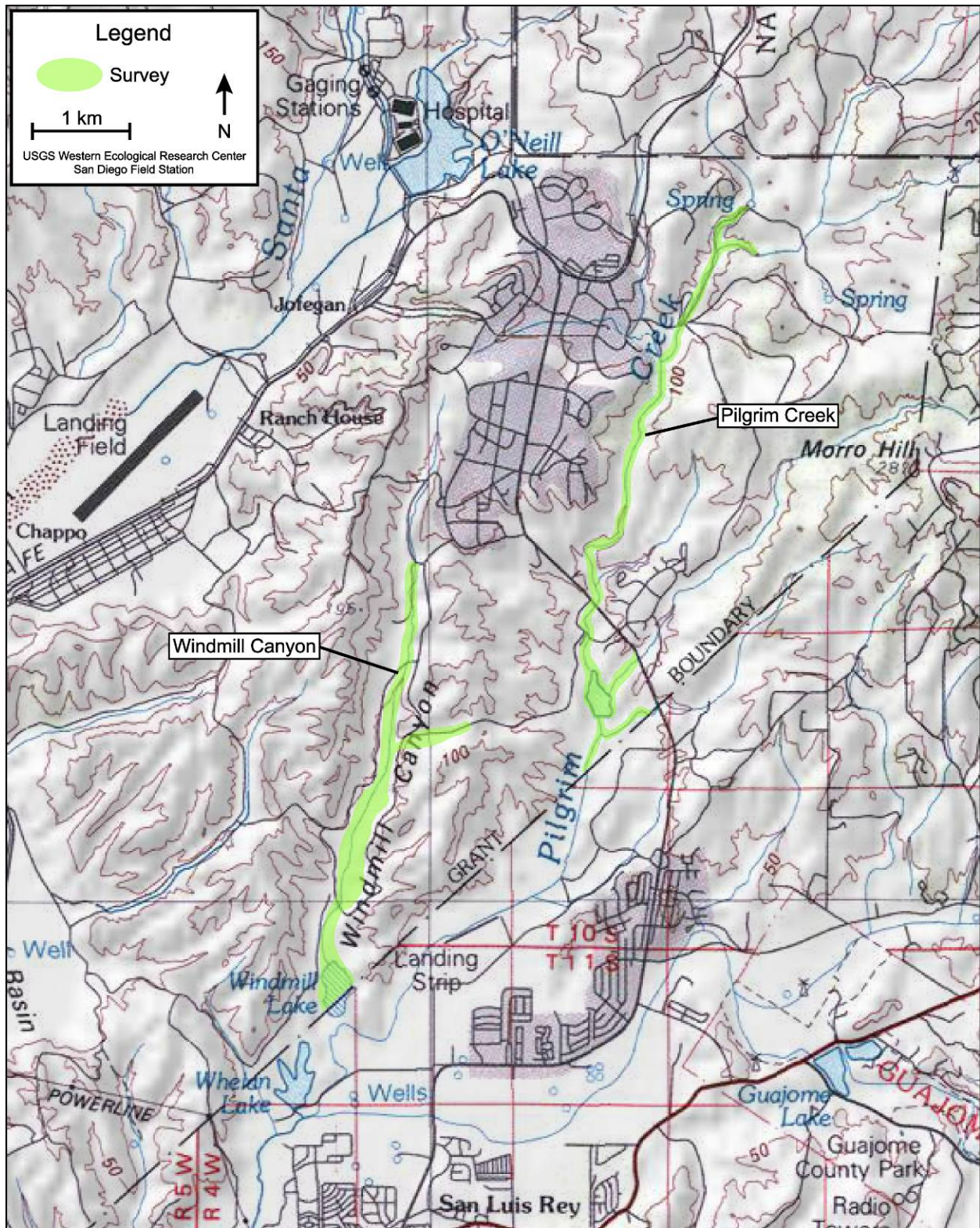


Fig. 9. Willow Flycatcher survey areas at Marine Corps Base Camp Pendleton, 2011: Windmill Canyon and Pilgrim Creek.

APPENDIX B

LOCATIONS OF SOUTHWESTERN WILLOW FLYCATCHERS AT MARINE CORPS BASE CAMP PENDLETON, 2011

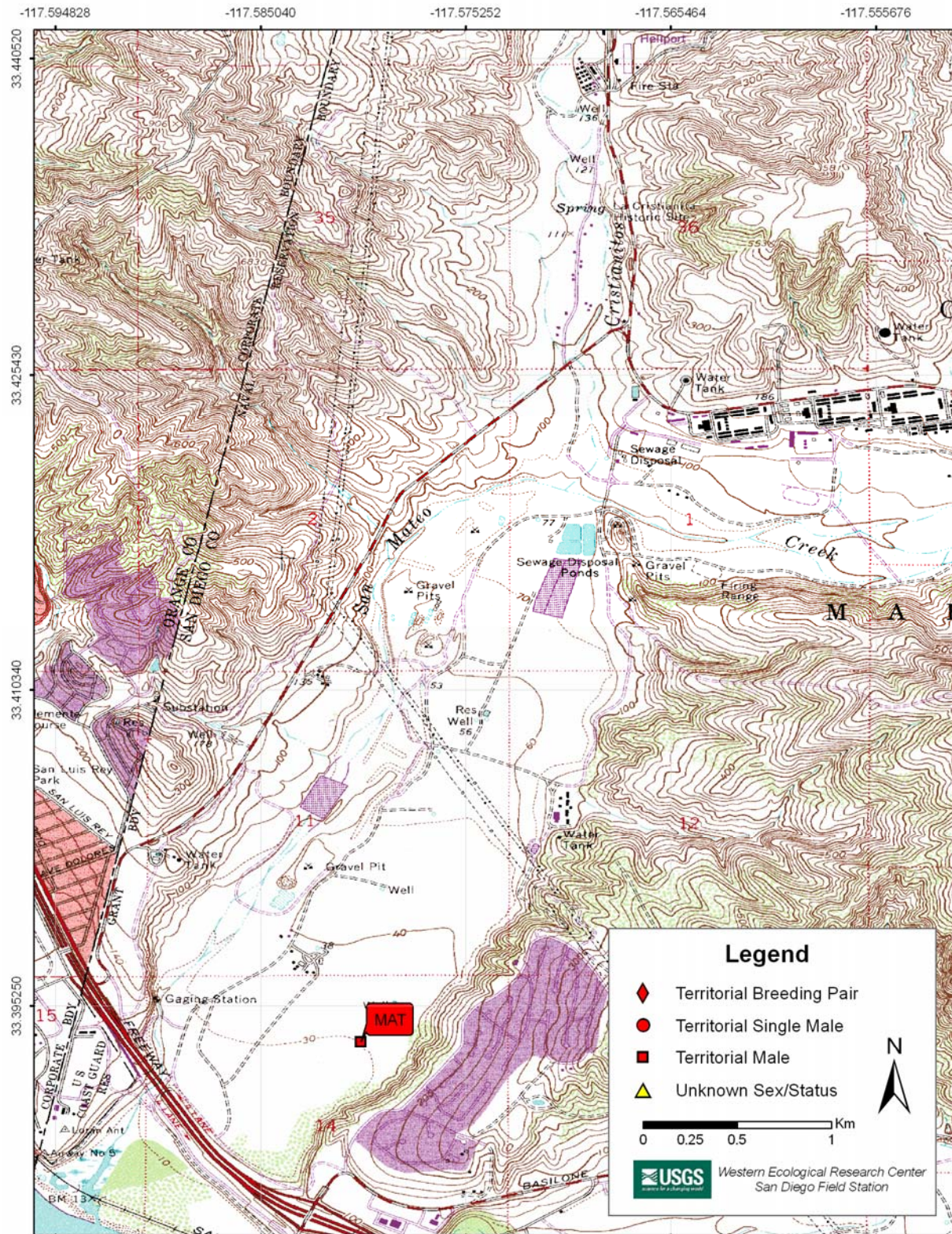


Fig. 10. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2011: San Mateo Creek.

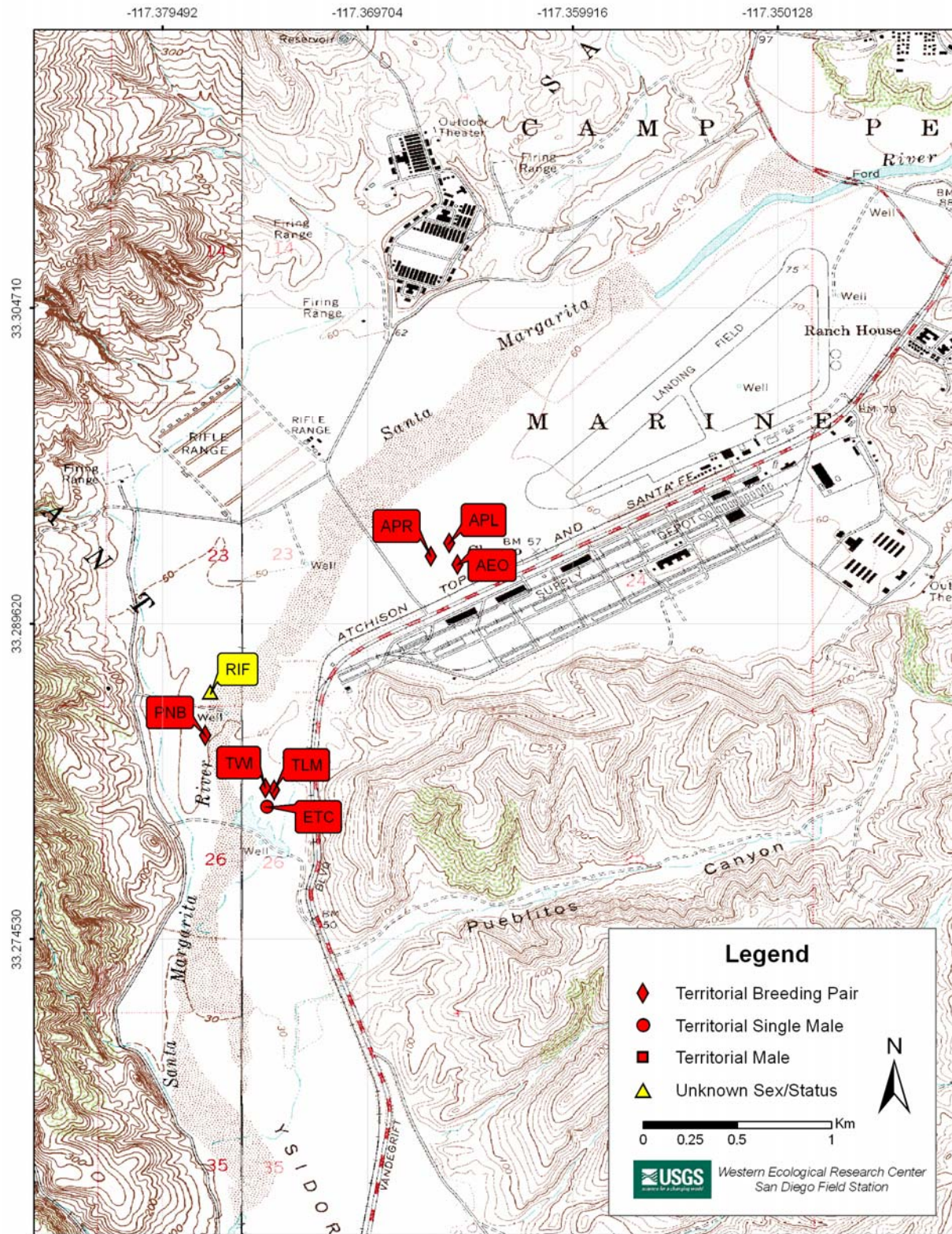


Fig. 11. Locations of Willow Flycatchers at Marine Corps Base Camp Pendleton, 2011: Santa Margarita River (midstream).

APPENDIX C

SOUTHWESTERN WILLOW FLYCATCHER TERRITORY LOCATIONS AT MARINE CORPS BASE CAMP PENDLETON, 2011

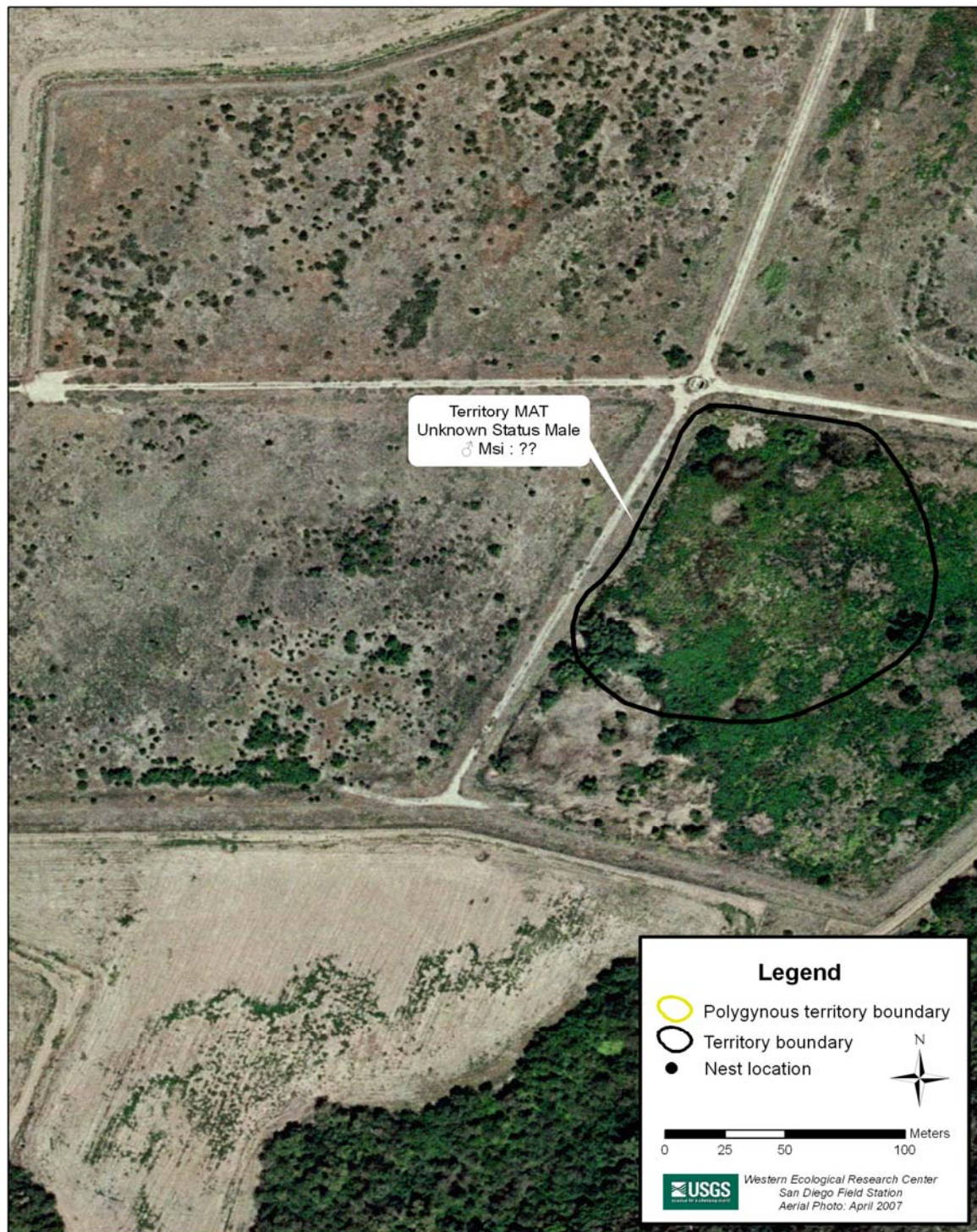


Fig. 12. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2011: San Mateo Creek.

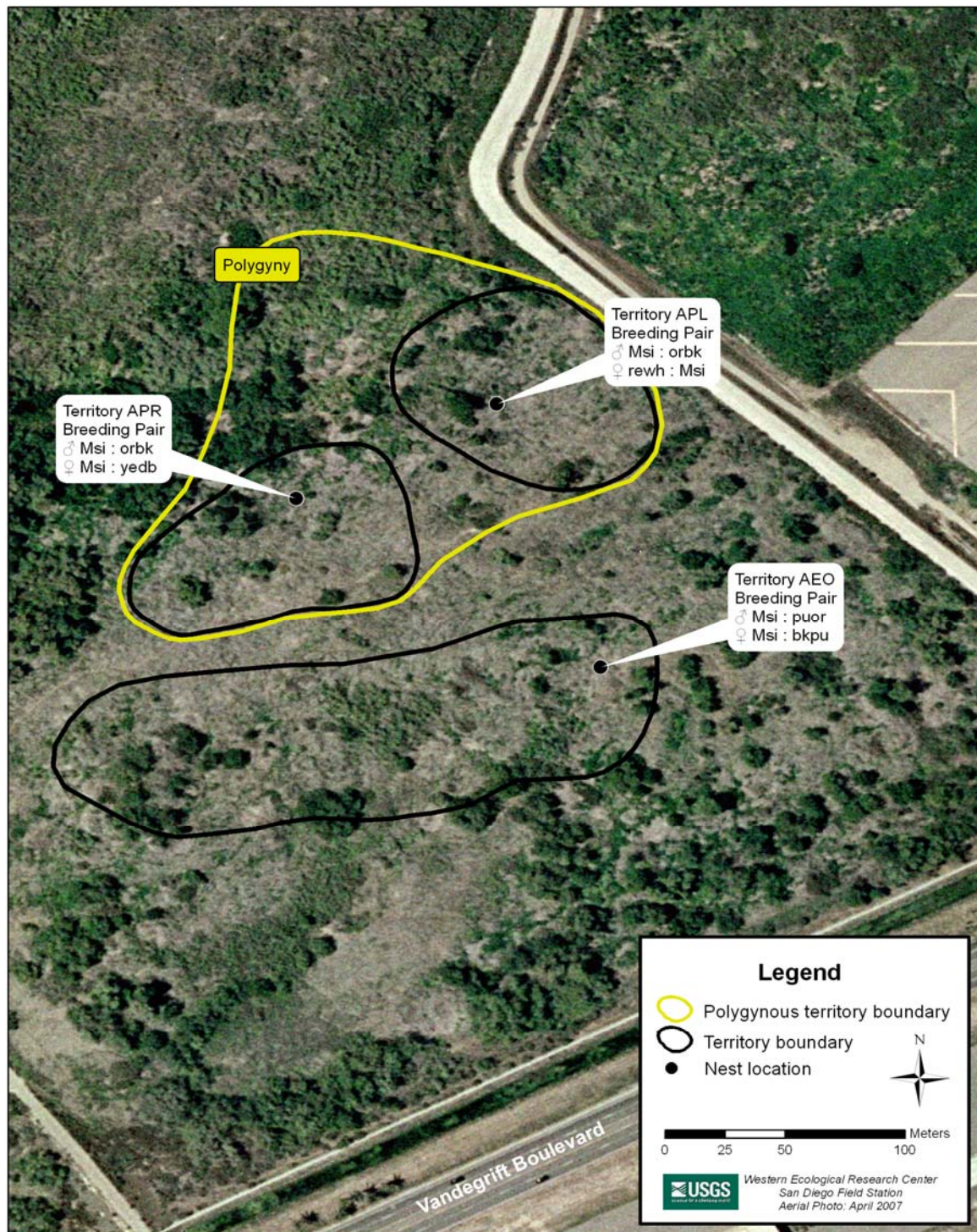


Fig. 13. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2011: Air Station Breeding Area, Santa Margarita River.

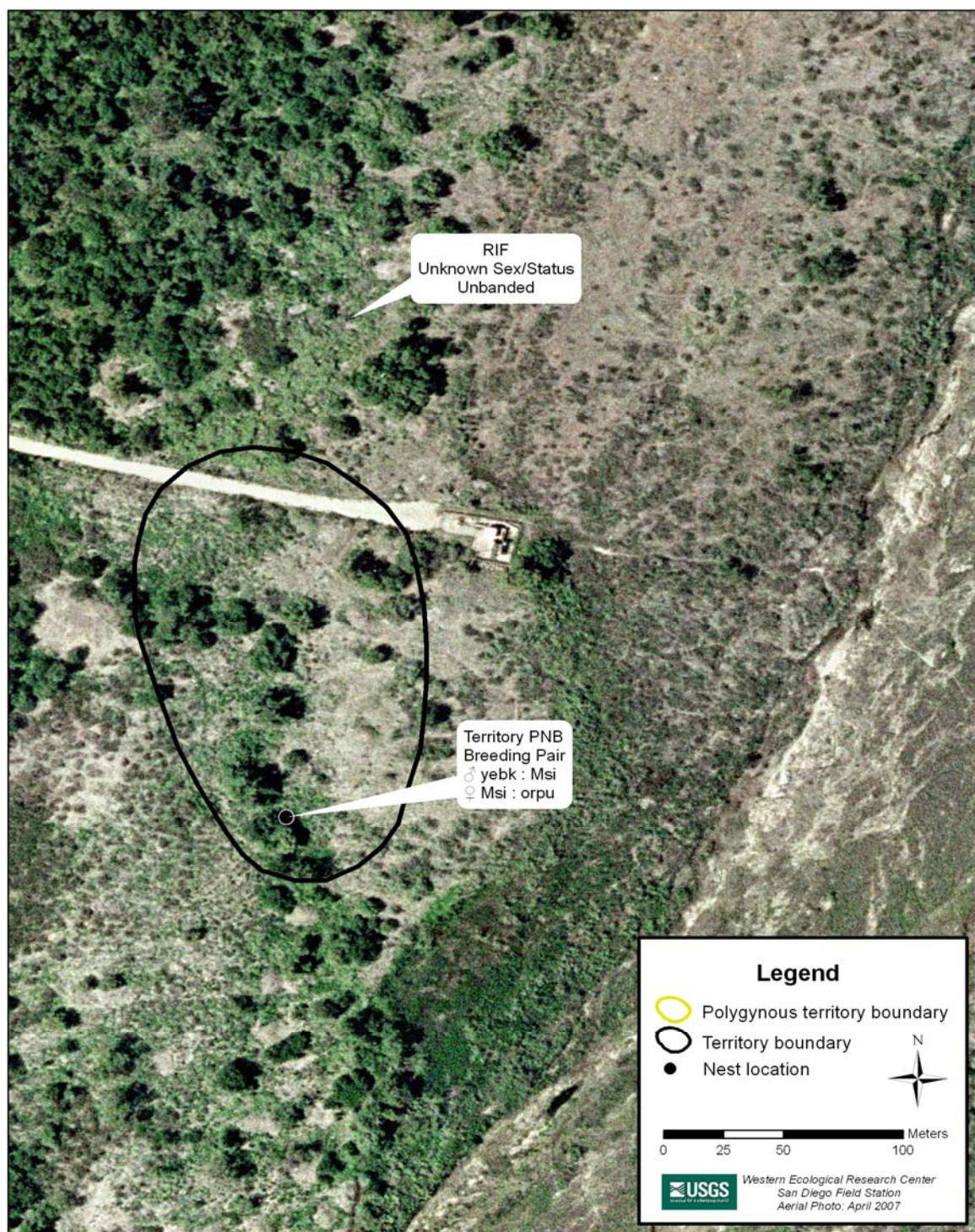


Fig. 14. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2011: Pump Road Breeding Area, Santa Margarita River.

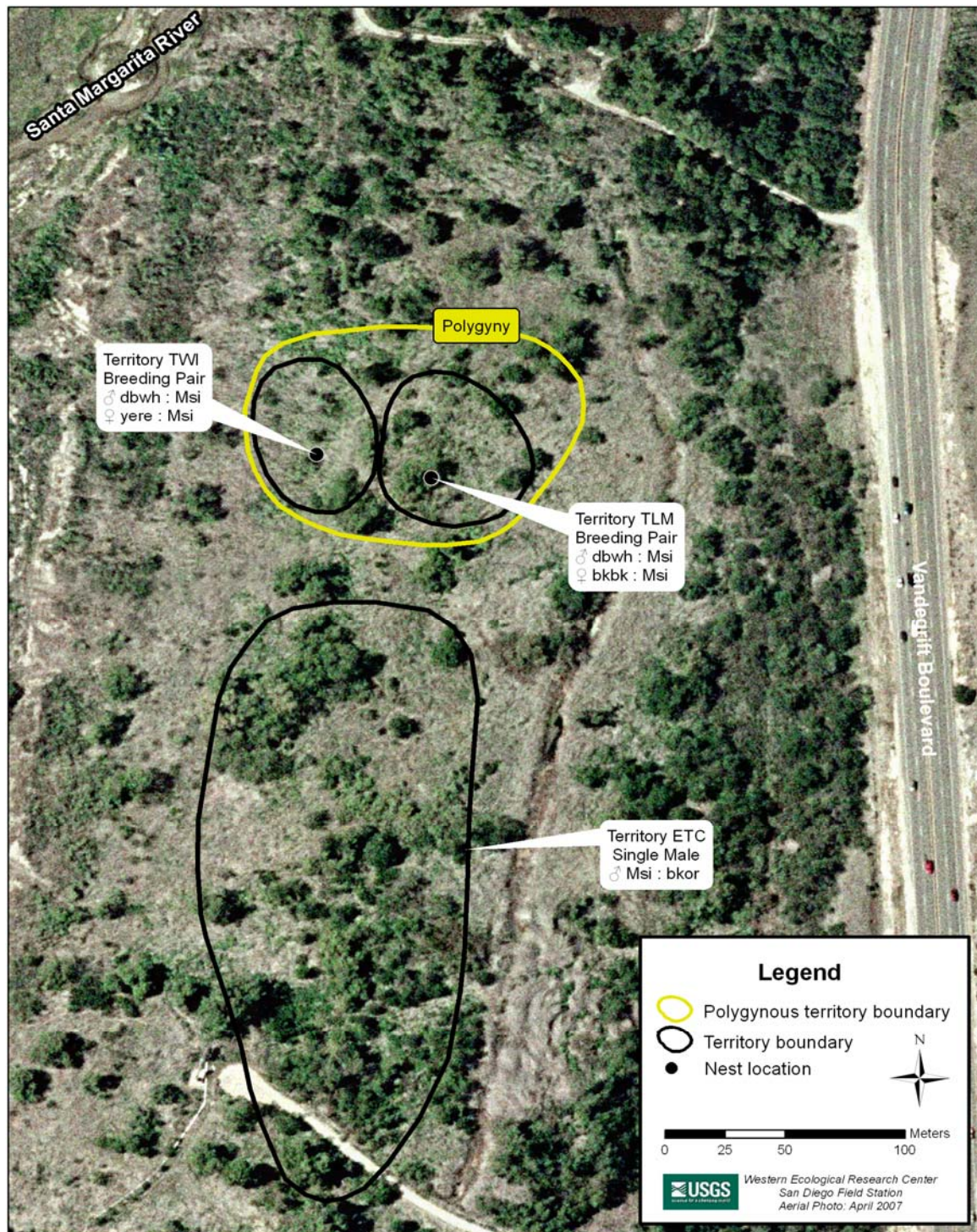


Fig. 15. Southwestern Willow Flycatcher territories at Marine Corps Base Camp Pendleton, 2011: Treatment Ponds and Pueblitos Breeding Areas, Santa Margarita River.

APPENDIX D

BAND COMBINATIONS AND IDENTIFICATION OF SOUTHWESTERN WILLOW FLYCATCHER NESTLINGS BANDED ON MARINE CORPS BASE CAMP PENDLETON, 2011

Band combinations and identification of Southwestern Willow Flycatcher nestlings
banded on Marine Corps Base Camp Pendleton in 2011.

| Territory ID | Nest ID | Nestling Band Combination^a | Federal Band Number |
|---------------------|----------------|--|----------------------------|
| PNB | 1 | none : Msi | 245087058 |
| PNB | 1 | none : Msi | 245087059 |
| PNB | 1 | none : Msi | 245087060 |
| TLM | 1 | none : Msi | 245087061 |
| TLM | 1 | none : Msi | 245087062 |
| TLM | 1 | none : Msi | 245087063 |
| APL | 1 | none : Msi | 245087065 |
| APL | 1 | none : Msi | 245087066 |
| AEO | 1 | none : Msi | 245087067 |
| AEO | 1 | none : Msi | 245087068 |
| AEO | 1 | none : Msi | 245087069 |
| TWI | 1 | none : Msi | 245087070 |
| TWI | 1 | none : Msi | 245087071 |
| APR | 2 | none : Msi | 245087072 |
| APR | 2 | none : Msi | 245087073 |

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