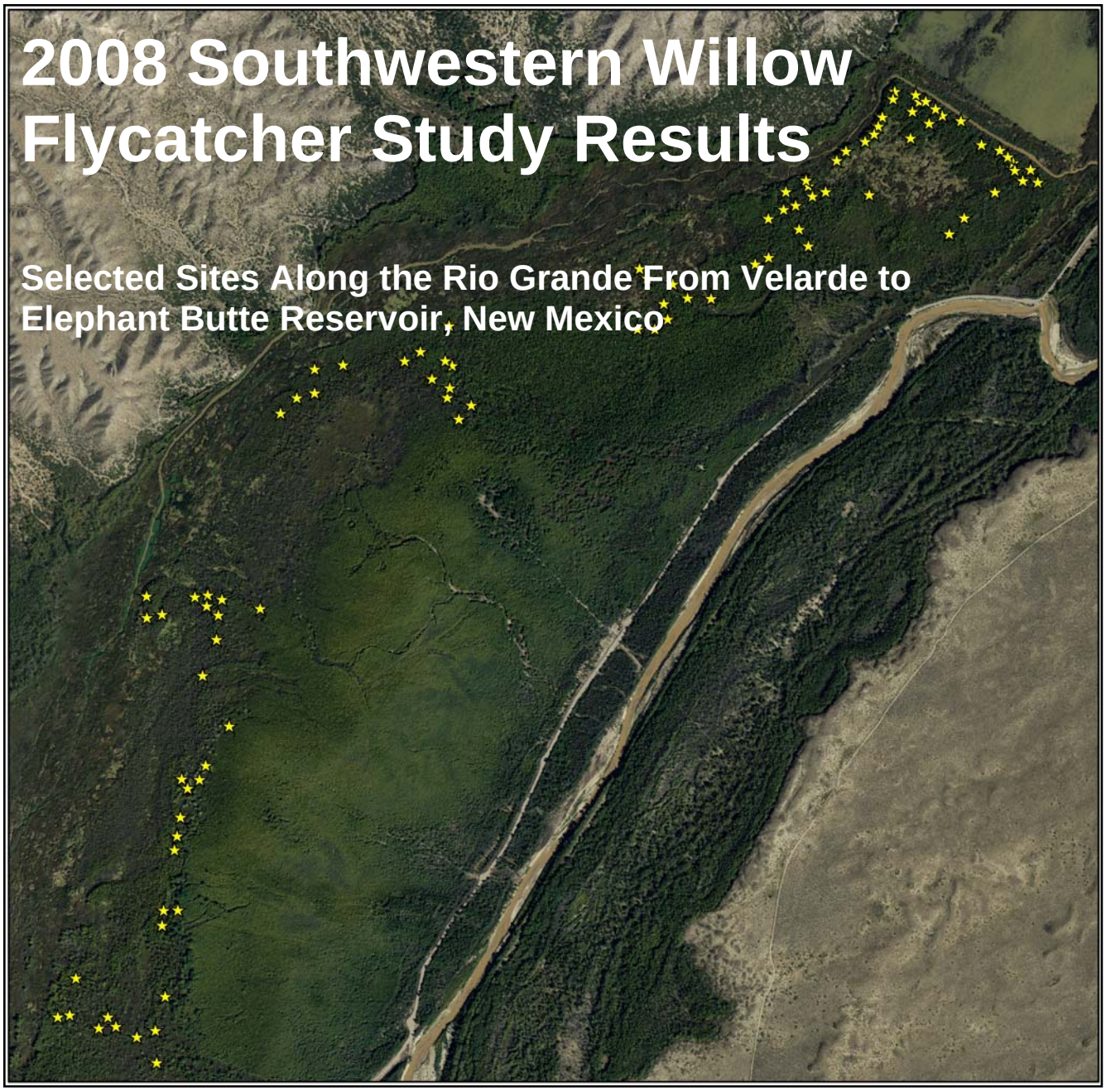
RECLAMATION

Managing Water in the West

2008 Southwestern Willow Flycatcher Study Results

Selected Sites Along the Rio Grande From Velarde to Elephant Butte Reservoir, New Mexico



U.S. Department of the Interior
Bureau of Reclamation
Fisheries and Wildlife Resources
Denver, Colorado

April 2009

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

2008 Southwestern Willow Flycatcher Study Results

Selected Sites Along the Rio Grande From Velarde to Elephant Butte Reservoir, New Mexico

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U.S. Department of the Interior
Bureau of Reclamation
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Executive Summary

Overview

During the summer of 2008, the Bureau of Reclamation (Reclamation) conducted surveys and nest monitoring of the federally endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) (SWFL) in eight distinct reaches along approximately 200 kilometers of the Rio Grande in New Mexico between Velarde and Elephant Butte Reservoir. Surveys were performed to contribute to current baseline population data of the SWFL along the Middle Rio Grande and also to meet Reclamation's Endangered Species Act (ESA) compliance commitments. There were 480 resident SWFLs documented in 287 territories and forming 193 breeding pairs. As in previous years, the San Marcial reach of the river was by far the most productive containing 235 territories and 168 pairs.

Nest monitoring was conducted at all sites where nesting pairs were detected. Nests were monitored for success rates, productivity, and Brown-headed Cowbird (*Molothrus ater*; BHCO) parasitism. The San Marcial reach proved most productive, producing 186 nests and fledging 209 SWFL young. The Sevilleta reach produced 13 nests and fledged 12 SWFL young. Unknown nest fates accounted for the reduction in fledglings. Overall, parasitism decreased, predation increased and abandonment and success were similar to the past several years.

Other studies were initiated or continued in 2008. These include: (1) BHCO point counts, (2) livestock grazing study, (3) SWFL nesting hydrology study and (4) vegetation/habitat mapping. These studies are designed to provide further insight into potential threats to and habitat requirements of SWFL populations.

Survey Results –

Reclamation funded reaches:
Velarde – 0 territories
Frijoles Canyon – 1 territory
San Marcial – 235 territories

Middle Rio Grande (MRG) Endangered Species Collaborative Program funded reaches:
Belen – 4 territories
Sevilleta National Wildlife Refuge (NWR)/La Joya – 31 territories
San Acacia – 2 territories
Escondida – 1 territory
Bosque del Apache NWR – 5 territories
Tiffany – 8 territories

Recommendations

1. Continue annual surveying and nest monitoring within occupied and "critical habitat" reaches to determine reproduction, nest success, recruitment, and population trends of SWFLs within the Rio Grande Basin.
2. Give special attention to the core concentration area between sites LF-17/17a and the Elephant Butte delta to document expansion of SWFLs into the Elephant Butte conservation pool.
3. Survey suitable/potential habitat in various reaches of the Upper and Middle Rio Grande every 3 to 5 years to document new occupation by resident SWFLs.
4. Continue nest monitoring and addling/removal of BHCO eggs/chicks from parasitized SWFL nests in lieu of cowbird trapping.
5. Conduct habitat monitoring, utilizing data from the nest vegetation quantification study, at any restoration sites to document the effectiveness of various restoration practices.

Introduction

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*; SWFL) is a state-listed and federally-endangered subspecies of the Willow Flycatcher (*Empidonax traillii*; WIFL). It is an insectivorous, Neotropical migrant that nests in dense riparian or wetland vegetation in the Southwestern United States (Figure 1). SWFLs typically arrive at their Middle Rio Grande breeding sites by mid-May (the earliest detection is May 6) and continue to arrive through early June. They depart for wintering areas in Mexico, Central America, and northern South America between late July and mid-August (Sogge et al. 1997, USFWS 2002).

Recent studies indicate that SWFL populations have declined across their range (USFWS 2002). The primary causes of declining populations are likely habitat loss or modification and brood parasitism by the Brown-headed Cowbird (*Molothrus ater*; BHCO) (USFWS 2002). The U.S. Fish and Wildlife Service (USFWS) officially listed the SWFL as endangered in February 1995 (USFWS 1995). The SWFL is also listed as endangered or a species of concern by the states of Arizona, California, Colorado, New Mexico, Texas, and Utah (Sogge et. al. 1997, TPWD 2005). A recovery plan for the SWFL was finalized in August 2002. To accompany the recovery plan, a series of issue papers associated with the recovery of the endangered SWFL has also been prepared by the Recovery Team. These papers address current issues and recommend management alternatives in regard to BHCO parasitism, livestock grazing, water management, exotic vegetation, habitat restoration, fire management, and recreational impacts (USFWS 2002).

In October 2005, the US Fish and Wildlife Service (USFWS) designated Critical Habitat for the SWFL along the Middle Rio Grande in three separate segments, separated by the Sevilleta and Bosque del Apache National Wildlife Refuges (NWR) which were excluded from the designation. The designated reaches include "from the southern boundary of the Isleta Pueblo for 44.2 miles to the northern boundary of the Sevilleta NWR. The Middle Rio Grande segment extends for 27.3 miles from the southern boundary of the Sevilleta NWR to the northern boundary of the Bosque del Apache NWR. The most southern Rio Grande segment extends for 12.5 miles from the southern boundary of the Bosque del Apache NWR to the overhead powerline near Milligan Gulch…"(USFWS 2005). This designation does not include the conservation pool of Elephant Butte Reservoir.

Presence/absence surveys are conducted to determine the distribution and abundance of the endangered SWFL during the relatively brief breeding season when they become a seasonal resident of the Southwestern United States. Bureau of Reclamation (Reclamation) personnel have conducted presence/absence surveys and nest monitoring during the May to July survey season within the Rio Grande Basin since 1995. In 1994, the New Mexico Natural Heritage Program (NMNHP 1994) conducted presence/absence surveys and nest monitoring within portions of the San Marcial reach under a contract with the U.S. Army Corps of Engineers.

Figure 1. Breeding range of the SWFL (adapted from Unitt 1987 and Browning 1993).

The 2008 presence/absence surveys for SWFLs were conducted at selected sites along the Rio Grande from Velarde downstream to the delta of Elephant Butte Reservoir (Figure 2). Surveys were conducted between May 13 and July 28, 2008. Nest searches and nest monitoring of SWFL nests were conducted in conjunction with survey efforts by USFWS-permitted biologists.

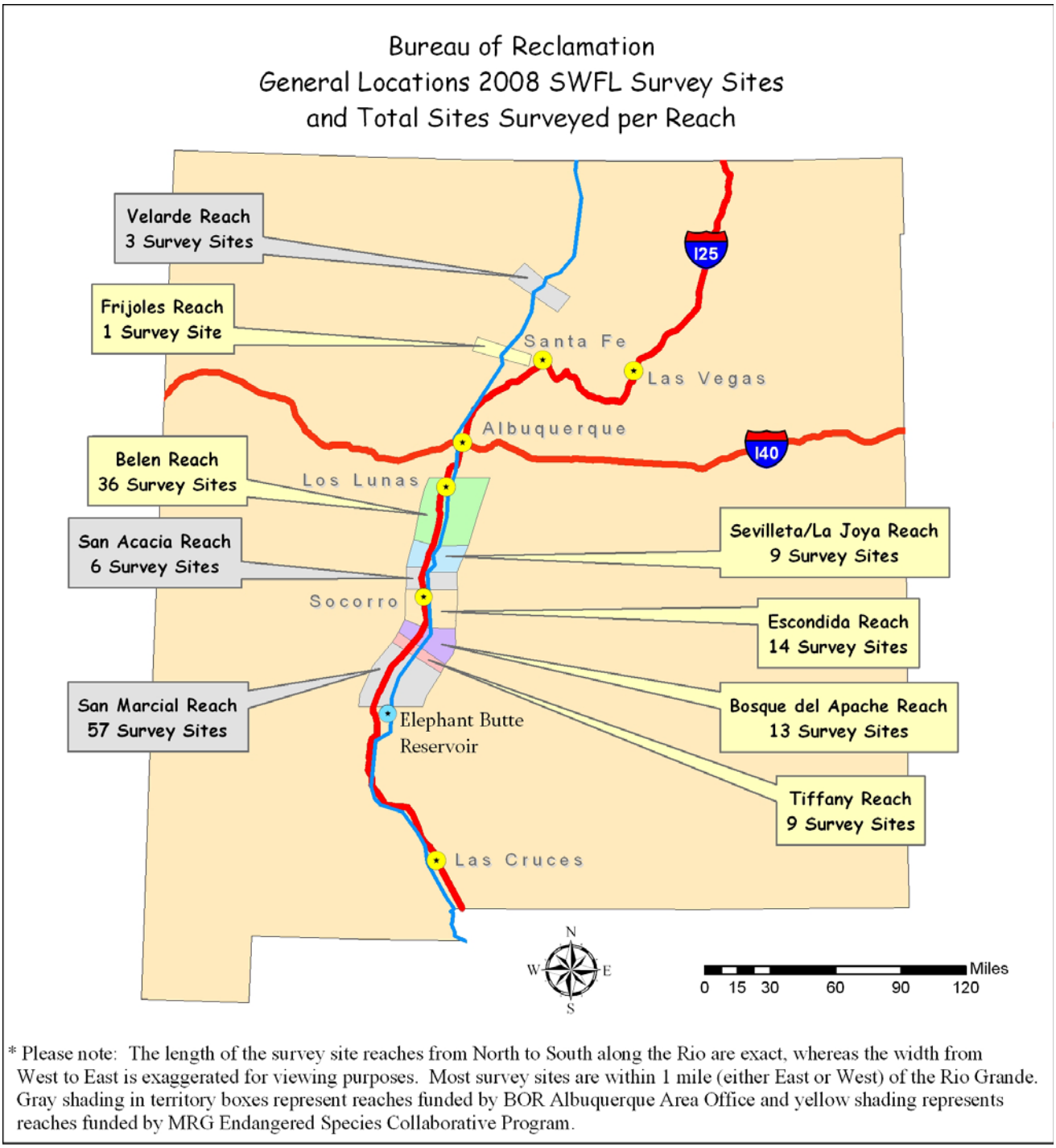

Figure 2. General locations of 2008 survey sites.

Goals and Objectives

Primary goals of the field studies performed in 2008 were:
1. Contribute to current baseline data regarding the population status, distribution, and habitat requirements of the SWFL in the Middle Rio Grande Basin, and
2. Meet Reclamation's Endangered Species Act (ESA) compliance commitments for ongoing and proposed projects and monitoring of completed projects.

Specific objectives included:
- Maintain project ESA compliance in specific action areas with five surveys.
- Monitor SWFL nests to determine productivity, parasitism and predation rates, population recruitment, and limiting factors.
- Determine relationships between SWFL nesting and hydrologic parameters.
- Assess habitat availability and utilization by breeding SWFLs.

Related Studies

In addition to the presence/absence surveys and nest monitoring conducted in 2008, the following related studies were either previously conducted or continued in 2008:

- Using a modified Breeding Biology Research and Monitoring Database (BBIRD) protocol (Martin et al. 1997), an avian nest monitoring study was conducted from 1999 to 2004. Potential BHCO host nests were monitored to determine the effectiveness of the discontinued cowbird trapping effort and to gain a better understanding of the effects and intensity of factors such as brood parasitism and predation on productivity of riparian obligate species. Parasitism levels, predation, nest success, and nest productivity of SWFLs and comparable riparian obligate species in various sites within the former trapping area were compared to those within two adjacent areas at least 12 kilometers (km) from the trapping area. Neither of the adjacent areas had been subject to cowbird trapping. One of the areas supported year-round grazing, and the other did not support any livestock grazing. Results suggest that trapping may reduce brood parasitism; however compensatory factors such as habitat, predation, and nest abandonment appear to make up for the increased success due to decreased BHCO parasitism. Further information on this study can be found in *Riparian Obligate Nesting Success as Related to Cowbird Abundance and Vegetation Characteristics Along the Middle Rio Grande, New Mexico* (Moore 2006).

- Avian point counts were continued to determine the distribution and abundance of BHCOs and host bird species within the Middle Rio Grande Basin. Transects were established within four study areas to determine the distribution and density of BHCOs and to determine the effectiveness of the cowbird trapping program. Data from 1999 to 2008 have shown a dramatic decline in BHCOs per point in the Sevilleta and Bosque del Apache reaches. BHCO abundance has increased within the San Marcial reach and declined slightly in the San Acacia reach. Similarly, host species abundance has increased markedly in the San Marcial reach while decreasing slightly in the other three reaches. Higher quality habitat in the San Marcial reach is likely drawing in riparian-obligate host species which, in turn, may be attracting greater numbers

of BHCOs. Methods and results of this study can also be found as a component of *Riparian Obligate Nesting Success as Related to Cowbird Abundance and Vegetation Characteristics Along the Middle Rio Grande, New Mexico* (Moore 2006).

- A study to monitor and evaluate the impacts of livestock grazing on the establishment and development of riparian vegetation was also continued. This study was initiated in 1997 to determine the effects of seasonal livestock grazing on the potential future habitat of the endangered SWFL and the physical disturbance to existing occupied habitats. Data from a series of established livestock exclosures and photo stations are collected biennially and processed. The study ended in 2008 and study data will be presented in the draft report *A Long Term Assessment of Livestock Impacts on Riparian Vegetation: Elephant Butte Project Lands* (Ahlers et al. 2009, *in prep*).

- Development of a SWFL habitat suitability model for GIS (geographic information systems) was initiated in 1998 for the Middle Rio Grande Basin and continues to be refined based on changes in hydrology and updated vegetation maps. Riparian vegetation in the Middle Rio Grande Basin between Highway 60 and Elephant Butte Reservoir had been classified using the Hink and Ohmart (1984) classification system through a cooperative effort with the U.S. Forest Service. This system identifies vegetation polygons based on dominant species and structure. Plant community types are classified according to the dominant and/or codominant species in the canopy and shrub layers. During the summer and fall of 2002, as part of the Middle Rio Grande (MRG) Endangered Species Collaborative Program, Reclamation personnel updated vegetation maps from Belen to San Marcial using a combination of ground-truthing and aerial photo analysis. During the summer of 2004, the conservation pool of Elephant Butte Reservoir was again aerially photographed (true color) and vegetation heights were remotely-sensed using Light Detection and Ranging (LIDAR) methods. Most recently, aerial photographs were again taken during the summer and fall of 2007 and ground truthing was conducted during summer 2008. These data are currently being processed and will be used to update the current SWFL GIS habitat model.

- A study to quantify the vegetation at known SWFL breeding sites began in 2003. Data gathered included nesting height and substrate, vegetation density, height diversity, canopy cover, and hydrology. Methodologies were refined in 2004 and a formal study was initiated. Between 2004 and 2006, data were gathered at 112 nests and will be used to increase overall knowledge of the nesting and general habitat requirements of the species. The resulting analysis of these data will also help to provide guidelines for riparian restoration projects targeted for SWFL habitat. See *Vegetation Quantification of Southwestern Willow Flycatcher Nest Sites* (Moore 2007) for details of this study. In 2007, data were gathered at 11 non-nest sites within maturing habitat in both the delta of Elephant Butte Reservoir and adjacent to the Los Lunas Restoration Site. These data will be compared to nest data to assess the suitability of these areas for nesting SWFLs. Results of this study are available in *An Assessment of Potential Southwestern Willow Flycatcher Habitat* (Moore 2009)

- In 2005, photostations were established adjacent to developing habitat in the delta of Elephant Butte Reservoir. Permanent photopoints are visited annually in August and photos are taken at predetermined bearings to document changes in riparian vegetation. Currently, three sets of

annual photos at each of the 13 stations have been taken and some have documented considerable vegetation growth. Results of this study can be found in *Elephant Butte Reservoir Delta Photo Stations – 2005-2008* (Ahlers 2009a).

- A hydrology monitoring study was initiated in 2004 to monitor the relationship of hydrology, habitat and breeding SWFLs. Nineteen "hydrostations" were placed in the high quality occupied habitat within the delta of Elephant Butte Reservoir and were monitored weekly during the SWFL breeding season. This study is further explained and data are presented in the following sections.

Methods

Study Area

Survey sites were selected based on environmental compliance needs related to Reclamation projects and a desire to continue updating the baseline population data of SWFLs in the Rio Grande Basin. Sites consist of riparian habitat bounded by waterbodies, levees, or other physical features that are able to be surveyed by one person in one day. The 2008 survey area encompassed selected sites along the Rio Grande in New Mexico between Velarde and Elephant Butte Reservoir. This stretch contained nine distinct survey reaches: Velarde, Frijoles Canyon, Belen, Sevilleta/La Joya, San Acacia, Escondida, Bosque del Apache, Tiffany, and San Marcial. Survey efforts varied among reaches and sites based on research needs, project compliance, and effort needed to ensure thorough coverage. Table 1 shows a summary of the survey effort within each reach.

Presence/Absence Surveys

All sites were surveyed using the repeated call-playback method in accordance with the protocols established in Sogge et al. (1997) and the USFWS revised protocol (USFWS 2000). Surveys in individual sites were conducted a minimum of 5 days apart, generally between 0530 and 1030 or 1100 MDT (depending on weather conditions), by trained and permitted personnel. Survey forms were completed daily for each respective site. Survey dates are summarized in Table 2.

The first survey conducted in late May increases the likelihood of detection, since territorial males are more vocal when establishing territories than after nesting has begun. It was anticipated that migrant WIFLs (Willow Flycatchers that are not the *extimus* subspecies) would also be detected. The second and third surveys were conducted between early June and early July to (1) confirm the establishment of territories and/or nesting, (2) detect late settling males, and (3) determine which sites remained occupied throughout the breeding season. The fourth and fifth surveys, conducted during mid-July in project-related sites, were initiated in 2002 to derive a greater degree of confidence regarding the breeding status, habitat association, or presence/ absence of SWFLs at the selected sites. WIFLs documented on or after June 10 were considered resident birds (i.e., SWFLs)

for reporting purposes, however, some were likely late migrants. Each site was surveyed as thoroughly as conditions would allow.

Table 1. Number of sites and surveys per reach – Middle Rio Grande 2008.

Survey reach	Total sites surveyed	Number of surveys
Velarde	3	3
Frijoles Canyon	1	3
Belen	36	3: all sites but SV-11 through 15 (5 surveys)
Sevilleta/La Joya[1]	9	5
San Acacia	6	5
Escondida	14	LF-33: 2 (due to safety issues) LF-03 through 08 and LF-43a and b, 44b, and 45: 3 LF-05, 34, 42, and 44a: 5
Bosque del Apache	13	3: all sites but BA-02, 04N, and 04S (2 surveys due to high water)
Tiffany[2]	9	3
San Marcial[3]	56	5
Total	147	See above

[1] One site in the Sevilleta/La Joya reach was not surveyed due to landowner issues.
[2] Site LF-26 was not surveyed in 2008 because the entire site burned in May 2006.
[3] Pre-season reconnaissance in sites EB-15, 16 and 17 determined that habitat in these sites was unsuitable for breeding SWFLs, so no surveys were conducted.

Table 2. SWFL survey schedule for the 2008 field season.

Survey number	Survey period*
1	May 15 – May 31
2	June 1 - June 21
3	June 22 – July 27
4	July 3 - July 14
5	July 15 - July 24

* For general surveys, a minimum of three surveys per site are required; one each during the first three survey periods. In project-related sites, a minimum of five surveys are required. The final three surveys are performed during the third survey period and must be at least 5 days apart.

Nest Searches/Monitoring

Nest searches were conducted by a USFWS-permitted biologist and/or technician under the direct supervision of a permitted biologist upon discovery of a breeding or suspected breeding SWFL pair. To minimize disturbance and maximize accuracy of monitoring efforts, nest searches and monitoring were conducted using methods outlined in Martin and Geupel (1993) and the Southwestern Willow Flycatcher Nest Monitoring Protocol (Rourke et al. 1999). The nest area was located by observing diagnostic SWFL breeding behavior and listening for calls within the habitat patch. Once located, the nest site was approached cautiously with minimum disturbance to vegetation. Typically, adult SWFLs did not immediately reveal nest locations. All suitable midstory trees and shrubs in the suspected area were carefully inspected until the characteristic small, cup-shaped nest (as described in Tibbitts et al. [1994]) was found. Nests were usually located within a few minutes of nest search initiation.

At all nest sites, physical data required by the Willow Flycatcher Nest Site Data Form were collected. Nest contents were not monitored during the nest building/egg laying stages—the period when disturbance is most likely to cause adults to abandon the nest—or as the suspected fledging date approached when nestlings are likely to be force-fledged as a result of disturbance. Nests with eggs/young were examined quickly using a mirror mounted on a telescopic pole. Nesting chronology was then estimated following the initial search and examination. Subsequent visits were minimized and timed so at least one inspection would be made of both eggs and nestlings. Data resulting from these inspections were recorded on the Willow Flycatcher Nest Record Form.

At the conclusion of the first or early-season nesting attempts, the nesting pair was not monitored for approximately one week to minimize disturbance and allow for possible initiation of another nesting attempt. Then a re-nest/second brood search was performed to detect any subsequent nesting attempts. A re-nest is a nesting attempt that occurs after a nest fails while a second brood occurs after a nest successfully fledges young. When possible, nests were monitored through completion. However, a few nests were not monitored to completion and had nestlings at least eight days old at the last visit and were considered successful based on best biological opinion.

In 2002, the practice of addling or removing BHCO eggs from parasitized nests was initiated when necessary and possible. This activity was continued in 2008. SWFL eggs were never disturbed and time spent at the nest was minimized. Frequently, based on nesting chronology, it was determined that the BHCO egg would not have a chance to hatch. In these cases nests were monitored normally to minimize disturbance.

Hydrology Monitoring

In conjunction with SWFL nest monitoring, a hydrology monitoring study was implemented in 2004 and continued through 2008. Nineteen “hydrostations” (custom-built staff gauges) were installed in proximity to the “core” SWFL population in the headwaters of Elephant Butte Reservoir (Figures 3 and 4). Four additional hydrostations were installed in newly occupied habitat in 2008.

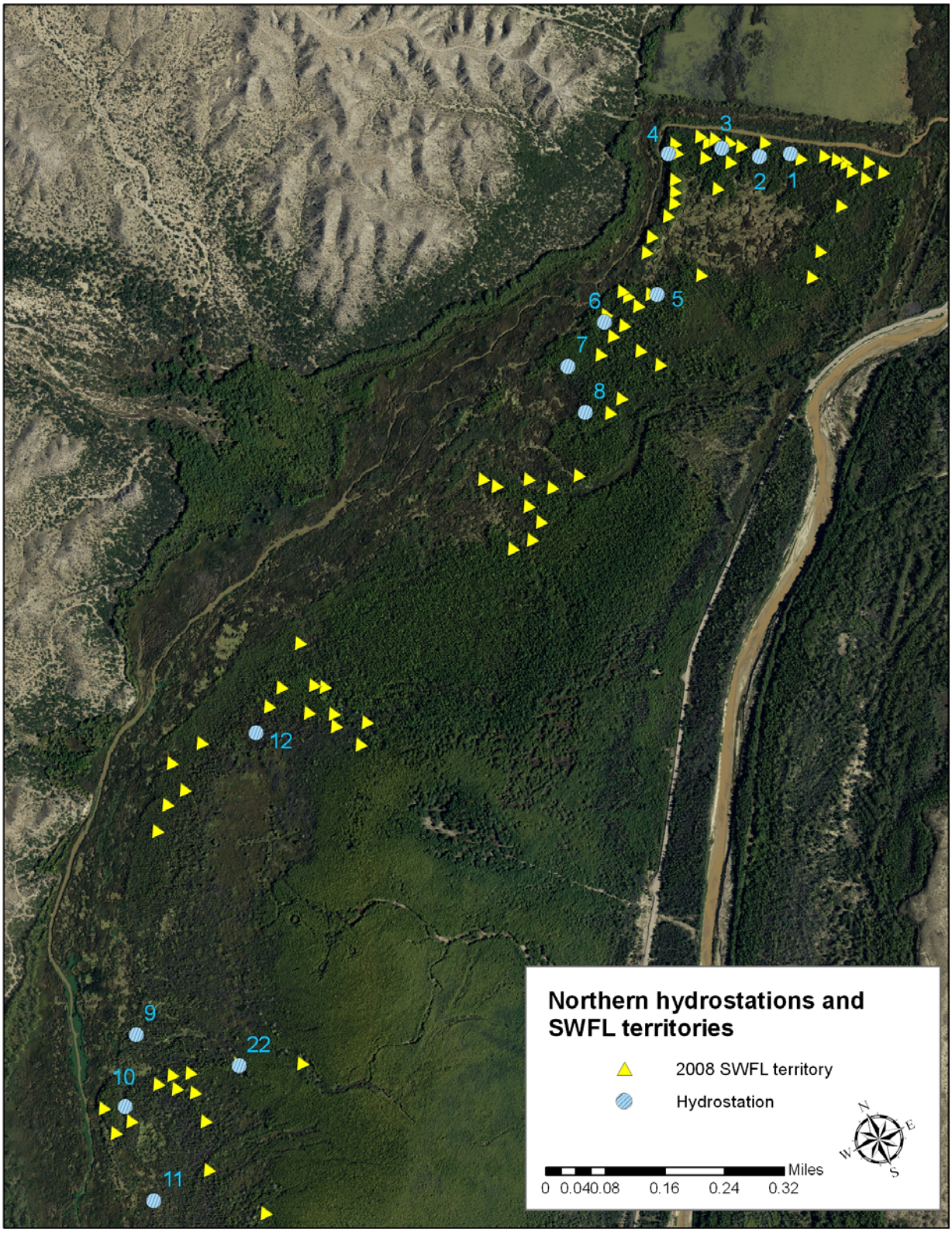

Figure 3. Northern hydrostations and locations of 2008 SWFL territories.

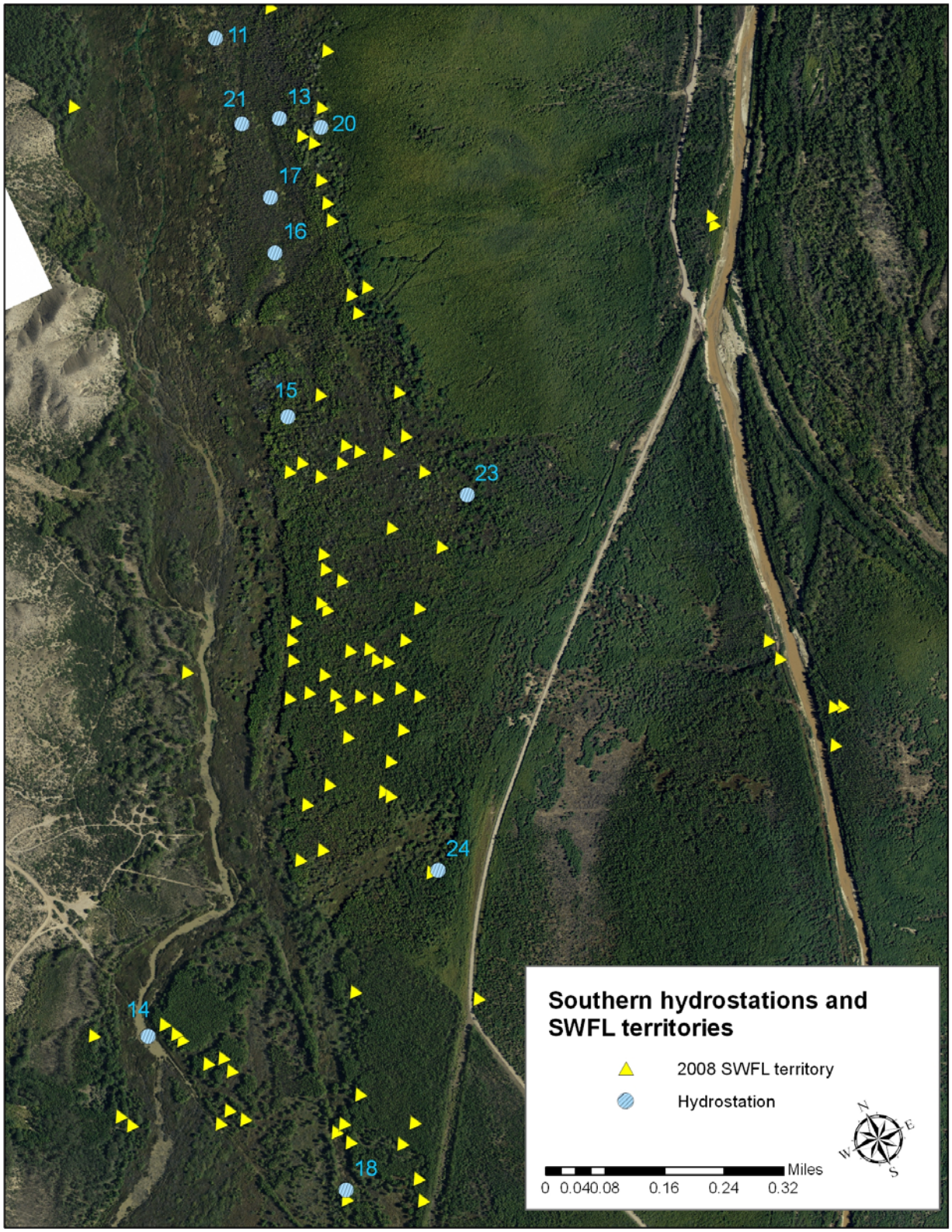

Figure 4. Southern hydrostations and locations of 2008 SWFL territories

Hydrostations were placed in locations representative of the overall site's hydrology and were monitored during the SWFL breeding seasons from 2004 through 2008. These data were used to determine the relationship between flows in the LFCC and depth of water within the "core" SWFL breeding areas of the Elephant Butte Reservoir delta.

During hydrostation data analysis, two different methods were utilized to determine the relationship of LFCC flows (at San Marcial) and water depth at occupied sites. The first method was to average the LFCC flows recorded immediately prior to and after drying of the site was recorded. For example: If surface water at a hydrostation was recorded when surface flows were 100 cfs, and the station was dry upon the next recording at 50 cfs, the average flow at which drying occurred would be approximately 75 cfs. The second method, used for sites that did not dry during data collection, utilized linear regression of water depth and LFCC flows over multiple years of data to estimate at what LFCC flows the site would no longer be flooded. Only regressions with a coefficient of determination (R^2) of ≥ 0.5 were used.

Data from the 2004 through 2008 breeding seasons were also compared to SWFL nest variables (success, productivity, predation, parasitism, and distance to water) to determine if any relationships exist between hydrology and nesting. For details of this hydrology monitoring study, see *A Review of Southwestern Willow Flycatcher Nesting Parameters Within Elephant Butte Reservoir, NM 2002-2008* (Ahlers 2009b, *in prep*.).

Results

Presence/Absence Surveys

During presence/absence surveys conducted from May 15 through July 24, 708 WIFLs were detected (515 males and 193 females). Based on detections prior to June 10 and the birds' lack of territorial behavior, 228 were believed to have been migrants (all of which were considered males due to singing, which explains the skewed sex ratio shown above). The remaining 480 birds (287 males and 193 females) were considered resident SWFLs. However, based on detection dates, ten of the males were likely late migrants. SWFL detections within the Velarde, Belen, Sevilleta/La Joya, San Acacia, Escondida, Bosque del Apache, Tiffany, and San Marcial reaches are presented in Figures 5 through 14, respectively.

The 480 documented SWFLs established 287 territories and formed 193 pairs. Documented nesting attempts confirmed the existence of 155 pairs; 202 nests were located and monitored. Thirty-eight additional pairs were observed and, although nesting was suspected, nests were not located in any of these territories. Of the 202 confirmed nesting attempts, 97 were believed successful, 83 failed, and the outcome of 27 was unknown. Successful nests include those which supported chicks at least 9 days old on the last nest visit. Every effort was made to monitor nests until nestlings were at least 10 days old. However, several nests that were not monitored into the late nestling stage were considered to have likely fledged young and were thus included in the successful nest count. These

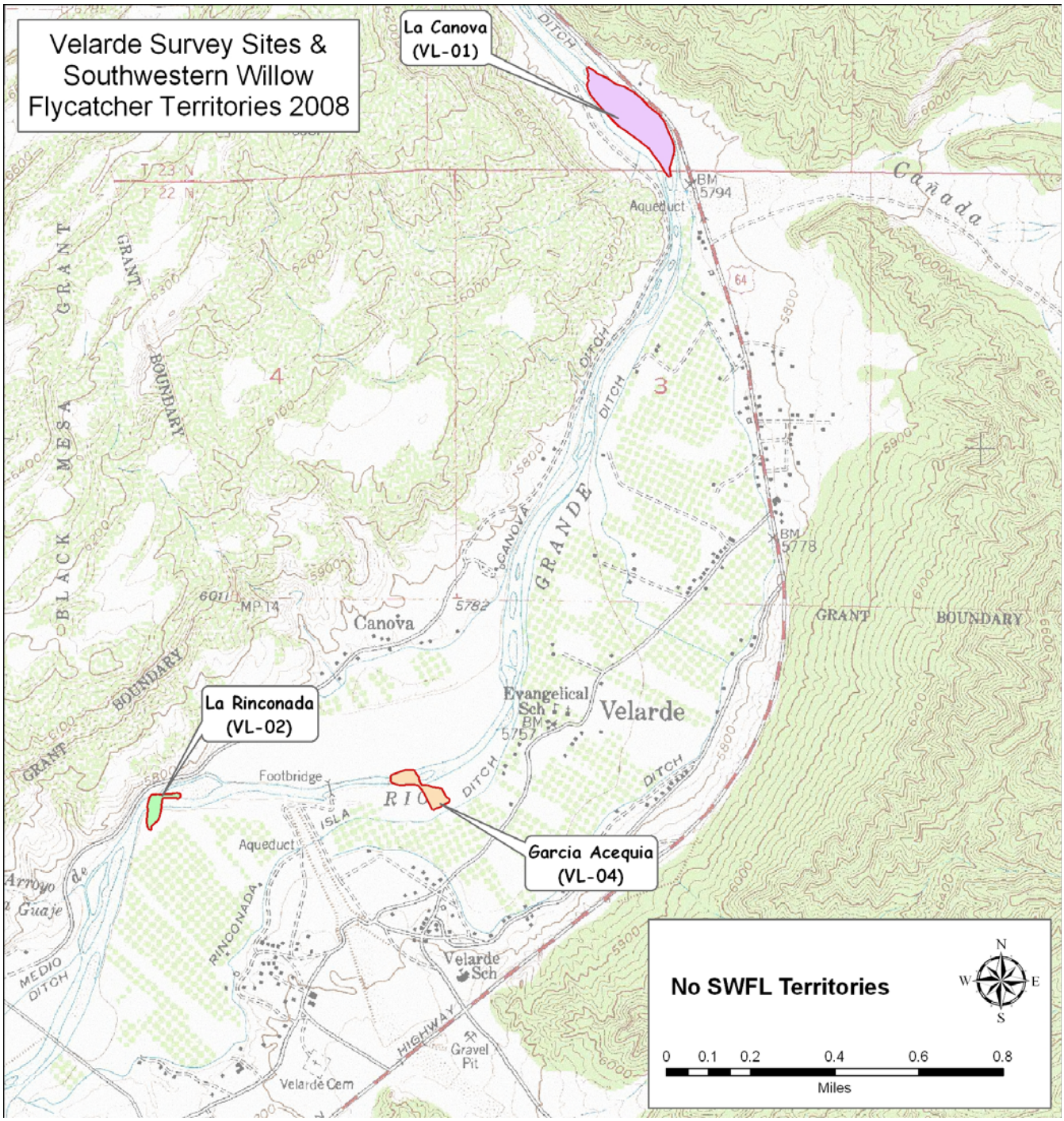

Figure 5. Overview of SWFL detections within the Velarde survey sites.

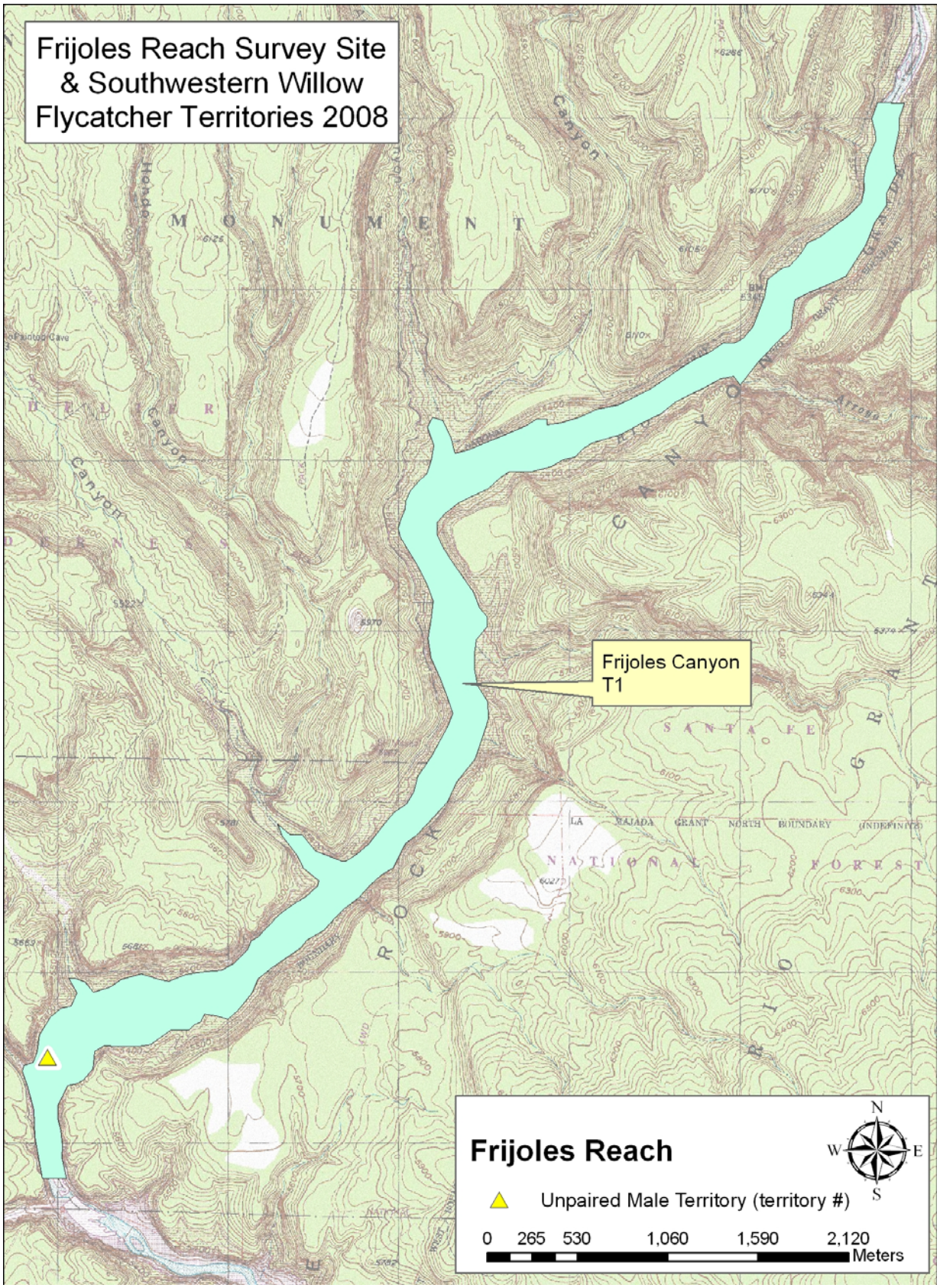

Figure 6. Overview of SWFL detections within the Frijoles survey site.

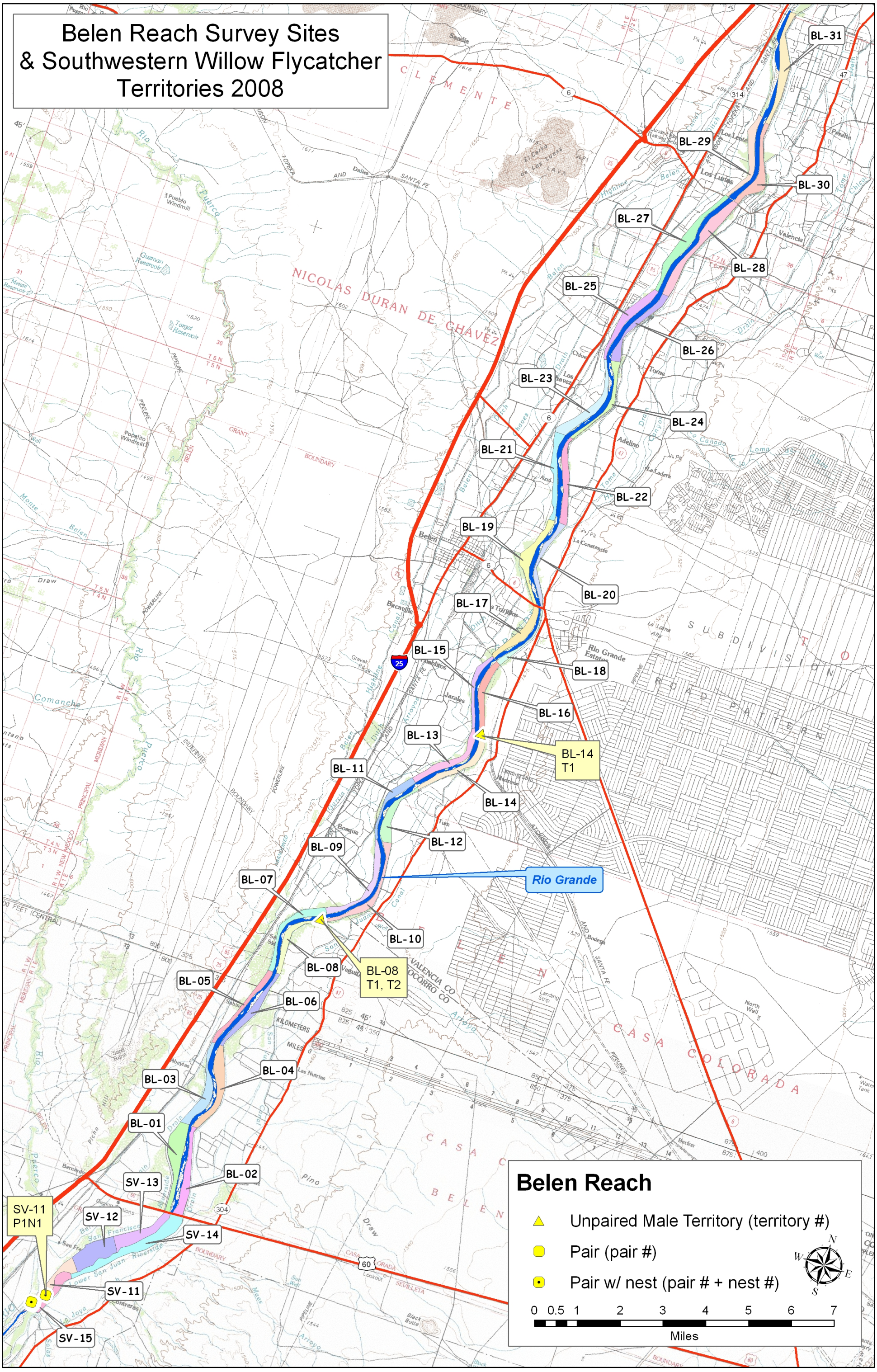

Figure 7. Overview of SWFL detections within the Belen survey sites.

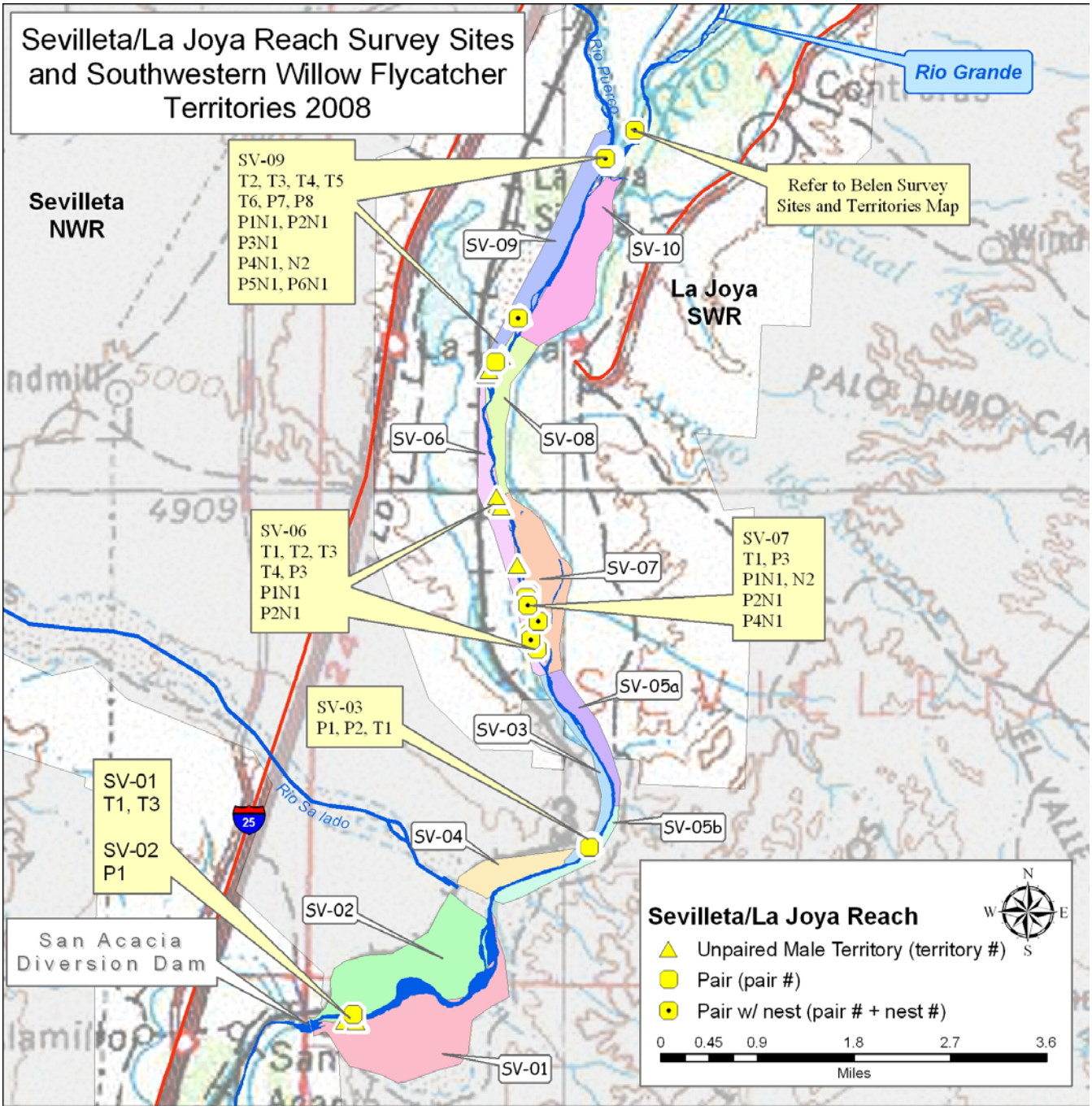

Figure 8. Overview of SWFL detections within the Sevilleta/La Joya survey sites.

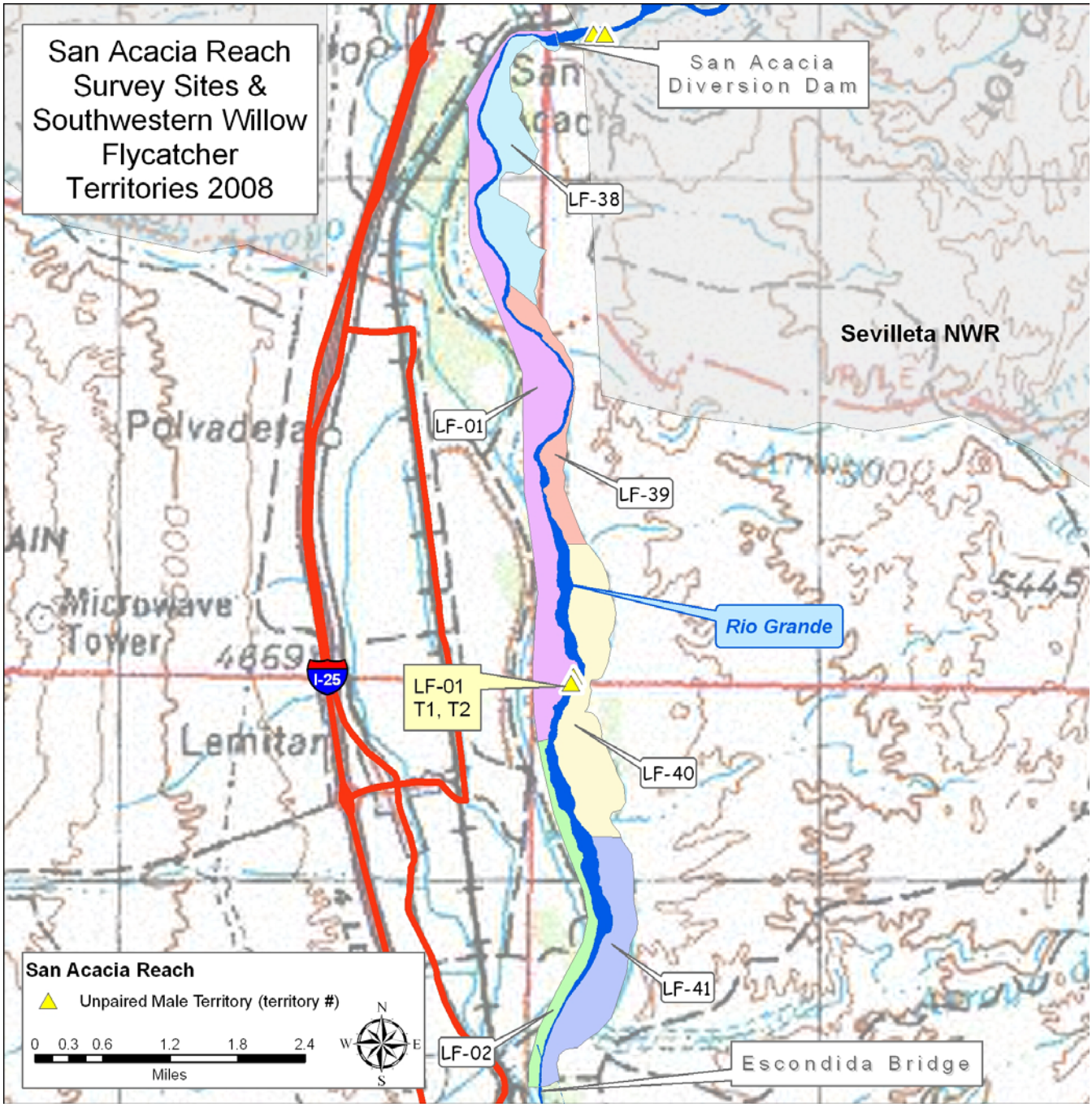

Figure 9. Overview of SWFL detections within the San Acacia survey sites.

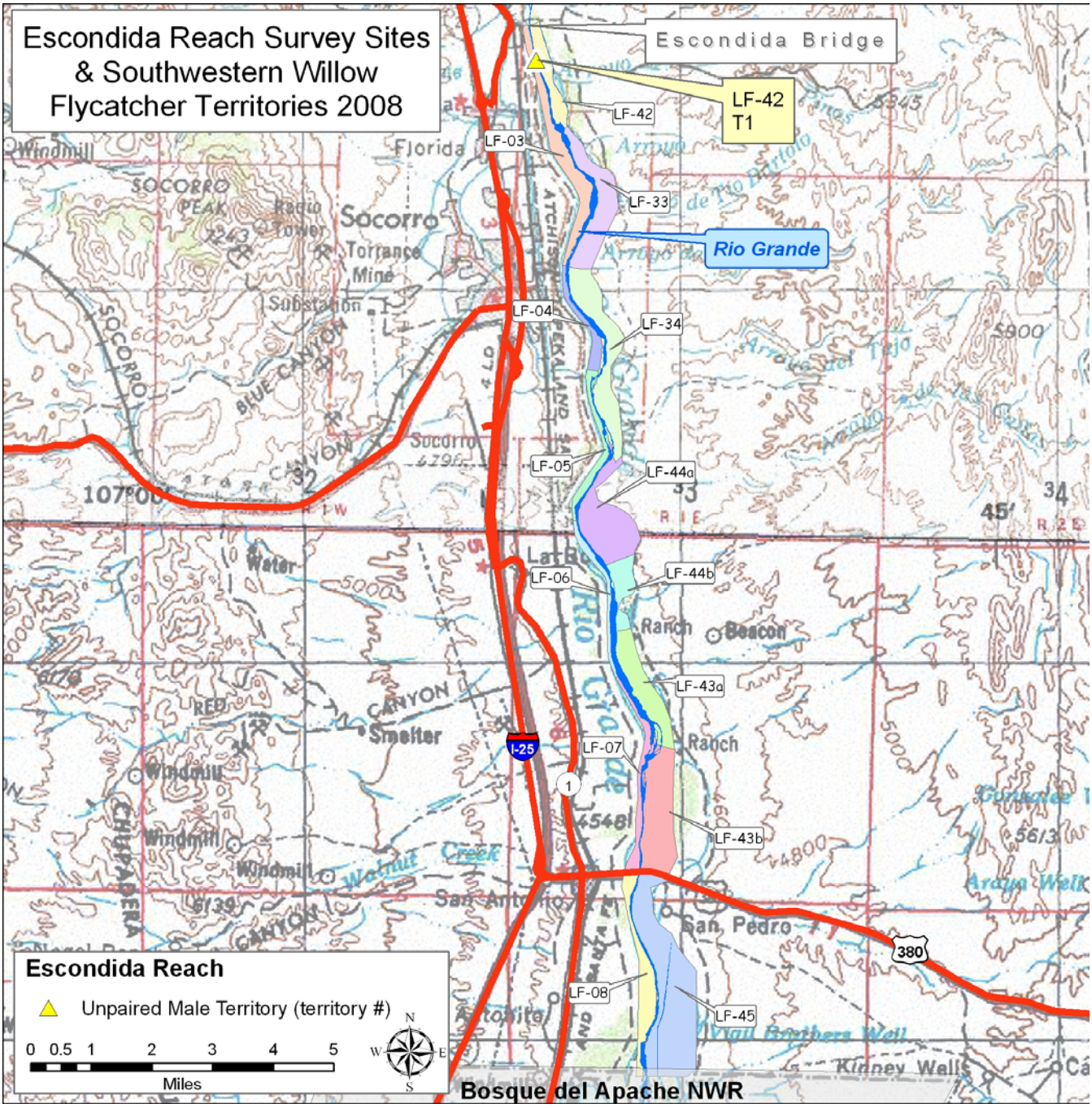

Figure 10. Overview of SWFL detections within the Escondida survey sites.

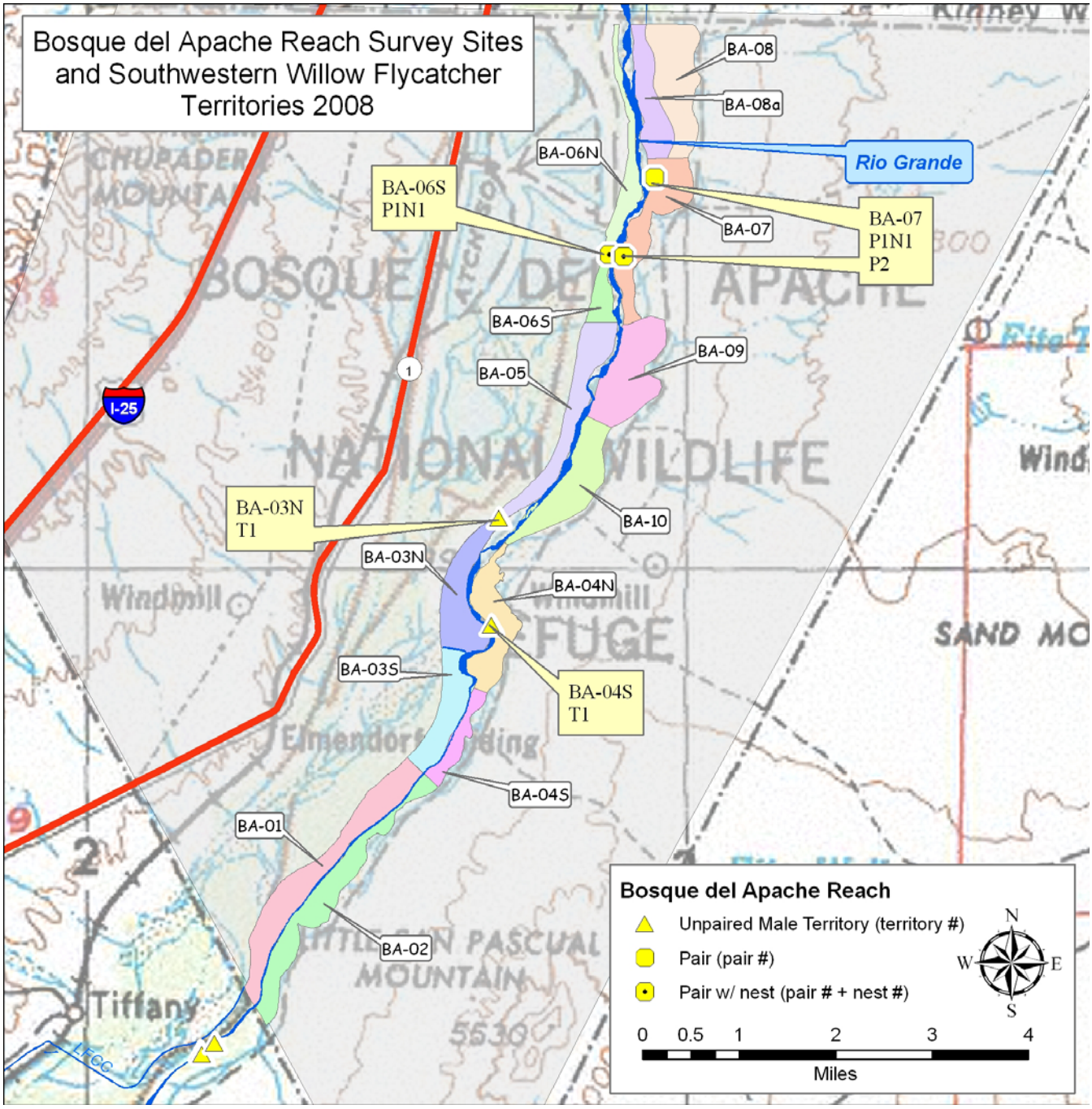

Figure 11. Overview of SWFL detections within the Bosque del Apache survey sites.

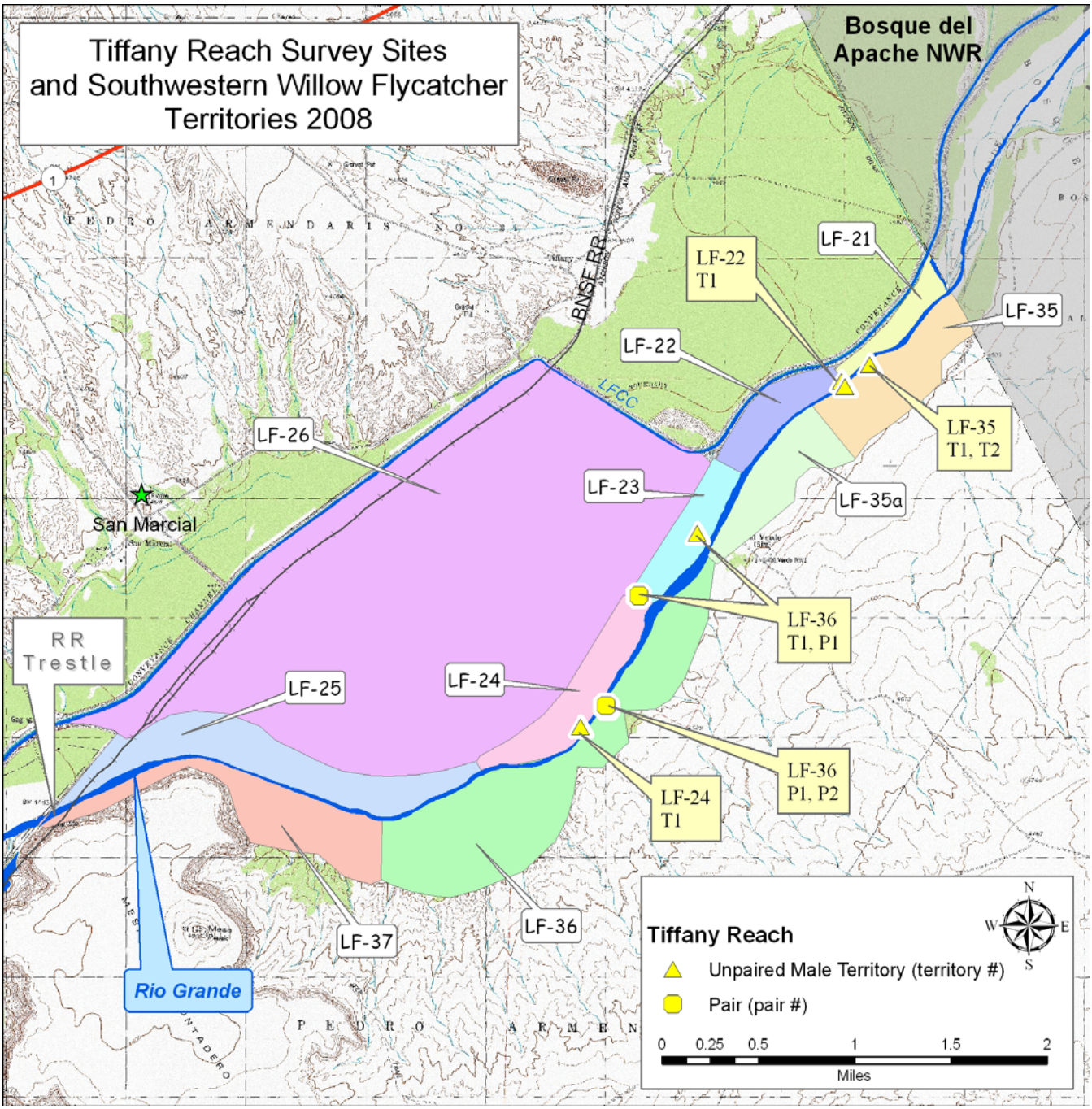

Figure 12. Overview of SWFL detections within the Tiffany survey sites.

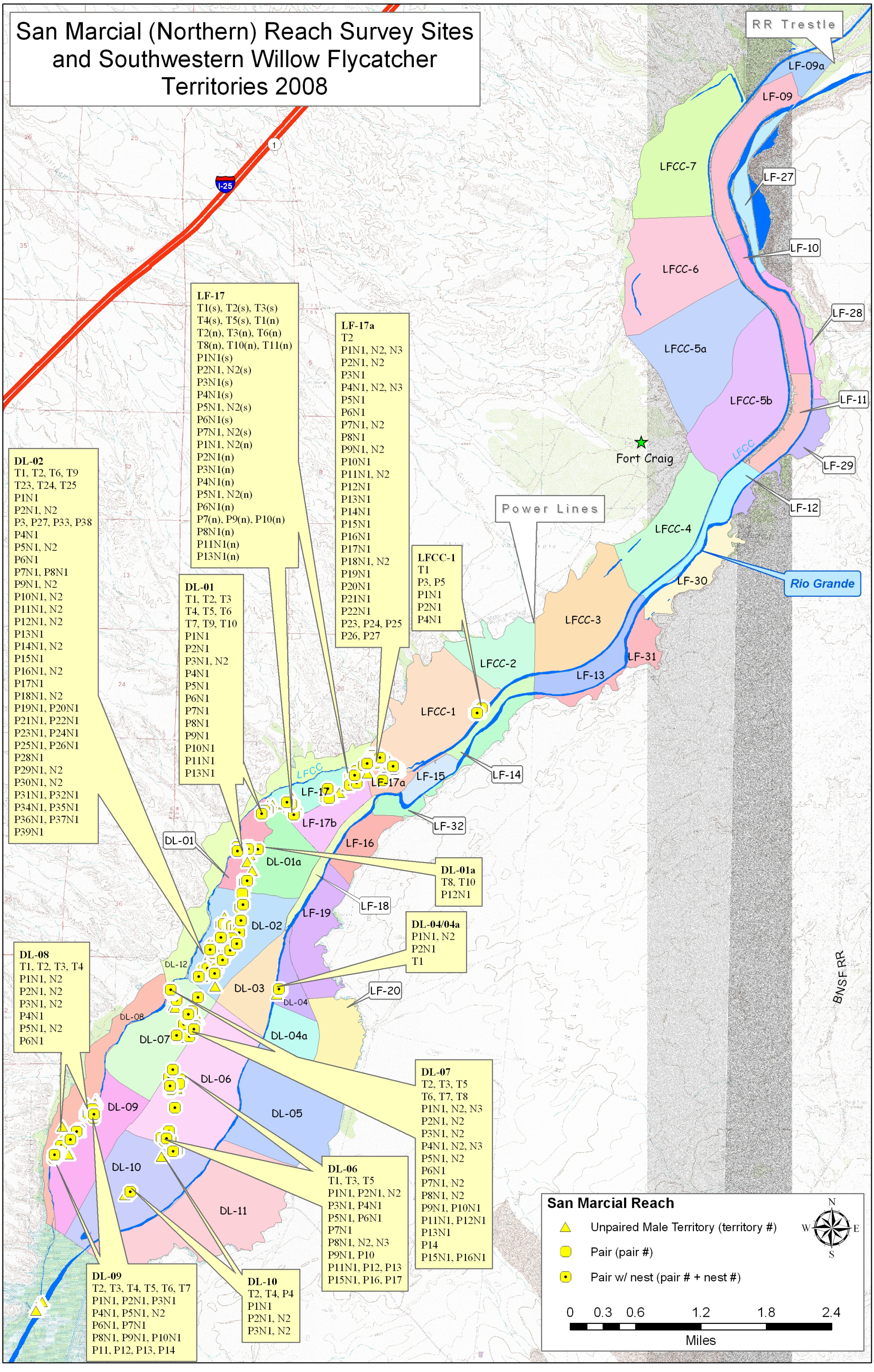

Figure 13. Overview of SWFL detections within the northern San Marcial survey sites.

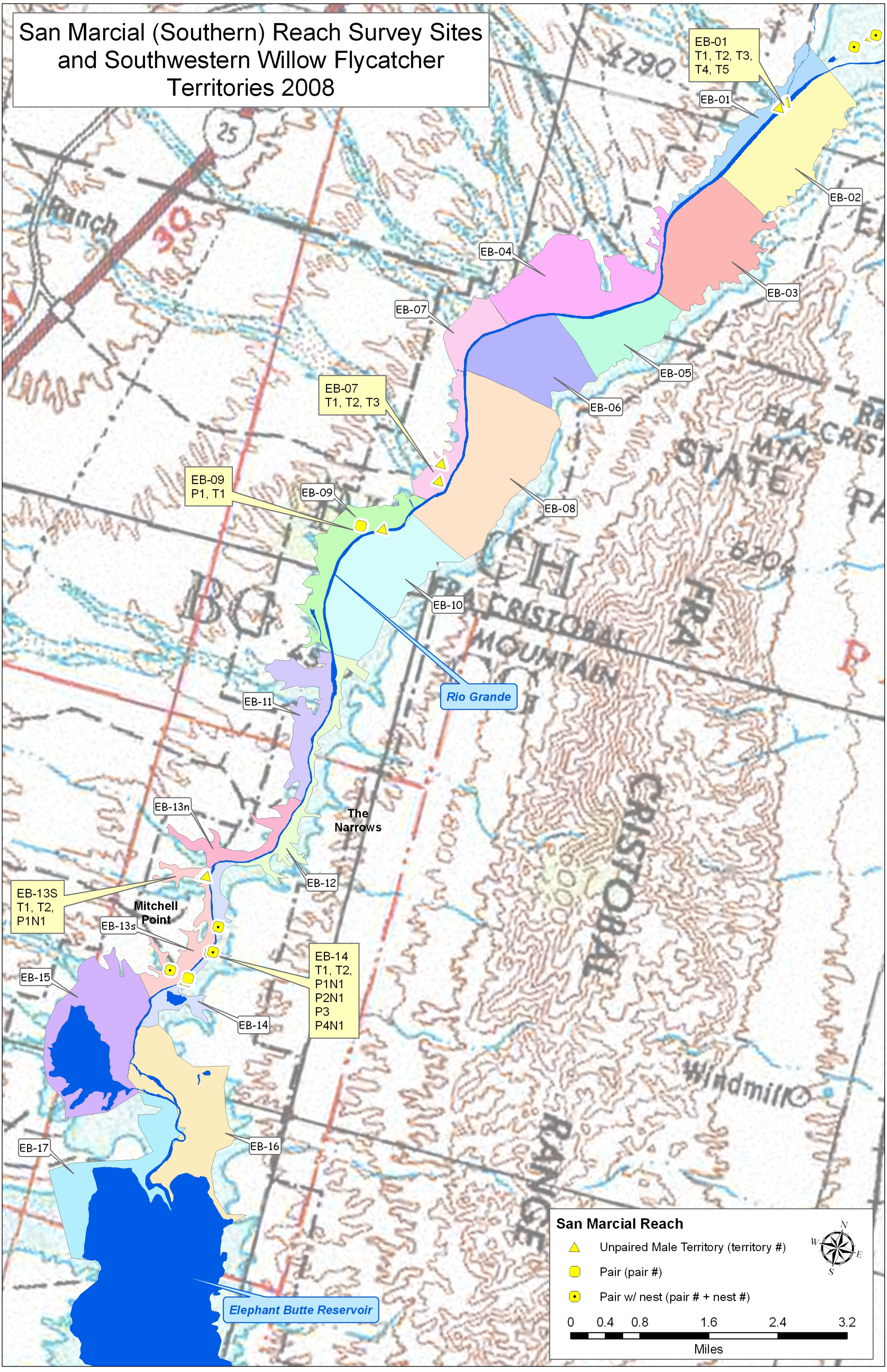

Figure 14. Overview of SWFL detections within the southern San Marcial survey sites.

nests included one with seven day old chicks and seven with eight day old chicks on the last visit of the nesting cycle. Best biological judgement was used to determine that these nests were likely successful. SWFL detection results for 2008 are summarized in Table 3.

During the 2008 season, five surveys were completed in 54 percent of the sites surveyed. Within these 80 sites, three new SWFL territories were found during the fourth or fifth surveys in two sites (SV-03 and LF-01). The territory in SV-03 was in very close proximity to other territories and it is likely that these birds were originally undetected or mistaken for the other territorial SWFLs nearby. The territories documented in LF-01 were in a small patch of habitat on the southern end of the site and were either not present during previous surveys, were non-territorial birds that happened to be present during the fourth survey, or were missed during previous surveys. These observations reinforce the importance of conducting fourth and fifth surveys in project areas and provide greater confidence to the absence of the species in unoccupied sites. Presence/absence survey forms are presented in Appendix A. Occupied reaches and sites are detailed in the following sections (all site coordinates in UTM NAD 83 Datum, Zone 13 S).

Frijoles Canyon

This reach was surveyed by Reclamation for the first time in 2008 and, for ease of data entry, consists of one site. It extends from the confluence of the Rio Grande and Frijoles Canyon downstream along the Rio Grande to the Cochiti Pueblo (approximately 9 km). The floodplain is constrained horizontally by a steep-walled canyon in many areas. However, side-canyons and sloughs in many locations within this site contain highly suitable SWFL habitat in the form of coyote willow (*Salix exigua*) and Gooddings willow (*Salix gooddingii*). Many of these areas are positively impacted by beaver activity and contain water even during low river flows. Eleven WIFLs were documented in this site in 2008; ten migrants and one WIFL that was likely a late-migrant (documented only on June 16) that was considered a resident.

Belen Reach

This reach extends from the southern boundary of the Isleta Pueblo to the confluence of the Rio Puerco and Rio Grande and encompasses riparian habitat within the active floodplain. It contains 36 sites which were surveyed three times (with the exception of SV-11 through SV-15, which were surveyed five times to ensure thorough coverage). The majority of habitat in this reach consists of a mix of cottonwood (*Populus deltoides*) gallery, with sparse saltcedar (*Tamarix* sp.), Russian olive (*Eleagnus angustifolia*) and/or coyote willow understory. The river in this reach is relatively degraded and banks are often incised or undercut. Most sites are bounded by the Rio Grande on one side and an extensive levee system on the other. Suitable SWFL habitat in this reach is patchy and consists primarily of developing stands of willows and Russian olive on lower terraces and recently established river bars. During 2008, 115 WIFLs were recorded in this reach. However, 110 were determined to be migrants, three were possible late migrants that were recorded as territories because of date of detection, and two formed a pair and nested in site SV-11.

Site BL-08 is approximately 13 kilometers (km) south of Belen on the east side of the Rio Grande (3822172 N 336839 E to 3819731 N 335718 E). Habitat within this site consists of a mature cottonwood canopy with sparse Russian olive and saltcedar below. Small patches of higher quality WIFL habitat are developing on bars and terraces along the river. Of the six WIFLs documented in this site, five were found within these patches and none were resident birds. Two WIFLs were

Table 3. Summary of 2008 WIFL detections in the Middle Rio Grande.

Site Name	WIFLs Observed[1]	Est. Number of Pairs	Est. Number of *E.t. extimus*[2]	Est. Number of Territories	Nest (s) Found[3]	Nest Success	Comments
Frijoles Canyon[4]	11	0	1	1	N/A	N/A	10 migrants and 1 unpaired male (likely late migrant, detected 6/16)
BL-01	1	0	0	0	N/A	N/A	Migrant
BL-03	1	0	0	0	N/A	N/A	Migrant
BL-05	5	0	0	0	N/A	N/A	5 Migrants
BL-08	6	0	2	2	N/A	N/A	4 migrants and 2 unpaired males (likely late migrants)
BL-09	7	0	0	0	N/A	N/A	7 migrants
BL-12	5	0	0	0	N/A	N/A	5 migrants
BL-14	28	0	1	1	N/A	N/A	27 migrants and 1unpaired male (likely late migrant)
BL-15	1	0	0	0	N/A	N/A	Migrant
BL-17	14	0	0	0	N/A	N/A	14 migrants
BL-19	10	0	0	0	N/A	N/A	10 migrants
BL-20	1	0	0	0	N/A	N/A	Migrant
BL-21	6	0	0	0	N/A	N/A	6 migrants
BL-22	1	0	0	0	N/A	N/A	Migrant
BL-24	3	0	0	0	N/A	N/A	3 migrants
BL-25	1	0	0	0	N/A	N/A	Migrant
BL-26	2	0	0	0	N/A	N/A	2 migrants
BL-27	2	0	0	0	N/A	N/A	2 migrants
BL-28	4	0	0	0	N/A	N/A	4 migrants
BL-30	3	0	0	0	N/A	N/A	3 migrants
BL-31	1	0	0	0	N/A	N/A	Migrant
SV-11	5	1	2	1	1	1 successful	3 migrants and 1 pair with nest
SV-12	2	0	0	0	N/A	N/A	2 migrants
SV-14	3	0	0	0	N/A	N/A	3 migrants
SV-15	3	0	0	0	N/A	N/A	3 migrants
Belen Reach[5] Summary	115	1	5	4	1	1 successful	110 migrants; 3 unpaired males (likely late migrants); 1 pair with nest

[1] When a single WIFL responded to the tape playback, and there was no evidence of pairing, it was considered to be an unpaired male. It is possible that some WIFLs counted as males may have been females, especially during the migration period.

[2] A documented WIFL was considered to be a resident *Empidonax traillii extimus* if it was documented on or after June 10 or nesting activity could be confirmed.

[3] A second brood occurs after a SWFL pair has had a successful nesting attempt (i.e., young are fledged). A re-nest commonly occurs after an unsuccessful first nesting attempt.

[4] Frijoles Canyon Reach = From Cochiti Pueblo, upstream to the confluence with Frijoles Canyon

[5] Belen Reach = From south boundary of Pueblo of Isleta, downstream to confluence of Rio Puerco and Rio Grande.

Table 3 (cont'd). Summary of 2008 WIFL detections in the Middle Rio Grande.

Site Name	WIFL's Observed	Est. Number of Pairs	Est. Number of *E.t. extimus*	Est. Number of Territories	Nest (s) Found	Nest Success	Comments
SV-01	2	0	2	2	N/A	N/A	2 unpaired males
SV-02	11	1	2	1	No	N/A	9 migrants and 1 pair
SV-03	5	2	5	3	No	N/A	1 unpaired male and 2 pairs
SV-04	3	0	0	0	N/A	N/A	3 migrants
SV-05a/05b	1	0	0	0	N/A	N/A	Migrant
SV-06	12	3	10	7	2	1 failed 1 unknown	2 migrants; 4 unpaired males; 1 pair; 2 pairs w/nests
SV-07	10	4	9	5	4	3 failed 1 unknown	1 migrant; 1 unpaired male; 1 pair; 3 pairs w/nests
SV-09	22	8	21	13	7	3 failed 4 successful	1 migrant; 5 unpaired males; 2 pairs; 6 pairs w/nests
Sevilleta/La Joya [6] Reach Summary	66	18	49	31	13	7 failed 4 successful 2 unknown	17 migrants; 13 unpaired males; 7 pairs; 11 pairs w/nests
LF-01	6	0	2	2	N/A	N/A	4 migrants and 2 unpaired males
LF-38	1	0	0	0	N/A	N/A	Migrant
San Acacia Reach [7] Summary	7	0	2	2	N/A	N/A	5 migrants; 2 unpaired males
LF-05	1	0	0	0	N/A	N/A	Migrant
LF-07	1	0	0	0	N/A	N/A	Migrant
LF-08	3	0	0	0	N/A	N/A	3 migrants
LF-33	1	0	0	0	N/A	N/A	Migrant
LF-34	2	0	0	0	N/A	N/A	2 migrants
LF-42	1	0	1	1	N/A	N/A	1 unpaired male
LF-43b	1	0	0	0	N/A	N/A	Migrant
LF-44a	1	0	0	0	N/A	N/A	Migrant
LF-44b	1	0	0	0	N/A	N/A	Migrant
LF-45	3	0	0	0	N/A	N/A	3 migrants
Escondida Reach [8] Summary	15	0	1	1	N/A	N/A	14 migrants; 1 unpaired male
BA-03N	1	0	1	1	N/A	N/A	1 unpaired male
BA-03S	4	0	0	0	N/A	N/A	4 migrants
BA-04N	1	0	1	1	N/A	N/A	1 unpaired male (possible late migrant but heard during 1st 2 surveys)

[6] Sevilleta/La Joya Reach = From confluence of Rio Puerco and Rio Grande, downstream to San Acacia Diversion Dam

[7] San Acacia Reach = From San Acacia Diversion Dam, downstream to Escondida Bridge

[8] Escondida Reach = From Escondida Bridge, downstream to north boundary of Bosque del Apache NWR

Table 3 (cont'd). Summary of 2008 WIFL detections in the Middle Rio Grande.

Site Name	WIFL's Observed	Est. Number of Pairs	Est. Number of *E.t. extimus*	Est. Number of Territories	Nest (s) Found	Nest Success	Comments
BA-06N	5	0	0	0	N/A	N/A	5 migrants
BA-06S	3	1	2	1	1	1 unknown	1 migrant; 1 pair w/nest
BA-07	4	2	4	2	1	1 unknown	1 pair; 1 pair w/nest
Bosque del Apache Reach[9] Summary	18	3	8	5	2	2 unknown	10 migrants; 2 unpaired males (1 possible late migrant); 1 pair; 2 pairs w/nests
LF-21	1	0	0	0	N/A	N/A	Migrant
LF-22	2	0	1	1	N/A	N/A	1 migrant; 1 unpaired male (possible late migrant)
LF-23	7	1	3	2	No	N/A	4 migrants; 1 unpaired male (possible late migrant); 1 pair
LF-24	1	0	1	1	N/A	N/A	Unpaired male (possible late migrant)
LF-25	1	0	0	0	N/A	N/A	Migrant
LF-35	3	0	2	2	N/A	N/A	1 migrant; 2 unpaired males
LF-35a	1	0	0	0	N/A	N/A	Migrant
LF-36	4	2	4	2	No	N/A	2 pairs
Tiffany Reach [10] Summary	20	3	11	8	No	N/A	9 migrants; 5 unpaired males (3 possible late migrants); 3 pairs
LF-17	51	19	51	32	21	8 failed 9 successful 4 unknown	13 unpaired males; 3 pairs; 16 pairs w/nests
LF-17a	55	27	55	28	31	11 failed 18 successful 2 unknown	1 unpaired male; 5 pairs; 22 pairs w/nests
LF-18	2	0	0	0	N/A	N/A	2 migrants
LF-29	1	0	0	0	N/A	N/A	Migrant
LF-30	2	0	0	0	N/A	N/A	2 migrants
LF-31	1	0	0	0	N/A	N/A	Migrant
LFCC-01	13	5	11	6	3	2 failed 1 successful	2 migrants; 1 unpaired male; 2 pairs; 3 pairs w/nests
LFCC-05a	1	0	0	0	N/A	N/A	Migrant
LFCC-05b	1	0	0	0	N/A	N/A	Migrant
DL-01a	5	1	4	3	1	1 successful	1 migrant; 2 unpaired males; 1 pair w/nest
DL-01	32	12	32	20	13	5 failed 5 successful 3 unknown	8 unpaired males; 12 pairs w/nests

[9] Bosque del Apache Reach = From north boundary of Bosque del Apache NWR, downstream to southern boundary of Bosque del Apache NWR.

[10] Tiffany Reach = From south boundary of Bosque del Apache NWR, downstream to railroad trestle.

Table 3 (cont'd). Summary of 2008 WIFL detections in the Middle Rio Grande.

Site Name	WIFL's Observed	Est. Number of Pairs	Est. Number of *E.t. extimus*	Est. Number of Territories	Nest (s) Found	Nest Success	Comments
DL-02	90	39	85	46	45	21 failed 24 successful	5 migrants; 7 unpaired males; 4 pairs; 35 pairs w/nests
DL-03	2	0	0	0	N/A	N/A	2 migrants
DL-04/4a	5	2	5	3	3	1 failed 2 unknown	1 unpaired male; 2 pairs w/nests
DL-06	41	16	35	19	14	7 failed 6 successful 1 unknown	6 migrants; 3 unpaired males; 5 pairs; 11 pairs w/nests
DL-07	39	16	38	22	24	9 failed 10 successful 5 unknown	1 migrant; 6 unpaired males; 1 pair; 15 pairs w/nests
DL-08	22	6	16	10	10	3 failed 3 successful 4 unknown	6 migrants; 4 unpaired males; 6 pairs w/nests
DL-09	36	14	34	20	11	3 failed 7 successful 1 unknown	2 migrants; 6 unpaired males; 4 pairs; 10 pairs w/nests
DL-10	14	5	12	7	6	4 failed 2 successful	2 migrants; 2 unpaired males; 1 pair; 4 pairs w/nests
DL-12	2	0	0	0	N/A	N/A	2 migrants
EB-01	12	0	5	5	N/A	N/A	7 migrants; 5 unpaired males
EB-04	1	0	0	0	N/A	N/A	Migrant
EB-07	5	0	3	3	N/A	N/A	2 migrants; 3 unpaired males
EB-09	3	1	3	2	No	N/A	1 unpaired male; 1 pair
EB-13N	2	0	0	0	N/A	N/A	2 migrants
EB-13S	8	1	4	3	1	1 failed	4 migrants; 2 unpaired males (possible late migrants); 1 pair w/nest
EB-14	10	4	10	6	3	1 failed 1 successful 1 unknown	2 unpaired males; 1 pair; 3 pairs w/nests
San Marcial Reach [11] Summary	456	168	403	235	186	76 failed 87 successful 23 unknown	53 migrants; 67 unpaired males (2 possible late migrants); 27 pairs; 141 pairs w/nests
TOTAL 2008 Survey Summary	**708**	**193**	**480**	**287**	**202**	**83 failed 92 successful 27 unknown**	**228 migrants; 94 unpaired males (10 of which are possible late migrants); 38 pairs; and 155 pairs w/nests**

[11] San Marcial Reach = From railroad trestle, downstream through the narrows to Elephant Butte Reservoir Pool (Monticello Bay)

documented during the "resident period" on June 11, but were not found again and were likely late migrants.

Site BL-14 is 6 km south of Belen on the east side of the river (3830871 N 340218 E to 3827937 N 338546 E). The site is relatively narrow and vegetation consists of sparse Russian olive and saltcedar with an occasional patch of overstory cottonwood. There are also several large patches containing weedy/grassy vegetation. 28 WIFLs were documented in this site during surveys 1 and 2. All but one were considered migrants and the one WIFL documented on June 13, although considered an unpaired male territory, was likely a late migrant as it was not documented during the 3rd survey period.

Site SV-11 is on the La Joya State Waterfowl Area north of the Rio Puerco (3806837 N 331875 E to 3805122 N 330783 E). Habitat within the site is predominantly composed of dense saltcedar and Russian olive. On the eastern edge of the site, coyote willow and seepwillow (*Baccharis salicifolia)* are intermixed with the saltcedar and Russian olive. At the southern end of the site adjacent to the river, a high-flow channel contains saltcedar, Russian olive, coyote willow, seepwillow, Goodding's willow, and cottonwood. Five WIFLs were documented in this site: three were migrants and one pair was located in higher quality habitat on the southern end of the site.

Sevilleta/La Joya Reach

This reach extends from the confluence of the Rio Grande and Rio Puerco downstream to the San Acacia Diversion Dam and encompasses riparian habitat within the active floodplain. Lands within this reach are managed by the New Mexico Department of Game and Fish (La Joya State Waterfowl Area) and U.S. Fish and Wildlife Service (Sevilleta National Wildlife Refuge). Of the nine sites in this reach, eight were surveyed five times (SV-08 was omitted due to landowner issues). Habitat within this reach ranges from highly suitable SWFL habitat composed of coyote willow and Russian olive along the banks of the river to overstory cottonwood gallery and sparse, decadent saltcedar. The river in this reach is degraded and overbank flooding, particularly on the higher terraces, rarely occurs. 66 WIFLs were detected in this reach during 2008 surveys; 17 were determined to be migrants, 13 were unpaired male territories, and 36 formed pairs.

Site SV-01 is located between the San Acacia Diversion Dam and the confluence with the Rio Salado on the east side of the Rio Grande (3793719N 328870E to 3792140N 326238E). Habitat within the site is dominated by Russian olive, saltcedar and cottonwood. The majority of the site is a higher, very sparsely vegetated terrace consisting of saltcedar and open areas. A lower terrace along the river contains dense stands of Russian olive, overstory cottonwoods and dense coyote willow just upstream of the dam. Standing water frequently occurs in this area. Two territorial, unpaired males were located in this site.

Site SV-02 is immediately upstream of the San Acacia Diversion Dam on the west side of the Rio Grande (3793719N 328870E to 3792199N 326224E). Habitat within this site is similar to SV-01, with sparsely vegetated areas away from the river consisting of saltcedar and open, weedy patches and higher quality WIFL habitat in the form of coyote willow and cottonwood near the Rio Grande. Eleven WIFLs were observed in this site during 2008 surveys. Nine were migrants detected on May 21 while two remained to establish a breeding pair in the large patch of suitable habitat immediately upstream of the dam.

Site SV-03 is approximately 5 km upstream of the San Acacia Diversion Dam on the west side of the river (3797415 N 329795 E to 3794541 N 330046 E). Habitat is composed almost entirely of very dense saltcedar interspersed with Russian olive and gallery cottonwoods. This site is very dry and receives infrequent overbank flooding. Soil underneath the saltcedar canopy is occasionally moist due to rains or moisture trapped in the thick layer of saltcedar duff. The dense saltcedar in the northern half of the site has been cleared as a firebreak to protect the occupied SWFL habitat in the southern end. During the winter of 2006-2007, several large saltcedar trees within the previously occupied habitat patch were blown down resulting in reduced habitat suitability for nesting SWFLs. Five WIFLs in this site comprised two breeding pairs and one unpaired male territory in 2008.

Site SV-06 is located on the La Joya State Waterfowl Area on the west side of the Rio Grande (3801755 N 328855 E to 3797415 N 329795 E). This site is long and narrow and vegetation consists of sparse saltcedar interspersed with patches of Russian olive and coyote willow. Overstory cottonwood galleries are also present. Territories increased dramatically in 2008. 12 WIFLs were documented; two were migrants, four unpaired males and six formed three breeding pairs.

Site SV-07, located on the west side of the river approximately 7 km north of the San Acacia Diversion Dam (3800075 N 329074 E to 3797415 N 329795 E), consists of a few different habitat types. On the eastern side of the site, away from the river, habitat consists of sparse saltcedar and occasional Russian olive. Several strips of gallery cottonwoods exist within this site. On recently formed riverbars adjacent to the active river channel, there are dense patches of native willows and Russian olive. Ten WIFLs, including one migrant, one unpaired male, and four pairs, were found in dense Russian olive during surveys in 2008.

Site SV-09 is approximately 8 km south of Highway 60 on the west side of the river immediately downstream of the Rio Grande/Rio Puerco confluence (3805506 N 330744 E to 3801755 N 328855 E). Habitat is a mixture of native and exotic vegetation, including saltcedar, Russian olive, coyote willow, Goodding's willow, and cottonwood. Habitat near the river is of higher quality than that away from the river and receives periodic overbank flow in certain areas. Several high flow channels in the northern end of the site periodically receive overbank flows. A total of 22 WIFLs were documented in this site during 2008 surveys. Six pairs were located in the coyote willow and Russian olive dominated habitat near the confluence with the Rio Puerco. One pair and two unpaired males were located in similar habitat in the middle of the site and one pair, three unpaired males and one migrant were located at the southern end of the site.

San Acacia Reach

This reach runs from the San Acacia Diversion Dam to the Escondida Bridge and encompasses approximately 16 km of riparian corridor. Six sites within this reach were each surveyed five times. The active floodplain within this reach is relatively narrow and is constrained by the Low Flow Conveyance Channel (LFCC) to the west and the uplands to the east. Habitat with this reach is varied and consists of a mixture of gallery cottonwood, saltcedar of various ages and structures, and coyote willow and Russian olive along the river. The highly degraded river channel in this reach has reduced overbank flooding and limited significant understory growth in many areas. However, several river bars in this reach have produced habitat that appears suitable to WIFLs and, in 2008,

one of these bars became occupied by two unpaired males. These are the first resident SWFLs to occupy this reach since surveys began in 1996.

Site LF-01 is a very long site (11 km) that is immediately south of the San Acacia Diversion Dam on the west side of the river (3792140N 326238E to 3782141N 326140E). The reason for its great length is that it is a very narrow site and much of the habitat is highly unsuitable for WIFLs. Habitat is dominated by a mixture of overstory cottonwood and sparse saltcedar and other shrubby vegetation. Very little overbank flooding occurs within the site. Conversely, during the past several years, several riverbars have developed large patches of coyote willow and Russian olive with suitable structure and density for WIFL occupation. One of these patches became occupied by two unpaired male SWFLs in 2008.

Escondida Reach

The Escondida Reach extends from the Escondida Bridge to the northern boundary of the Bosque del Apache NWR. It includes riparian habitat within the floodplain bounded by the LFCC to the west and uplands to the east. The 14 sites in this reach were surveyed either three or five times, depending on Reclamation project locations. This reach is very similar hydrologically and vegetatively to the San Acacia Reach. Habitat is a mixture of cottonwood gallery, saltcedar and other woody shrubs of various heights and densities, and smaller patches of native willows along the river. Little overbank flooding occurs. Small numbers of resident SWFLs were documented in this reach in 2002 and 2006. In 2008, one unpaired male SWFL was documented.

Site LF-42 is immediately downstream of the Escondida bridge on the east side of the river (3777172N 325979E to 3774396N 326810E). The site is dominated by stands of gallery cottonwood, sparse saltcedar and other shrubs and strips of native willows along the river. Overbank flooding occurs rarely. One unpaired male SWFL was located in this site during the 1st and 3rd surveys.

Bosque del Apache Reach

This reach encompasses riparian habitat within the active floodplain of the Bosque del Apache NWR. Thirteen sites were each surveyed three times during 2008, with the exception of three sites where flooding prevented surveys during the first survey period. Habitat within this reach varies widely from decadent, dense saltcedar to large, mature cottonwood galleries to dense patches of coyote willow and Russian olive. This reach of the river is less degraded and large stretches of the active floodplain flood during high spring and summer flows. Eighteen WIFLs, including 10 migrants, two unpaired males, and three SWFL pairs, were detected in this site during 2008 surveys.

Site BA-03N is located on the Bosque del Apache NWR approximately 7 km north of the southern refuge boundary and immediately north of the Bosque Channel Widening Project (3741030 N 327004 E to 3738796 N 326371 E). The majority of the habitat in this site is dense, monotypic saltcedar with a few patches of native vegetation on the riverside. There is an older riverbar on the south end of the site that contains native vegetation in the form of large overstory cottonwoods and patches of coyote willow and seepwillow. A large portion of the saltcedar in the northern half of the site has been cleared. Most of this site was flooded early in the survey season and one unpaired male was documented during 2008 surveys.

Site BA-04N is across the river from site BA-03N in the Bosque del Apache NWR (UTM NAD 83 Zone 13 south – 3740664 N 327026 E to 3738231 N 326491 E). Vegetation within this site is dominated by sparse saltcedar with the exception of recently developed river bars that contain Russian olive and native willows. These riverbars contain the best SWFL habitat within this site. The site is also relatively dry with the exception of lower lying areas and high flow channels that receive overbank flooding during high river flows. During 2008, flooding prevented surveying during the first survey period. However, an unpaired male SWFL was detected from across the river during the first survey period and confirmed during the second.

Site BA-06S is a relatively short (1.3 km) site that is approximately 4 km south of the northern Bosque del Apache boundary on the west side of the river (3745590 N 328829 E to 3744316 N 328879 E). Habitat within this site consists primarily of decadent saltcedar with sparse cottonwood canopy along the levee, sparse mid-age saltcedar in the interior, and young cottonwood, Russian olive and coyote willow in the southern portion of the site along the river. Nearly the entire site was flooded during the 2008 survey season, preventing thorough surveys during the first and second surveys; one migrant and one nesting pair were documented.

Site BA-07 is approximately 3 km south of the northern Bosque del Apache boundary on the east side of the river (3747044 N 329380 E to 3744284 N 328986 E). The site was flooded during early parts of the 2008 survey season, preventing thorough surveys during the first survey period, but dried out as the summer progressed. Habitat within the site varies from marsh in the northeastern portion of the site to young cottonwood, coyote willow, saltcedar and Russian olive adjacent to the river. Two pairs of SWFLs were located during 2008 surveys.

Tiffany Reach

The Tiffany Reach extends from the southern boundary of the Bosque del Apache to the San Marcial railroad trestle and encompasses riparian habitat within the active floodplain of the Rio Grande. It includes nine sites which were surveyed three times (a 10th site, LF-26, burned during 2006 and wasn't surveyed). Vegetation in this reach consists primarily of various age classes of saltcedar with occasional patches of native willows and cottonwoods, particularly near the river. A large open-water marsh also exists at the foot of Black Mesa, upstream from the railroad trestle. Portions of this reach receive overbank flooding and a sediment plug in the southern end of this reach in both 2005 and 2008 forced river water through habitat in the southern end of this reach. 20 WIFLs, including nine migrants, five unpaired male SWFL territories and three SWFL pairs, were observed in this reach in 2008.

Site LF-22 is approximately 1.5 km south of the southern Bosque del Apache boundary on the west side of the river (3732177 N 321944 E to 3731409 N 321097 E). It is a relatively short site (1.2 km long) and vegetation is dominated by mid-aged saltcedar. Along the river, patches of coyote willow, Goodding's willow and overstory cottonwoods occur. Also, there is a small patch of cottonwoods on the southern end of the site adjacent to the levee. Two migrant WIFLs were documented in this site during 2008 surveys, although, due to date of detection, one was considered a resident SWFL.

Site LF-23 is approximately 3 km south of the southern Bosque del Apache NWR boundary on the west side of the river (UTM NAD 83 Zone 13 south – 3731409 N 321097 E to 3730314 N 320381 E). It is dominated by monotypic saltcedar and contains a few strips of gallery cottonwoods and

some coyote willow along the river. This site was flooded as a result of a sediment plug in the Rio Grande in 2008. Seven WIFLs were documented in this site in 2008; four were determined to be migrants, one was an unpaired male SWFL documented only on June 13th (a possible late migrant), and two formed a pair.

Site LF-24 is located 4 km upstream of the San Marcial railroad trestle on the west side of the river (3730314N 320381E to 3728915N 318915E). This site was also impacted by the sediment plug of 2008. Up to three feet of water was present within much of the site during most of the survey season. Vegetation consists primarily of two different types. A majority of the site contains dense stands of monotypic saltcedar. Conversely, there are several large patches of mixed saltcedar, coyote willow and Goodding's willow adjacent to the river and high flow channels. One unpaired male SWFL was documented in the site, although it was likely a late migrant based on its date of detection.

Site LF-35 is immediately south of the southern Bosque del Apache boundary on the east side of the Rio Grande (3732924 N 322831 E to 3731979 N 321672 E). The site is approximately 1.5 km in length and a berm/ditch runs the length of the site and breaks the habitat into two main types. On the east side, away from the river, habitat is almost exclusively young to mid-aged saltcedar. An emergent marsh forms during wetter years. On the river side of the berm, habitat is composed of a mix of mid-aged to mature coyote willow, cottonwood, Goodding's willow and Russian olive with occasional sparse saltcedar understory. Three WIFLs were documented in this site in 2008 consisting of one migrant and two unpaired males.

Site LF-36 is a large site located 3 km upstream of the San Marcial railroad trestle on the east side of the Rio Grande (3730728 N 320792 E to 3728521 N 318082 E). Much of the site is monotypic saltcedar, particularly the areas that are distant from the river, and a portion of the saltcedar in the northern part of the site has been cleared. There are also several patches of willows and cottonwoods in the southern end of the site and this area also frequently holds surface water from a high water table and/or overbank flooding. Two SWFL pairs were located in this site in 2008.

San Marcial Reach

This reach is the longest of our survey reaches and contains the most survey sites and SWFL territories. It extends from the San Marcial railroad trestle downstream through the delta of Elephant Butte Reservoir. It encompasses 56 sites, both inside and outside the active floodplain, that were surveyed five times each. Habitat within this reach consists of some of the best native SWFL habitat within the subspecies' range. Vast expanses of native Goodding's willow and coyote willow formed in the conservation pool of Elephant Butte Reservoir as the reservoir receded during the late 1990's and early 2000's. This habitat currently sustains a large population of breeding SWFLs. Formerly occupied habitat also exists outside the reservoir pool, however, this habitat has degraded during the past several years and much of the native vegetative component has died off. The degraded river channel provides very little overbank flooding in this reach. However, surface water is provided to the sites on the western side of the reservoir pool by the LFCC outfall. During 2008 surveys, 456 WIFLs, including 53 migrants, 67 unpaired male SWFL territories, and 168 SWFL pairs, were detected in this reach.

Site LF-17 is located in the northern end of the conservation pool of Elephant Butte Reservoir, and south of the LFCC outfall (3718796 N 308899 E to 3718303 N 307471 E). The area encompassed by LF-17 in 2003 was split in two (LF-17 and LF-17b) prior to the 2004 survey season to allow more attention to the high quality, occupied habitat on the western side of the site. Formal surveys were not conducted within this site. Instead, experienced/permitted (nest monitoring) biologists conducted extensive nest searches/surveys. Thorough survey results were achieved without the additional disturbance/stress of "formal" surveys. For purposes of documentation, survey forms were completed to reflect abundance during the five survey periods. Due to water provided by the LFCC outfall, standing water or saturated soil was present in much of this site throughout the 2008 survey season. Habitat is very high quality with mature Goodding's willow dominant and occasional coyote willow, saltcedar, and cottonwoods mixed in. Habitat within the originally occupied northern portion of the site is becoming more decadent and less attractive to nesting SWFLs as time progresses, as beaver activity takes its toll, and as understory trees are shaded out by large, overstory willows. Habitat within the southern end of the site is a younger age-class and should maintain its suitability longer. Nineteen SWFL pairs and 13 unpaired male SWFL territories were documented during 2008 surveys.

Site LF-17a is located immediately north of LF-17 adjacent to the LFCC outfall (3719016 N 309039 E to 3718308 N 309016 E). Quality habitat adjacent to the LFCC is a mixture of native willow habitat interspersed by high-flow channels filled with cattails (*Typha* sp.). Over the past several years, habitat has expanded in this site so that these cattail-filled high-flow channels have nearly filled in with native willows. A large patch of cattails is still present in the middle of the site and a mixture of saltcedar, young cottonwood and Goodding's willow occurs in the southeastern portion of the site. This site, due to its proximity to the LFCC, was flooded during much of the 2008 survey season. However, sediment deposition has been heavy in this site during the past several years and higher flows in the LFCC are now necessary for overbank flooding. Formal surveys were not conducted within this site. Instead, biologists conducted extensive nest searches/surveys. Thorough survey results were achieved without the additional disturbance/stress of "formal" surveys. For purposes of documentation, survey forms were completed to reflect SWFL abundance during the five survey periods. Twenty-seven SWFL pairs and one unpaired male SWFL territory were documented in this site in 2008.

Site LFCC-01 is on the west side of the LFCC just north of site LF-17a and the conservation pool of Elephant Butte Reservoir (3719889 N 310952 E to 3718675 N 309560 E). It is a large site that contains vast expanses of open water that is bordered by dense saltcedar, cattail marsh or cottonwood/willow community. Small patches of moderately-suitable SWFL habitat occur throughout the site with the best being a patch of young cottonwood, saltcedar and seepwillow adjacent to the LFCC. It is in this patch that five SWFL pairs, one unpaired male and two migrants were documented during 2008 surveys.

Site DL-01a was initially included in Site DL-01, but was split to allow formal surveys to be conducted, while only focused nest/territory searches are conducted in DL-01 to minimize disturbance. The site is in the northern end of the Elephant Butte Reservoir conservation pool approximately 2 km south of the LFCC outfall (3717453 N 308282 E to 3716809 N 307932 E). The majority of habitat in this site is mid-aged saltcedar. Small patches of Goodding's willow, coyote willow and cattails are present on the western edge adjacent to DL-01, where hydrology is suitable.

On the eastern edge of the site, there is a large swath of coyote willow, cottonwood, Goodding's willow and saltcedar. Most of the native vegetation has died out due to a lack of groundwater and/or changing soil chemistry. One migrant, two unpaired males and one pair were documented in this site in 2008.

Site DL-01 is immediately south of LF-17 in the conservation pool of Elephant Butte Reservoir (3718303 N 307471 E to 3716976 N 306739 E). This site has been one of the most heavily occupied SWFL sites in the Middle Rio Grande for the past three seasons. Because of this, prior to the 2004 survey season, it was split into two sites, DL-01 and DL-01a, to allow increased attention to the high quality habitat on the western side of this site. Formal surveys were not conducted within the site. Instead, biologists conducted extensive nest searches/surveys. Thorough survey results were achieved without the additional disturbance/stress of "formal" surveys. However, for purposes of documentation, survey forms were completed to reflect abundance during the five survey periods. Habitat within this site is highly suitable for SWFL habitation. Due to its location, vegetation has developed extensively as reservoir levels receded. Vegetation is composed of extensive Goodding's willow stands interspersed with occasional saltcedar shrubs. Large, dense patches of cattails extend the length of the site on the western edge. This site also receives regular flooding caused by the breach in the LFCC. Eight unpaired male SWFL territories and 12 pairs were documented in this site in 2008.

Site DL-02 is immediately south of DL-01 in the Elephant Butte Reservoir conservation pool (3716809 N 307932 E to 3715299 N 306713 E). Habitat on the western edge is very similar to DL-01, with large stands of mid-aged Goodding's willow and coyote willow, sparse saltcedar understory, and large expanses of cattails. This portion of the site is regularly flooded. The eastern side of the site, where groundwater is deeper, is dominated by various age classes of saltcedar. This site contained the most SWFL territories of any site in our study area in 2008. SWFLs in this site are concentrated in the high quality native habitat on the western edge along the LFCC. Five migrants, seven unpaired males and 39 pairs were documented in this site in 2008.

Site DL-04/04a is located immediately southeast and across the Rio Grande from DL-02 (3716400 N 307841 E to 3715271 N 307545 E). Site DL-04 was split into DL-04 and DL-04a prior to the 2003 survey season to allow for increased attention to the high quality SWFL habitat adjacent to the river. However, decreased habitat suitability in occupied patches in addition to increased SWFL abundance elsewhere has led to these sites being surveyed together once again. Along the western edge, suitable SWFL habitat is composed of mature native species such as Goodding's willow and coyote willow. The interior of the site is composed of a mixture of mature saltcedar, Russian olive, and native species including coyote willow, Goodding's willow, and cottonwood. Habitat quality within this site has declined since 2005 when the river degraded and the water table dropped and SWFL territory numbers have reflected this decline. One unpaired male SWFL and two pairs were documented in this site in 2008.

Site DL-06 is immediately south of Site DL-02 on the west side of the Rio Grande in the Elephant Butte Reservoir conservation pool (3714748 N 307408 E to 3713090 N 306690 E). High quality SWFL habitat is dominated by coyote willow and Goodding's willow, interspersed by smaller patches of saltcedar and cattail marsh. Much of the site is dry, due its disconnection from the active river channel and distance from the LFCC outfall. However, areas in the southwestern portion of the

site receive flooding during high flows in the LFCC. SWFLs occupied these areas in 2008 and six migrants, three unpaired males and 16 pairs were documented.

Site DL-07 is located directly south of DL-02 on the east side of the LFCC outfall (3715299 N 306713 E to 3713826 N 305732 E). This site contains several patches of highly suitable SWFL habitat in the form of mature Goodding's willow and coyote willow, particularly in the northern end of the site along the LFCC outfall and former high-flow channels. The rest of the site is a mix of dead or decadent saltcedar and open areas with low-growing herbaceous vegetation such as grasses and emergent aquatics. There is a fair amount of marshy habitat within this site if water from the LFCC is present in sufficient quantity. One migrant, six unpaired male SWFL territories and 16 SWFL pairs were detected during 2008 surveys.

Site DL-08 is located on the west side of the LFCC outfall south of Dryland Road (3715506 N 306009 E to 3711922 N 304339 E). It is a narrow, linear site that is dominated by marshy areas interspersed with young to mid-age saltcedar, Goodding's willow, coyote willow and seep willow. Several patches of high quality SWFL habitat exist adjacent to the LFCC outfall and portions of the site are regularly flooded. Territories within this site were immediately adjacent to the LFCC outfall in mid-age stands of native willows and saltcedar. Six migrants, four unpaired male SWFL territories and six SWFL pairs were documented.

Site DL-09, located directly south of DL-07 and north of the LFCC outfall/Rio Grande confluence (3713826 N 305732 E to 3711830 N 304474 E), contains habitat that is very similar to DL-07. A large cattail marsh occupies the southern half of the site. Several large patches of high quality Goodding's willow habitat, with sparse saltcedar and coyote willow in the understory, exist in the northern portions of the site. Much of the site was either flooded or saturated throughout the survey season. Two migrants, six unpaired male SWFL territories and 14 SWFL pairs were detected in this site during 2008 surveys.

Site DL-10 is located directly north of the LFCC outfall/Rio Grande confluence and bordered by the Rio Grande on the east (3713090 N 306690 E to 3711593 N 304811 E). Vegetation within the northern portion of this site is dominated by Goodding's willow and coyote willow stands interspersed by large swaths of cattail marsh and weedy habitat. The southern half of the site is almost exclusively cattail marsh. Most of this site has been flooded in the past, as evidenced by deep cracks in the soil, but the northern portion rarely contains standing water currently. Two migrants, two unpaired male SWFLs, and five pairs were located in this site in 2008.

Site EB-01 is a long, narrow site that runs from the confluence of the LFCC outfall and the Rio Grande to just upstream of Nogal Canyon on the west side of the river (3712009N 304210E to 3708220N 302630E). A majority of this site is cattail marsh. However, strips of relatively suitable SWFL habitat exist adjacent to uplands and the river. This site is regularly flooded both by groundwater and the LFCC outfall. Seven migrants and five unpaired male SWFLs were located in this site in 2008.

Site EB-07 runs along the west side of the floodplain just upstream of "The Narrows" (3705885N 299727E to 3701965N 299342E). It is a relatively narrow site bounded by uplands to the west and the Rio Grande to the east. Habitat within the site varies from cattail marsh and shrubby *Baccharis* and saltcedar to native patches of coyote and Goodding's willow. Much of the site was flooded

during 2008 surveys. WIFLs, including two migrants and three unpaired males, were located in marginally suitable habitat consisting of young Goodding's willow, saltcedar, *Baccharis* and cattails.

Site EB-09 is located within the pool of Elephant Butte Reservoir immediately upstream of "The Narrows" (3701931 N 299615 E to 3698740 N 298618 E). Habitat within this site consists of intermediate aged saltcedar, seepwillow and Goodding's willow that is developing rapidly due to a high water table and seepage from the uplands. Several areas of ponded water contain willows and cattails (*Typha* sp.). One unpaired SWFL and one pair were documented in this site in 2008.

EB-13S is a narrow, linear site in the southern end of "The Narrows" of Elephant Butte Reservoir (3694261 N 297523 E to 3691076 N 296957 E). Habitat diversity within this site is high. Vegetation ranges from dense young saltcedar to mid-aged patches of Goodding's willow, coyote willow and seep willow to cattail marsh. Large side canyons contain high quality Goodding's willow habitat. Portions of this site are regularly flooded or contain saturated soils due to seepage from the uplands. In 2008, rising reservoir levels flooded the southern end of this site. Six migrants (two of which were considered residents due to being detected after June 10) and one pair were documented during 2008 surveys.

Nest Searches/Monitoring

During 2008, Reclamation personnel monitored a total of 202 nests in the Middle Rio Grande valley. Of these, 92 were successful, 83 failed, and the outcome of 27 was unknown. Of nests with known outcomes (n = 175), only nine were parasitized and all BHCO eggs were addled. Of these nine nests, six were subsequently abandoned, one was predated and two successfully fledged SWFLs. A total of 221 SWFLs were fledged during 2008. The following is a reach-by-reach and site-by-site summary of the SWFL nest monitoring efforts of 2008. See Appendix B for detailed nest site and nest monitoring data forms.

Belen reach

SWFL breeding habitat is limited in this reach and the highest quality habitat consists primarily of developing coyote willow and/or Russian olive on lower terraces and river bars. Nesting SWFLs were first documented in this reach in 2005 when one pair produced two nests in SV-11. No nesting was documented in 2006 and then one pair again produced two nests in 2007 in site SV-11. During 2008, one pair in **SV-11** produced one nest that successfully fledged three SWFLs.

Sevilleta/La Joya reach

Unlike the native plant-dominated habitats which support most other SWFL territories in the Middle Rio Grande valley, this reach is dominated by exotic species (saltcedar and Russian olive). Since the discovery of breeding SWFLs in this reach in 1999, SWFL nest numbers increased from 3 in 1999 to a high of 21 in 2004 (Table 4). Since then, nest numbers declined to a low of six in 2007 and then rebounded to 13 in 2008. Nest searching effort in this reach was reduced in 2007 and 2008 due to the abundance of nesting pairs in the San Marcial reach. Thus, pair and territory numbers should be used in place of nests to determine recent population trends in this reach. Of the 13 nests discovered in 2008, two were renests. Four nests were successful, seven failed and the fates of two were unknown. At least nine young are believed to have successfully fledged from these nests. Four

nests were known to be parasitized; two successfully fledged and two were subsequently abandoned. The following is a site-by-site breakdown of all SWFL nesting in the Sevilleta/La Joya reach during 2008:

Table 4. Summary of SWFL nest monitoring (1999-2008) – Sevilleta/La Joya reach

Year	# Territories	# Pairs	# Nests found	# Nests parasitized (%)	# Nests predated (%)	# Nests abandoned (%)	Unknown success	# Successful nests (%)	Estimated total # chicks fledged	Estimated productivity (# chicks per successful nest)
1999	4	4	3	0	0	1 (33%)*	0	2 (67%)	5	2.5
2000	8	5	6	2 (33%)*	0	2 (33%)*	0	3 (50%)	6	2.0
2001	11	10	9	4 (50%)*	1 (13%)	0	1	6 (75%)	12	2.0
2002	13	10	13**	4 (31%)*	6 (46%)*	0	0	8 (62%)	16	2.0
2003	17	9	12**	1 (9%)*	3 (27%)*	4 (36%)*	1	4 (36%)	10	2.5
2004	19	18	21**	5 (36%)*	7 (50%)*	0	7	7 (50%)	14	2.0
2005	17	10	10	0	1 (25%)*	2 (50%)*	6	1 (25%)	3	3.0
2006	21	15	18**	4 (25%)*	6 (38%)*	1 (6%)*	2	8 (50%)	20	2.5
2007	14	8	6	2 (33%)*	2 (33%)*	0	0	4 (67%)	11	2.8
2008	31	18	13**	4 (36%)*	3 (27%)*	4 (36%)*	2	4 (36%)	9	2.3
Total	155	110	111	26 (28%)	29 (32%)	14 (15%)	19	47 (51%)	106	2.3

Unknowns not included in nest variable calculation.
* Some nests were parasitized, predated, and/or abandoned.
** Some pairs re-nested after failed attempt or attempted a second, third, or fourth brood.

SV-06 – Three pairs in this site produced two nests. One was parasitized and subsequently abandoned and the fate of the other was unknown.

SV-07 – Four pairs in this site produced four nests. Nesting was not confirmed for one pair and one pair produced a renest. Of the four nests, two were predated, one was abandoned and the fate of one was unknown.

SV-09 – Of the eight pairs found in this site, six produced nests (including one renest). Four of the nests were successful (two of which were parasitized), one was predated, one was abandoned, and one was parasitized and subsequently abandoned. Nine SWFLs fledged from this site.

Bosque del Apache reach

SWFL nesting in this reach has been sporadic during the past six breeding seasons; a total of seven nests have been produced during this period. In 2008, one pair in **BA-07** and one pair in **BA-06S** produced one nest each. Fates of both were unknown.

Tiffany reach

With the exception of 2004, during which 11 nests were documented, SWFL nests in this reach have not been abundant during the past six years. Nest numbers totaled four, one and three in 2005, 2006 and 2007, respectively. During 2008, no nesting was documented in this reach and two pairs produced three nests (including one second brood). All three were successful, fledging eight SWFLs, and none were parasitized. The following is a site-by-site breakdown of all SWFL nesting in the Tiffany reach during 2007:

LF-35 – One pair in this site produced two nests; another pair was documented but nesting was not confirmed. Both nests were successful, none were parasitized and a total of three SWFLs were fledged.

LF-36 – The one pair documented in this site produced one nest. It successfully fledged three SWFLs and was not parasitized.

San Marcial reach

A total of 168 pairs and 186 nests (including 31 renests and 14 second or third broods) were documented in this reach in 2008. All but five pairs and three nests occurred within the Elephant Butte Reservoir conservation pool. 141 pairs were confirmed by the presence of nesting activity, the other 27 did not construct nests or nests were not found. Fledging of SWFL young occurred in 87 of the 186 nests, 56 nests were predated, 16 were abandoned, 4 failed directly due to parasitism, and the outcome of 23 was unknown. The 141 nesting SWFL pairs in this reach produced at least 209 fledglings. This reach contained 5 parasitized nests. Of these, four failed directly due to parasitism and one was predated. The following is a site-by-site breakdown of nest monitoring efforts for each of the survey sites inhabited by nesting SWFLs in the San Marcial reach during the 2008 SWFL breeding season. Table 5 details the SWFL nest monitoring done in the San Marcial reach since 1994.

DL-01 – SWFL pair and nest numbers in this site have remained relatively steady for the past three years after peaking at a high of 27 pairs and 47 nests in 2004. In 2008, 12 pairs were documented producing 13 nests, including one renest. Five nests were determined to be successful, three werew predated, two were abandoned, and fates of three were unknown. One nest was parasitized. At least 16 SWFLs were assumed to have fledged from this site.

DL-01a – One pair with a nest was documented in this site in 2008 just across the boundary from Site DL-01. The nest successfully fledged three SWFLs.

DL-02 – This site has experienced a steady increase in pair and nest numbers and is currently the most highly occupied site in our study area. During the 2008 season, a total of 39 pairs were documented; 35 nested and nesting could not be confirmed for four. 45 nests were monitored including five renests and five second broods. Of these, 24 were successful, 14 were predated, four failed directly due to parasitism, and two were abandoned. At least 59 SWFL young fledged from this site.

Table 5. Summary of SWFL nest monitoring in the San Marcial reach (1996-2008).

Year	# Territories	# Pairs (% of total territories)	# Nests found	# Nests parasitized (%)	# Nests predated (%)	# Nests abandoned (%)	Unknown success	# Successful nests (%)	Estimated total # chicks fledged	Estimated productivity (# chicks per successful nest)
1996	13	1 (8%)	1	0	0	1 (100%)	---	0	0	---
1997	10	3 (30%)	2	0	0	0	0	2 (100%)	4	2.0
1998	11	4 (36%)	2	0	0	0	0	2 (100%)	7	3.5
1999	12	5 (42%)	5	1 (20%)*	1 (20%)*	1 (20%)*	0	4 (80%)	10	2.5
2000	23	20 (87%)	19	2 (12%)*	1 (6%)	2 (12%)*	2	14 (82%)	29	2.1
2001	25	25 (100%)	36**	0	7 (19%)	2 (6%)	0	27 (75%)	79	2.9
2002	60	50 (83%)	66**	11 (17%)*	19 (29%)*	6 (9%)*	0	36 (55%)	≥86	2.4
2003	82	67 (82%)	96**	17 (18%)*	31 (33%)*	13 (14%)*	3	48 (52%)	≥126	2.6
2004	113	92 (81%)	153**	25 (17%)*	48 (32%)*	15 (10%)*	4	71 (48%)	187	2.6
2005	107	77 (72%)	127**	16 (13%)*	37 (31%)*	7 (6%)*	7	68 (57%)	≥197	2.9
2006	142	117 (82%)	148**	15 (10%)*	47 (33%)*	11 (8%)	4	83 (58%)	≥213	2.6
2007	197	153 (78%)	220**	29 (14%)*	40 (19%)*	31 (15%)	10	117 (56%)	320	2.7
2008	235	168 (71%)	186**	5 (3%)*	56 (34%)*	16 (10%)	23	87 (53%)	209	2.4
Total	1033	782 (76%)	1061	121 (12%)	287 (28%)	105 (10%)	53	559 (55%)	1467	2.6

Unknowns not included in nest variable calculation.
* Some nests were parasitized, predated, and/or abandoned.
** Some pairs re-nested after failed attempt or attempted a second, third, or fourth brood.

DL-04/04a – Pair numbers and nesting in this site have experienced a sizeable decrease during the past three years. Totals have decreased from 10 nesting pairs and 14 nests in 2005 to two pairs and three nests (including a renest) in 2008. One nest was predated and fates of the other two were unknown.

DL-06 – This site has also experienced a large increase in both pairs and nests during the past three years. It has gone from being unoccupied in 2005 to containing 16 pairs and 14 nests (including one renest and two second broods) in 2008. Nesting could not be confirmed for five pairs. Six nests were successful, three were predated, four were abandoned, and the fate of one was unknown. No parasitism occurred. Fourteen SWFL young fledged from this site.

DL-07 – Pair numbers in this site have increased from seven in 2005 to 16 in 2008, during which 24 nests (including nine renests) were monitored. Nesting was not documented for one pair. Ten nests successfully fledged, seven were predated, one was abandoned, and fates of five were unknown. None were parasitized. Twenty-three SWFLs fledged from this site.

DL-08 – Six pairs, which produced 10 nests (including two renests and two second broods), were documented in this site in 2008. Breeding SWFLs in this site have also increased greatly since first documented in 2005 (with one pair and one nest). Three nests were successful, two were predated, one was abandoned, and the fates of four were unknown. No parasitism occurred. Six SWFLs fledged from this site.

DL-09 – Fourteen pairs were documented in this site in 2008. Of these, nests were located for ten. Eleven nests were monitored (including one second brood). Seven nests were successful, two were predated, one was abandoned and the fate of one was unknown. No parasitism occurred and 18 SWFLs fledged from this site.

DL-10 – Nesting SWFLs were documented for the first time in this site in 2008. Five SWFL pairs were documented. Four of the pairs produced nests and a total of six nests (including two renests) were monitored. Of these, two were successful, three were predated and one was abandoned. No parasitism occurred and a total of six SWFLs fledged from this site.

EB-13S – Nesting was also first documented in this site in 2008. One pair produced one nest which was predated.

EB-14 – This site also contained nesting SWFLs for the first time in 2008. Four pairs were located. Of these, three produced one nest each. One nest was successful, one was predated, and the fate of one was unknown. Two SWFLs fledged from this site.

LF-17 – Pair and nest numbers have been relatively steady in this site since 2001. In 2008, 19 pairs and 21 nests (including three renests and two second broods) were documented. Nests were not located for three pairs. Nine nests were successful, five were predated, three were abandoned, and the fates of four were unknown. No parasitism occurred and a total of 19 SWFL young fledged from this site in 2008.

LF-17a – In 2008, this site was the second most productive in terms of SWFL nesting in our study area. Twenty-seven pairs were located and 31 nests were monitored. Nests were not located for five pairs and nests monitored included seven renests and two second broods. Eighteen nests were successful, ten were predated, one was abandoned and the fates of two were unknown. No parasitism was documented. Forty-three SWFL young fledged from this site in 2007.

LFCC-01 - Nesting was documented in this site for the first time in 2006. In 2007, four pairs produced five nests. During 2008, five pairs were located, producing three nests. Nests were not located for two pairs. One nest was successful and two were predated. None were parasitized. Three SWFLs fledged from the site.

Hydrology Monitoring

Insufficient data exist for analysis of the four hydrostations established in 2008. Of the other 19, 13 became dry at various times during the 2004 to 2008 study period. These 13, as shown in Figure 15, dried out at different LFCC flows based on their location relative to the LFCC outfall and other

hydrologic characteristics of each site. All but one were flooded when LFCC flows were at least 200 cfs and seven of 13 were flooded when flows were at least 100 cfs.

Six hydrostations were continually flooded during the study (8, 10, 11, 14, 17, and 21), even with minimal flows in the LFCC. Regression analysis of LFCC flow rates and water depth at each hydrostation also indicates the persistence of flooding during low LFCC flows. Minimal LFCC flows for the study period were between 10 and 30 cfs, recorded during late May and early June of 2006. A high water table is likely more responsible for flooding these sites than water from the LFCC and it is likely that a prolonged period of low or absent LFCC flows, sufficient to lower the water table, would be necessary to remove floodwaters from these sites.

One interesting observation was made concerning hydrostations 1 through 4. During the past five years, LFCC flows required for flooding of these sites have varied significantly. Flooding flows for stations 1, 3 and 4 gradually increased between 2004 and 2007 (Figure 16 - insufficient data were gathered in 2008 for analysis). Conversely, flooding was recorded at decreasing flows for station 2 during the same period. These changes are due to the fact that these stations are located in the northern end of the conservation pool of Elephant Butte Reservoir and immediately adjacent to the LFCC outfall. Water from the LFCC outfall impacts these stations first, both depositing (aggrading) and removing (degrading) sediment. Water slows as it passes through flooded vegetation and much of the suspended sediment drops out. Thus, floodwater depths and flows required for flooding have been more stable for the southern (downstream) stations.

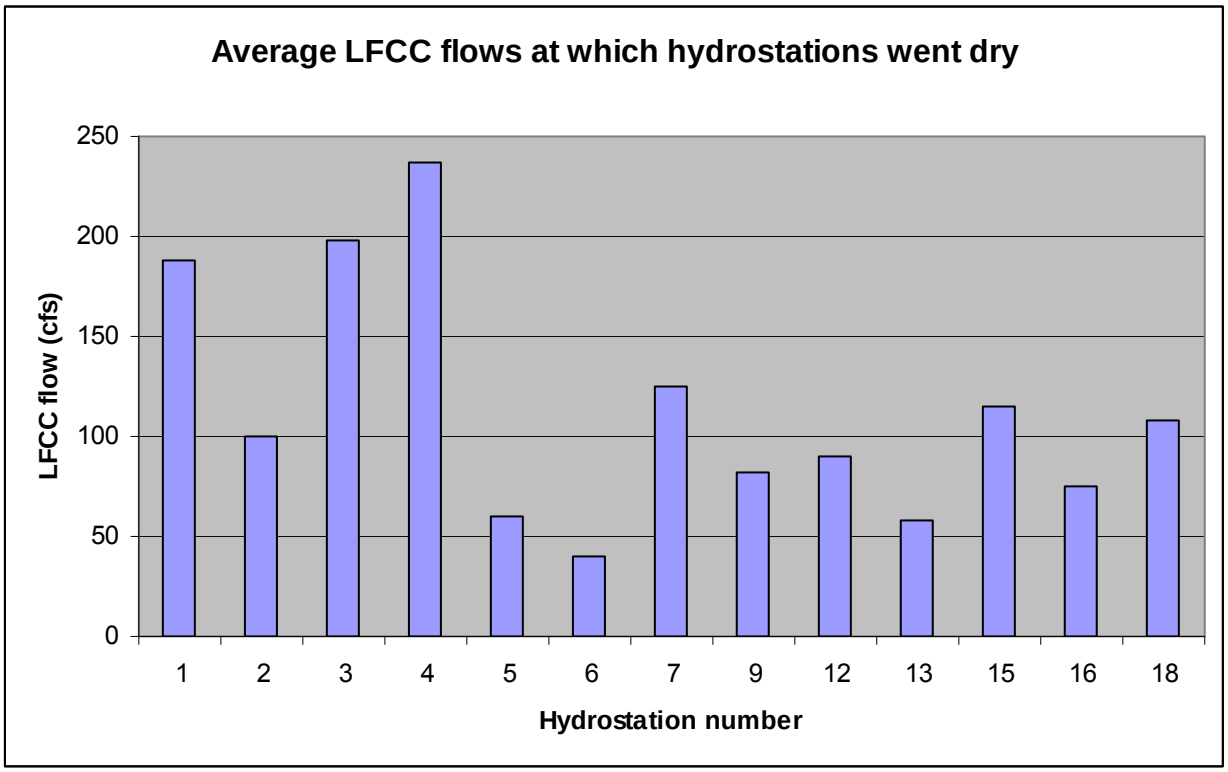

Figure 15. Average flows at which hydrostations went dry (six did not dry during the study period).

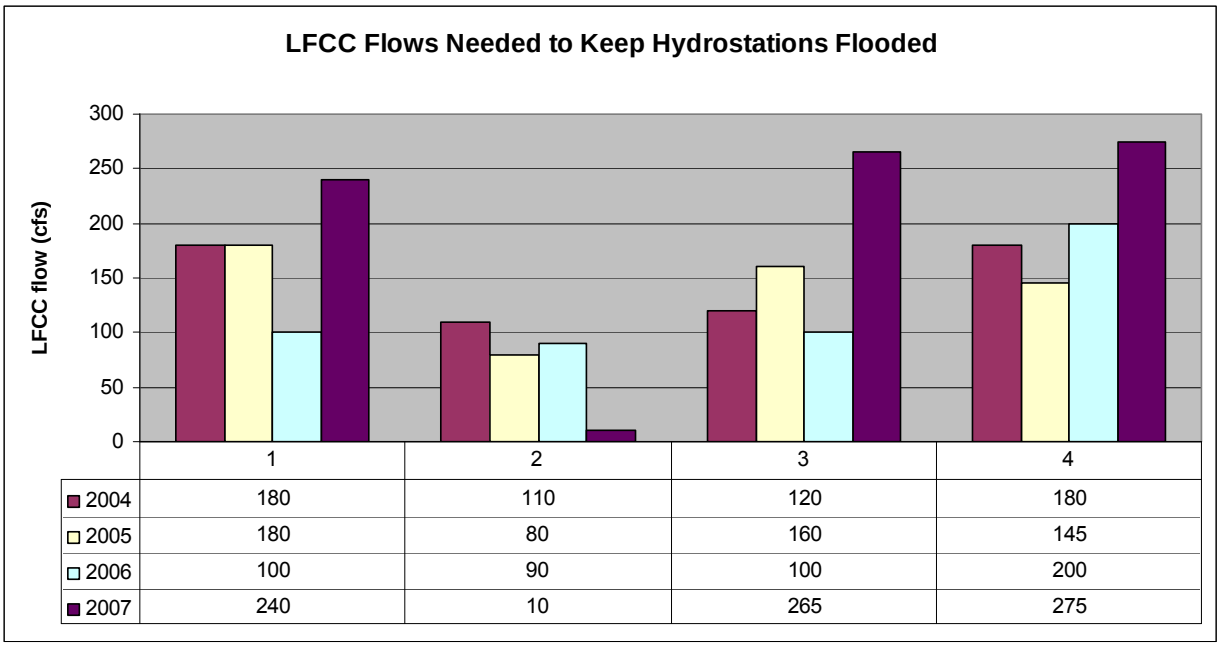

Figure 16. Minimum LFCC flows at San Marcial necessary to keep hydrostations 1 through 4 flooded during 2004 through 2007. Note increasing trends for stations 1, 3 and 4 and decreasing trend for station 2.

Hydrology data were compared to SWFL nest variables (i.e., success, productivity, predation, abandonment and parasitism). Over the entire study area between 2004 and 2008, 96.1 percent of nests (n = 862) were within 100 m (328 feet) of surface water and 92.2 percent were within 50 m (164 feet) of surface water. Nesting success, predation and cowbird parasitism rates were statistically similar for both nests within and outside 50 m from water and nests within and outside 100 m from water (Table 6). Although sample sizes differed greatly, productivity of successful nests was greater and statistically significant for nests within 50 m of water than for those outside of 50 m (t-test of means, $\alpha = 0.05$, $P = 0.04$, $t = 2.02$). Four classes were used to analyze nesting variables based on hydrology immediately under each nest: dry all season, saturated/flooded then dry, saturated all season and flooded all season (a subset of saturated all season). Of all nests monitored between 2004 and 2008 (n = 862), 26.1 percent were dry all season, 1.4 percent were saturated or flooded then dry, 71.9 percent were saturated all season, and 49.2 percent were flooded all season. Due to the small sample size, nests that were saturated/flooded then dry were not considered in statistical analyses. Nest success and predation were statistically similar for all three classes. Cowbird parasitism was greater for nests that were dry all season than for those that were saturated or flooded all season (Chi-square test, $\alpha = 0.05$, $P < 0.01$, $Df = 2$, $\chi^2 = 11.2$). Also, when compared to the other two classes independently, successful nests that were above dry soil all season produced fewer fledglings than nests that were either above saturated soil all season or above floodwater all season (a subset of saturated all season) (ANOVA, $P = 0.06$, $Df = 2$, F-ratio = 2.81). See Habitat and Nesting Variable Analysis appendix and Ahlers (2009b, *in prep.*) for graphical representations of hydrology and nest variable comparisons.

Table 6. Statistical results of hydrology comparisons.

	Hydrological Classification		
	Distance from Water		Hydrology Under Nest
Nesting variable	**≥ or < 50 m**	**≥ or < 100 m**	
Success	Same	Same	Same
Predation	Same	Same	Same
Cowbird parasitism	Same	Same	DAS > SAS, FAS
Productivity	Inside > outside	Same	DAS < SAS, FAS

Discussion

Presence/Absence Surveys

Velarde reach

SWFL territories in this survey reach have declined from a high of six in 1995 to one or zero between 2001 and 2008 (Table 7). Habitat quality in this reach has not declined greatly during this period suggesting that the amount of available breeding habitat in this reach may be insufficient to support a viable SWFL population. It is likely that limiting factors, such as predation and brood parasitism, are acting in concert with restricted amounts of available habitat to affect this local population that is unable to sustain itself. This local population is likely to fluctuate depending on local habitat conditions and reproductive success of nearby populations such as on Ohkay Owinge. Current trends seem to indicate that this small population in the Velarde reach has become unsustainable.

Frijoles reach

This reach was first surveyed by Reclamation during 2008 and no territorial SWFLs were documented. One late-migrant WIFL was found on June 16 and was treated as a resident bird based on its date of detection. However, this individual did not display territorial behavior and was not documented on subsequent surveys. Habitat within this reach is patchy and several large patches of high quality habitat exist. This reach is utilized by migrating WIFLs and it should only be a matter of time until it becomes occupied by resident SWFLs.

Belen reach

This reach was first surveyed in 2002 and one SWFL territory was detected at that time. Since then, territories have been documented in various sites within this reach. During 2008 surveys, four SWFL territories, including a breeding pair, were located. However, the three lone male territories were likely late migrants based on their dates of detection and never being documented again. Suitable SWFL habitat within this reach is limited. The majority of habitat consists of sparse, decadent saltcedar and Russian olive. Cottonwoods and grassy meadows are also interspersed throughout this reach. There are occasional stands of native willows adjacent to the river, most often

mixed with Russian olive or saltcedar, which is where the SWFL territories were documented in 2008. This reach also receives very little overbank flooding, with the exception of a few areas. Small patches of habitat continue to improve in quality, particularly in areas where restoration projects have occurred and/or natural recruitment of native willows has occurred. Considering the habitat available and the presence of "source" populations on the Pueblo of Isleta and in the Sevilleta/La Joya reach, the population in this reach has the potential for growth in the near future.

Table 7. Reach summary of SWFL territories/pairs in lands within the active floodplain of the Rio Grande surveyed by Reclamation between 1995 and 2008.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Velarde	6 T 1 P	4 T 0 P	5 T 5 P	2 T 2 P	2 T 1 P	2 T 2 P	1 T 1 P	0	n/s	1 T 0 P	0	1 T 0 P	0	0
Frijoles	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	1 T 0 P
Belen	n/s	n/s	n/s	n/s	n/s	n/s	n/s	1 T 0 P	n/s	0	4 T 1 P	1 T 0 P	10 T 1 P	4 T 1 P
Sevilleta/La Joya	n/s	n/s	n/s	n/s	4 T 4 P	8 T 5 P	11 T 10 P	13 T 10 P	17 T 9 P	19 T 18 P	17 T 10 P	21 T 15 P	14 T 8 P	31 T 18 P
San Acacia	n/s	0	0	0	0	0	0	0	0	0	0	0	0	2 T 0 P
Escondida	n/s	n/s	0	0	0	0	0	4 T 0 P	0	0	0	1 T 0 P	0	1 T 0 P
Bosque del Apache	n/s	n/s	n/s	1 T 0 P	0	0	0	3 T 0 P	3 T 1 P	1 T 1 P	0	4 T 1 P	7 T 6 P	5 T 3 P
Tiffany[1]	11 T 7 P	4 T 0 P	n/s	n/s	n/s	n/s	n/s	3 T 2 P	4 T 3 P	16 T 13 P	3 T 2 P	9 T 2 P	4 T 3 P	8 T 3 P
San Marcial[2]	3 T 0 P	13 T 3 P	10 T 4 P	11 T 4 P	12 T 5 P	23 T 20 P	25 T 25 P	63 T 52 P	86 T 70 P	113 T 92 P	107 T 77 P	142 T 117 P	197 T 153 P	235 T 168 P
Total	20 T 8 P	21 T 3 P	15 T 9 P	14 T 6 P	18 T 10 P	33 T 27 P	37 T 36 P	87 T 64 P	113 T 83 P	150 T 124 P	131 T 90 P	179 T 135 P	232 T 171 P	287 T 193 P

n/s = not surveyed, T = territory, P = pair.

(1) Survey results from 1995 and 1996 in the Tiffany reach are a combination of Reclamation and NMNHP surveys. The Tiffany reach, with the exception of sites LF-21 and LF-22 (surveyed in 2002 and 2003), was not surveyed during the years 1997-2003.

(2) The San Marcial reach includes all sites below the railroad bridge including the active flood plain and sites LFCC-1 through LFCC-7, outside the active flood plain.

Sevilleta/La Joya reach

SWFLs in the Sevilleta/La Joya reach were first documented in 1999 and territory numbers increased through 2004 (Table 7). Since then, territory numbers have remained relatively constant. In 2008, territory numbers were higher than any year since surveying began. This is due to the increased occupancy of sites SV-06, SV-07, and SV-09. Large patches of habitat in these sites have become increasingly suitable for breeding SWFLs during the past six or seven years. Conversely, the large SWFL population that occupied site SV-03 has dwindled during the past four years. Several large saltcedar trees within the occupied portion of SV-03 were blown down during the winter of 2006-2007, altering the density and structure of habitat and reducing its suitability for breeding SWFLs. There is still ample suitable habitat within this reach for additional SWFLs to occupy. Unpaired male territories are relatively more abundant within this reach (42 percent of territories) than within the San Marcial reach. This indicates that SWFLs are discovering new

suitable habitat and it is expected that SWFLs in this reach will continue to increase in number until the habitat is no longer suitable, available, or some other limiting factor impacts population growth. Unpaired male territories typically accounted for 20 to 30 percent of total SWFL territories during the past seven years.

Population expansion within this reach is also of significant interest due to the type of habitat present. A mixed vegetative community in the form of saltcedar, Russian olive and coyote willow dominates the majority of occupied sites in this reach, particularly sites SV-03, 06 and 07. Overbank flooding in this reach is limited but flooding or saturated soils are present near much of the occupied habitat. The proximity to water, density and vertical stratification of vegetation and scattered patches of native habitat seem to make certain sites attractive to breeding SWFLs.

San Acacia reach

Habitat in this reach is dominated by dry, decadent exotic vegetation in the form of saltcedar and Russian olive with an occasional cottonwood overstory. Quality SWFL habitat within this reach is very limited and composed of small patches of native vegetation along the river channel. High river flows during the past three years have resulted in some overbank flooding that has promoted reestablishment of native vegetation along lower terraces and river bars. One such river bar in site LF-01 contained two unpaired male SWFL territories in 2008. These are the first SWFL territories documented in this reach since surveys began in 1996. It will be interesting to see if this pattern of colonization continues within newly developing habitat.

Escondida reach

Habitat in this reach is very similar to that in the San Acacia reach. Most of the habitat is sparse exotic vegetation in the form of saltcedar and Russian olive with an occasional overstory of cottonwood. Some suitable SWFL habitat exists, or is forming, adjacent to the river and on recently formed riverbars.

This reach of the river seldom receives any overbank flooding and the water table has lowered in recent years so the patches of native vegetation are drying out and dying. Small numbers of resident SWFLs have been documented in this reach since 2002, most of which have been late migrants that were considered residents due to dates of detection. In 2008, one unpaired male territory was documented on June 30 in site LF-42. It was located in a narrow, mid-aged strip of cottonwood, saltcedar, Russian olive and coyote willow adjacent to the river. However, considering the lack of quality habitat in this reach, it is unlikely that a population of resident SWFLs will occupy this reach in the near future.

Bosque del Apache reach

SWFL territories have been few in number and broadly distributed in the reach during the past seven years. No large persistent populations have developed. This is likely due to the fact that large patches of suitable breeding habitat are not present. The five territories documented during 2008 were scattered throughout four different survey sites. All occurred in patches of habitat containing a mixture of saltcedar, coyote/Goodding's willow, cottonwood, and Russian olive. Flooding in 2007 and 2008 will likely promote development of higher quality SWFL habitat and it will be interesting to see if larger populations develop in this reach.

Tiffany reach

In 2004 a comprehensive survey of this reach was conducted for the first time since 1996 and 16 territories were documented. Since then, the population has fluctuated between three and nine territories. It is unclear why this reach experienced such a large decrease in territories. Habitat within the reach has matured, but it doesn't appear to be significantly different from 2004. Some habitat in site LF-37 was lost to high flow events of 2005 and it is possible that this displaced some territories. Also, the abundance of higher quality habitat elsewhere in the Middle Rio Grande may have caused some birds to relocate. Eight territories were documented in 2008; one considered a late migrant in sites LF-22, LF-23, and LF-24, one territory in LF-23, and two territories in sites LF-35 and LF-36. It doesn't appear that this reach is currently capable of sustaining a large population.

San Marcial reach

SWFL surveys have been conducted in this reach since 1994 (Table 7). Since 1995, SWFL territories and available habitat below the railroad bridge have increased greatly. Since 2000, a majority of these territories have occurred in the conservation pool of Elephant Butte Reservoir. As reservoir levels decreased during the late-1990s and early-2000s, vast expanses of primarily native habitat developed on the western side of the floodplain. This habitat consists of dense Goodding's and coyote willow of various age classes and is provided with water by the LFCC outfall. SWFLs first occupied suitable habitat in the uppermost reaches of the reservoir (sites LF-17 and LF-17a) and expanded downstream as habitat became suitable. During this same period, degradation and lower flows within the Rio Grande caused habitat upstream of the reservoir pool in the San Marcial reach to decline in quality. Due to these factors, the vast majority of SWFL territories within this reach, and our study area as a whole, are located within the reservoir pool. The 235 SWFL territories located in the San Marcial reach currently occupy 16 sites; all except one (LFCC-01 with 6 territories) are in the reservoir pool. Habitat modeling conducted during summer and fall of 2008 indicate that habitat is not a limiting factor to this population (Bureau of Reclamation 2009). It is likely that, in the absence of serious changes to the habitat or some stochastic event, this population will continue to expand into suitable habitat.

As stated above, the LFCC provides water to much of the high quality SWFL habitat on the western side of the floodplain. As described in the Hydrology Results section of this report, large portions of these sites are continually flooded, even with low flows in the LFCC. Habitats within these areas are beginning to show signs of stress in the form of reduced plant vigor and even death of individual trees. As this occurs, cattails and other emergent vegetation encroach on areas of monotypic willow habitat and vast expanses of cattails currently occupy large portions of sites LF-17, DL-01 and DL-02. A prolonged period of reduced LFCC flows sufficient to lower the water table in the flooded areas would likely be necessary to remove floodwaters from these sites and may actually be beneficial to the willow habitat in some areas.

In the future, as the dynamics of the reservoir cause water levels to rise and fall, it is likely that breeding habitat will continue to be created and destroyed. It is this type of dynamic system that SWFLs depend on for breeding habitat. From year to year there may be net gains and losses of habitat, but as a whole this population should persist and be a valuable source population for the surrounding areas into the foreseeable future.

Nest Searches/Monitoring

Belen reach

SWFL nesting was first documented in this reach in 2005. One nesting pair produced two nests in site SV-11. A SWFL pair was documented in approximately the same area in 2007 and again in 2008. Habitat in this area consists of Russian olive and saltcedar with scattered coyote willow. No nesting has been documented anywhere else in this reach since surveys began in 2002. Due to this fact, one can assume that this particular area contains the best SWFL nesting habitat in the entire reach. However, the proximity of small SWFL populations in sites SV-06, 07, and 09 downstream also is a factor in the occupation of SV-11. Visually suitable habitat patches exist sparsely throughout the reach and may be colonized in the near future. However, the lack of a nearby large "source" population has likely prevented this from occurring to date.

Sevilleta/La Joya reach

Since 2001, SWFL nesting in the Sevilleta/La Joya reach has fluctuated between six and 21 nests. In 2008, 13 nests and 18 pairs were documented in this reach (Tables 4 and 8). This represents a slight rebound from the low numbers documented in 2007. This rebound is encouraging and shows the ability of SWFLs to colonize newly suitable habitat if currently occupied habitat degrades below a point of suitability [habitat quality decreased in site SV-03 (where the majority of SWFL pairs occurred in the past) due to vegetation blowdown during the winter of 2006-2007]. Large patches of suitable habitat exist in sites SV-06, SV-07 and SV-09 in the form of saltcedar, Russian olive and coyote willow. It will be interesting to observe, in upcoming years, if nesting pair abundance in this reach continues to increase and becomes a stable population capable of acting as a source for surrounding areas.

The disparity between pair and nest numbers can be explained by a reduction in nest searching effort in this reach. Nest searching in this reach has always been more difficult due to the saltcedar and Russian olive habitat present. This factor, in combination with personnel limitations and greater pair abundance in the San Marcial reach, prompted nest searchers to spend more time in the San Marcial reach.

During the past several years, nesting SWFLs in this reach have shown a propensity for nesting higher in the substrate than the San Marcial population of SWFLs. This makes locating nests and monitoring them much more difficult and is the reason for the high percentage of unknown outcomes (17%, n = 111) among nests in this reach. It is unclear why SWFLs in this reach nest higher in the substrate.

One possible explanation for the greater nest height in this reach is predator avoidance. With the lack of surface water in this site, it is possible that the birds sense a greater potential for predation from terrestrial animals such as snakes and raccoons, and nesting higher keeps them farther from this threat. Another possible reason SWFLs nest higher in this reach than in San Marcial is that the predominately exotic saltcedar vegetation in this reach provides nest structure at greater heights and SWFLs would nest higher in native vegetation (willow) if nest sites were available. Determining why SWFLs are nesting higher in this reach would take extensive study. It is unlikely that answering this question would justify the time and expense needed to explore this issue.

A variable that could cause concern for the continued productivity of this population is the apparently higher level of BHCO parasitism experienced by SWFLs nesting in this reach. Since the discovery of this population in 1999, 26 nests (28 percent of known outcomes, n = 92) were parasitized as compared to 121 in the San Marcial reach (12 percent, n = 1003). This represents a significant difference (Chi-square, $\chi^2 = 19.02$, df = 1, $P < 0.01$) and is likely due to habitat differences and the greater density of BHCOs in the Sevilleta/La Joya reach (Moore 2006, Moore and Ahlers 2003). However, nest success rates are not significantly different (Chi-square, $\chi^2 = 0.61$, df = 1, $P = 0.43$).

Bosque del Apache reach

SWFL nesting in this reach has been very limited since 2003. Never have more than two nests been documented in a single year. The reasons for this were discussed in the Presence/Absence Survey Discussion. The small size and marginal suitability of SWFL habitat patches within this reach limits the development of a sizeable population.

Table 8. Rio Grande reach summary of SWFL nests in lands surveyed by Reclamation between 1995 and 2008.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Belen	n/s	n/s	n/s	n/s	n/s	n/s	n/s	0	n/s	0	2	0	2	1
Sevilleta/ La Joya	n/s	n/s	n/s	n/s	3	6	9	13	12	21	10	18	6	13
Bosque del Apache	n/s	n/s	n/s	0	0	0	0	0	1	2	0	1	1	2
Tiffany[(1)]	6	0	n/s	n/s	n/s	n/s	n/s	1	2	11	4	1	3	0
San Marcial	0	1	2	2	5	19	36	66	96	153	127	148	220	186
Total	6	1	2	2	8	25	45	80	111	187	143	168	232	202

n/s = not surveyed

(1) Nest monitoring results from 1995 and 1996 in the Tiffany reach are from the NMNHP (1995). The Tiffany reach, with the exception of sites LF-21 and LF-22 (surveyed in 2002 and 2003), was not surveyed during the years 1997-2003.

Tiffany reach

SWFL nesting in this reach has declined from 11 nests in 2004 to zero in 2008. As stated in the survey discussion, the reason for this decline is unknown. Habitat in this reach does not appear to have decreased in quality. The abundance of habitat to the south in the San Marcial reach may be attracting birds that otherwise would have continued north and established territories in the Tiffany reach. Some of the habitat in the Tiffany reach was damaged by high flows in 2005. This may have also impacted the amount and quality of available habitat. Overall, it appears that this population is on the decline and may not persist.

San Marcial reach

During the 2008 survey season, 186 SWFL nests were documented in this reach. It continues to be, by far, the most productive SWFL nesting reach in the study area. However, 2008 nest numbers declined from the 2007 season (Table 8). The decline in nests can be attributed to a change in nest searching policy by Reclamation biologists, not a reduction in population. Based on the overwhelming numbers of SWFL pairs and territories in the Middle Rio Grande and limited personnel resources, nest searching effort was reduced in 2008. In order to maximize efficiency while nest searching, if a pair was located and a nest was not found quickly, nest searchers labeled the territory as a pair without a nest and moved on to the next territory. This practice was done more often when conducting searches for renests, as pairs had been previously located and can be witnessed by the numbers of renests/2nd broods documented in 2008 (45) versus 2007 (86).

Conversely, pair numbers for this reach increased in 2008, as they have almost every year since surveys began in 1995. This population is likely to continue its expansion into unoccupied suitable habitat. See Habitat and Nesting Variable Analysis appendix for graphical representations of SWFL nesting variables and habitat association in Elephant Butte Reservoir.

In 1995, four of six (66 percent) SWFL nests discovered in the riparian area immediately upstream of the railroad bridge had been parasitized by cowbirds (NMNHP 1995). Cowbird control efforts were implemented between 1996 and 2001 and only 3 of 65 nests (5 percent) downstream of the railroad bridge were parasitized. Between 2002 and 2008 no cowbird trapping was done, and the parasitism rate among San Marcial SWFL nests ranged from 3 to 18 percent (Table 5). These higher numbers seem to indicate that, on a local scale, cowbird trapping may be effective at reducing parasitism rates. However, nest success rates, which are the ultimate indicator of BHCO trapping success, were not affected.

A riparian-obligate nest monitoring study was initiated in 1999 and continued through 2004 to study the effectiveness of BHCO trapping at reducing parasitism rates and increasing nesting success. Data analysis indicates that, while during certain years trapping may significantly lower BHCO parasitism rates, there was no statistically significant difference in nesting success rates between trapped and untrapped locations (Moore 2006). With many variables involved, including hydrology, vegetation characteristics, predator abundance, and the overall dynamism of the Rio Grande floodplain, it is difficult to determine what is responsible for the variation in BHCO parasitism and nest success rates between years. The SWFL recovery plan (USFWS 2002) states that "cowbird control should be considered if parasitism exceeds 20-30% after collection of two or more years of baseline data," so the decision to end the trapping program continues to be justified based on this recommendation.

Overall, during the 2006, 2007, and 2008 breeding seasons, 554 SWFL nests have been monitored in this reach, making it one of the most productive SWFL breeding areas in the subspecies' range and the largest source population in the Middle Rio Grande Basin. This holds special implications for the population as a whole. Responsible nest monitoring of this population needs to be continued to detect any significant increases in nest failure, cowbird parasitism, or any other variable detrimental to the survival of this population. Continued efforts should also be made to minimize disturbance both at occupied survey sites and individual nest sites.

Middle Rio Grande as a whole

Over the past ten years, a total of 1172 SWFL nests have been monitored along the Middle Rio Grande. Table 9 and the final section of this report provide details of habitat comparisons for SWFLs nesting along the Middle Rio Grande between 1999 and 2008. Statistical comparisons between categories were made using Chi-square tests. The following comparisons were considered: nesting success, BHCO parasitism, predation rates and nest abandonment vs. nest substrate and dominant territory vegetation and BHCO parasitism vs. survey reach. Between 1999 and 2008, 68 nests (5.8 percent) were in exotic vegetation-dominated (saltcedar and/or Russian olive) territories, 915 (78.1 percent) were in *Salix*-dominated territories, and 189 (16.1 percent) were in mixed-dominance territories. Exotic- and *Salix*-dominated territories are defined as >90 percent exotic or *Salix*, respectively. Mixed-dominance occurs when a dominant vegetation type is not obvious. For statistical analysis, only Salix and mixed dominance territories were considered due to the small sample size of exotic-dominated territories. In considering nest success for these situations, SWFL nests in *Salix*-dominated (56.2 percent, n = 886) areas were no more successful than those placed in mixed-dominance areas (49.7 percent, n = 183) ($\chi^2 = 2.58$, df = 1, $P = 0.11$). Table 10 provides details of pertinent statistical tests.

Parasitism, predation and abandonment rates between habitat types were compared using a Chi-square test including the two primary nesting habitat types (*Salix* and mixed). Parasitism rates in *Salix*-dominated territories were significantly lower than those in mixed dominance territories ($\chi^2 = 7.36$, df = 1, $P = 0.01$). The reason for this difference is likely the higher quality of the habitat provided by native vegetation. Predation and abandonment rates were similar for both habitat types.

A t-test of means ($\alpha = 0.05$) showed that productivity of nests, defined as number of birds fledged per successful nest, was similar for *Salix*-dominated (2.63 fledged birds/nest, n = 498) and mixed-dominance territories (2.53 fledged birds/nest, n = 91) (t = 1.05, $P = 0.29$). Although not statistically significant, it does appear that native habitat is more productive than mixed.

Nest substrate is defined as the species of tree where a SWFL nest is physically located. Though 78.1 percent of SWFL nests over the past 10 years were found in *Salix*-dominated areas, 37.3 percent of all nests and 28.4 percent of nests in *Salix*-dominated habitats were physically located in a saltcedar. Nest success is similar in three substrate categories (*Baccharis*/cottonwood was not compared due to its small sample size of 4): 55.8 percent (*Salix*), 52.9 percent (saltcedar), and 62.9 percent (Russian olive). No statistically significant difference was found to exist between *Salix* and saltcedar substrates ($\chi^2 = 0.86$, df = 1, $P = 0.35$ – Russian olive omitted due to difference in sample size). Additionally, parasitism rates between nests placed in the three different substrates (*Salix* 11.8 percent, saltcedar 15.0 percent, and Russian olive 14.3 percent) were similar and again no significant difference was found between *Salix* and saltcedar ($\chi^2 = 2.45$, df = 1, $P = 0.12$). Predation and abandonment rates were also similar for all three substrate classes. Productivity of SWFL nests in *Salix* (2.66 fledged birds/nest, n = 375) was higher than those placed in saltcedar (2.50 fledged birds/nest, n = 218) (t-test, t = 2.05, $P = 0.04$). Thus, although success, parasitism, and abandonment rates are similar for all nesting substrates, productivity is better for *Salix* substrates than for saltcedar substrates. The reasons for this are unclear.

Table 9. Habitat comparison of SWFL nesting within the Middle Rio Grande – 1999 to 2008.

Territory Vegetation Type		
Number of nests in exotic-dominated territories	68	5.8% of total
Number of nests in *Salix*-dominated territories	915	78.1% of total
Number of nests in mixed dominance territories	189	16.1% of total
Nest Substrate Species		
Number of nests in *Salix* substrate	692	59.0% of total
Number of nests in saltcedar substrate	437	37.3% of total
Number of nests in Russian olive substrate	38	3.2% of total
Number of nests in other (*Baccharis*/cottonwood) substrate	5	0.4% of total
Nest Substrate/Territory Vegetation Combination		
Number of nests in saltcedar substrate within *Salix*-dominated territories	260	(28.4% of 915 nests)
Number of nests in *Salix* substrate within exotic or mixed dominance territories	40	(15.6% of 257 nests)
Nest Success Per Nest Substrate Species		
Percentage of successful nests in *Salix* substrate	55.8%	(375 out of 672 nests)
Percentage of successful nests in saltcedar substrate	52.9%	(218 out of 412 nests)
Percentage of successful nests in Russian olive substrate.	62.9%	(22 out of 35 nests)
Percentage of successful nests in other (*Baccharis*/cottonwood) substrate	50.0%	(2 out of 4 nests)
Nest Success Per Territory Vegetation Type		
Percentage of successful nests in *Salix*-dominated territories	56.2%	(498 out of 886 nests)
Percentage of successful nests in exotic-dominated territories	51.2%	(28 out of 54 nests)
Percentage of successful nests in mixed dominance territories	49.7%	(91 out of 183 nests)
Cowbird Parasitism Per Nest Substrate Species		
Percentage of nests parasitized in *Salix* substrate	11.8%	(79 out of 672 nests parasitized)
Percentage of nests parasitized in saltcedar substrate	15.0%	(62 out of 412 nests parasitized)
Percentage of nests parasitized in Russian olive substrate	14.3%	(5 out of 35 nests parasitized)
Percentage of nests parasitized in other (*Baccharis*/cottonwood) substrate	25.0%	(1 out of 4 nests parasitized)
Cowbird Parasitism Per Territory Vegetation Type		
Percentage of nests parasitized in *Salix*-dominated territories	11.3%	(100 out of 886 nests)
Percentage of nests parasitized in exotic-dominated territories	24.1%	(13 out of 54 nests)
Percentage of nests parasitized in mixed dominance territories	18.6%	(34 out of 183 nests)
Productivity[1] Per Territory Vegetation Type		
Productivity of nests found in *Salix*-dominated territories	2.63/nest	(1309 young from 498 nests)
Productivity of nests found in exotic-dominated territories	2.21/nest	(62 young from 28 nests)
Productivity of nests found in mixed dominance territories	2.53/nest	(230 young from 91 nests)
Productivity[1] Per Nest Substrate Species		
Productivity of nests found in *Salix* substrate	2.66/nest	(997 young from 375 nests)
Productivity of nests found in saltcedar substrate	2.50/nest	(546 young from 218 nests)
Productivity of nests found in Russian olive substrate	2.23/nest	(49 young from 22 nests)
Productivity[1] Compared to Nest Substrate Species and Territory Vegetation Type		
Productivity of nests in *Salix* substrate within *Salix* dominated territories	2.64/nest	(944 young from 357 nests)
Productivity of nests in saltcedar substrate within *Salix* dominated territories	2.59/nest	(363 young from 140 nests)
Productivity of nests in saltcedar substrate within exotic dominated territories	2.13/nest	(49 young from 23 nests)
Total SWFL nests monitored	1172	

([1])Productivity is defined as the number of SWFL young fledged per successful nest.

Table 10. Details of habitat comparison statistical tests performed on SWFL nest habitat data from 1999 – 2008 in the Middle Rio Grande.

Chi-square Tests (α = 0.05)		
Comparison	χ^2 value	*P*-value
Success and dominant territory vegetation*	2.58	0.11
Parasitism and dominant territory vegetation*	**7.36**	**0.01**
Predation and dominant territory vegetation*	0.21	0.64
Abandonment and dominant territory vegetation*	0.56	0.45
Success and substrate species	0.86	0.35
Parasitism and substrate species	2.45	0.12
Predation and substrate species	0.09	0.77
Abandonment and substrate species	0.59	0.44
Sevilleta/La Joya vs. San Marcial parasitism	**19.02**	**<0.01**
T-test of Means (α = 0.05)		
Comparison	t	*P*-value
Productivity and dominant territory vegetation*	1.05	0.29
Productivity and substrate species	**2.05**	**0.04**

Data from known nest outcomes only. For all tests, degrees of freedom = 1.
* Due to small sample size of exotic-dominated territories, only *Salix*- and mixed-dominance territories included in statistical analyses.
Boldface = statistical significance

When comparing 10 years of nesting data from the two primary nesting reaches within the Middle Rio Grande, another factor becomes apparent. The rate of parasitism within the Sevilleta/La Joya reach (28.3 percent, n = 92) is much greater than that experienced by nesting SWFLs within the San Marcial reach (12.1 percent, n = 1003). Parasitism data from these reaches were compared and a significant difference was found ($\chi^2 = 19.02$, df = 1, $P < 0.01$). The reasons for this difference in parasitism rates can likely be explained by two factors. Territories within the Sevilleta/La Joya reach are either exotic-dominated or mixed. There are no native-dominated territories within this reach. Conversely, nearly all territories within the San Marcial reach are dominated by native vegetation. Native habitat likely provides better concealment and protects host nests from BHCO parasitism. Another factor is that BHCOs are typically more abundant in the Sevilleta/La Joya reach than in the San Marcial reach. Point counts have been conducted for the past 10 years in four different study reaches (Sevilleta/La Joya, San Acacia, Bosque del Apache, and San Marcial). Data from 1999 to 2008 showed that the mean number of cowbird detections per point varied annually but averaged almost two times greater within the Sevilleta/La Joya reach than within the San Marcial reach (Moore 2006). These numbers have changed during the past four years as BHCO abundance within the Sevilleta decreased and within San Marcial increased. However, the ratio of potential hosts to BHCOs in the San Marcial reach has been two to three times greater than the Sevilleta, which absorbs some of the parasitism pressure.

Lastly, in coordination with the USFWS, addling or removal of BHCO eggs from parasitized SWFL nests is a practice that was begun in 2002 and continued through 2008. Of the 139 SWFL nests parasitized during that period with known outcomes, BHCO eggs were addled or removed from 67 nests, 18 of which successfully fledged SWFL young (26.9 percent success). Parasitized nests over the past six seasons in the Middle Rio Grande that were unaltered were not as successful. Of 72 parasitized nests monitored, 58 failed and 14 successfully fledged young—a 19.4 percent success

rate. However, a Chi-square test with Yates' correction did not show a statistically significant difference ($\chi^2 = 1.08$, df = 1, $P = 0.30$) between altered and unaltered parasitized nests.

Recommendations

Recommendations for future work in the Middle Rio Grande fall into three categories:

1. Annual surveys of SWFL population concentrations
2. Periodic surveys of potential/unoccupied suitable habitat or restoration sites
3. Non survey-related

Annual Surveys

- Presence/absence surveys should continue in occupied reaches of the Middle Rio Grande to monitor the status of the SWFL population. These surveys will provide data regarding population trends and colonization of new sites adjacent to occupied sites.
- Presence/absence surveys should also continue in project-related areas where ESA compliance mandates and within Critical Habitat designation areas.
- Nest monitoring should continue in areas where pairing activity is documented. While it is becoming increasingly difficult to monitor every nest, a sample of at least 100 nests (if available) should be monitored each year. These data will provide insight into factors limiting recruitment and population growth such as parasitism and predation rates.
- Addling/removal of BHCO eggs from parasitized SWFL nests should continue, provided it can be done with minimal disturbance to the nest and the adult SWFLs.

Periodic Surveys

- Periodic surveys (every 3 to 5 years) by the appropriate land management entity should be performed in all unoccupied reaches with suitable habitat in the Middle Rio Grande in order to document any colonization of newly suitable habitat.
- In any sites where resident SWFLs are documented, nest searching and monitoring should be conducted by the appropriate management agency.
- Neotropical migrant bird point count surveys should be discontinued. Significant data exist regarding the abundance of BHCOs and potential host species within the four study reaches. Re-initiation of point counts may be considered in the future based on habitat changes and agency need.
- Assess habitat features at nest sites and occupied patches—both at the territory and patch level—to determine components characteristic of SWFL breeding areas where populations are expanding, remaining stable, or becoming extirpated.

Non Survey-related

- The SWFL Nest Vegetation Quantification Report will be finalized. Recommendations for further field work will be made in this report.
- The SWFL nesting hydrology study initiated in 2004 should be continued and additional hydrostations should be added in newly colonized habitat.
- Analysis of new aerial photography and ground-truthing of vegetation should be conducted to update the SWFL habitat suitability GIS model.

Conclusions

Presence/absence data will be beneficial when establishing a long-term monitoring plan and will aid in better understanding of the species' distribution, abundance, and potential threats to it. All available data will prove beneficial in the implementation of the Southwestern Willow Flycatcher Recovery Plan. As defined by the Recovery Plan for the Southwestern Willow Flycatcher (USFWS 2002), the Middle Rio Grande Management Unit, a part of the Rio Grande Recovery Unit, extends from just upstream of Cochiti Reservoir to Elephant Butte Dam. The recovery goal for this reach is 100 SWFL territories. Even without considering the territories occurring on the Pueblo of Isleta (14 documented in 2000; NMNHP 2000), the recovery goal for the Middle Rio Grande Management Unit has been sustained for 6 consecutive years (Table 7). Additional population growth is still needed in other Management Units for recovery objectives to be met within the Rio Grande Recovery Unit.

Acknowledgments

The authors of this document would like to thank the Albuquerque Area Office of the Bureau of Reclamation and the Middle Rio Grande Endangered Species Collaborative Program for generously funding these studies. We also acknowledge Deb Callahan, Vicky Johanson and Seth Kennedy for superior oversight of field crews during the field season. We thank the many field technicians for performing this work meticulously and dutifully. We appreciate the critical reviews and advice of Rob Doster.

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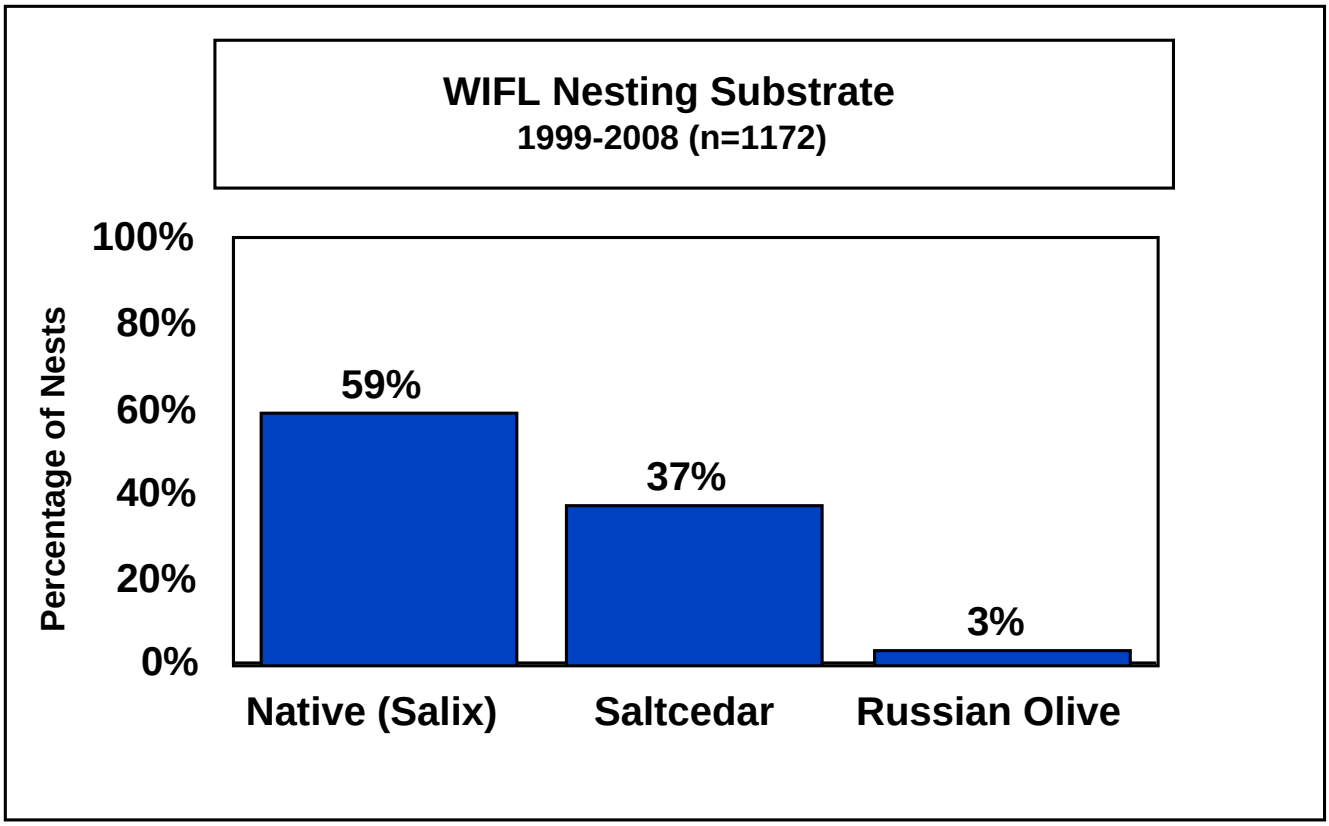
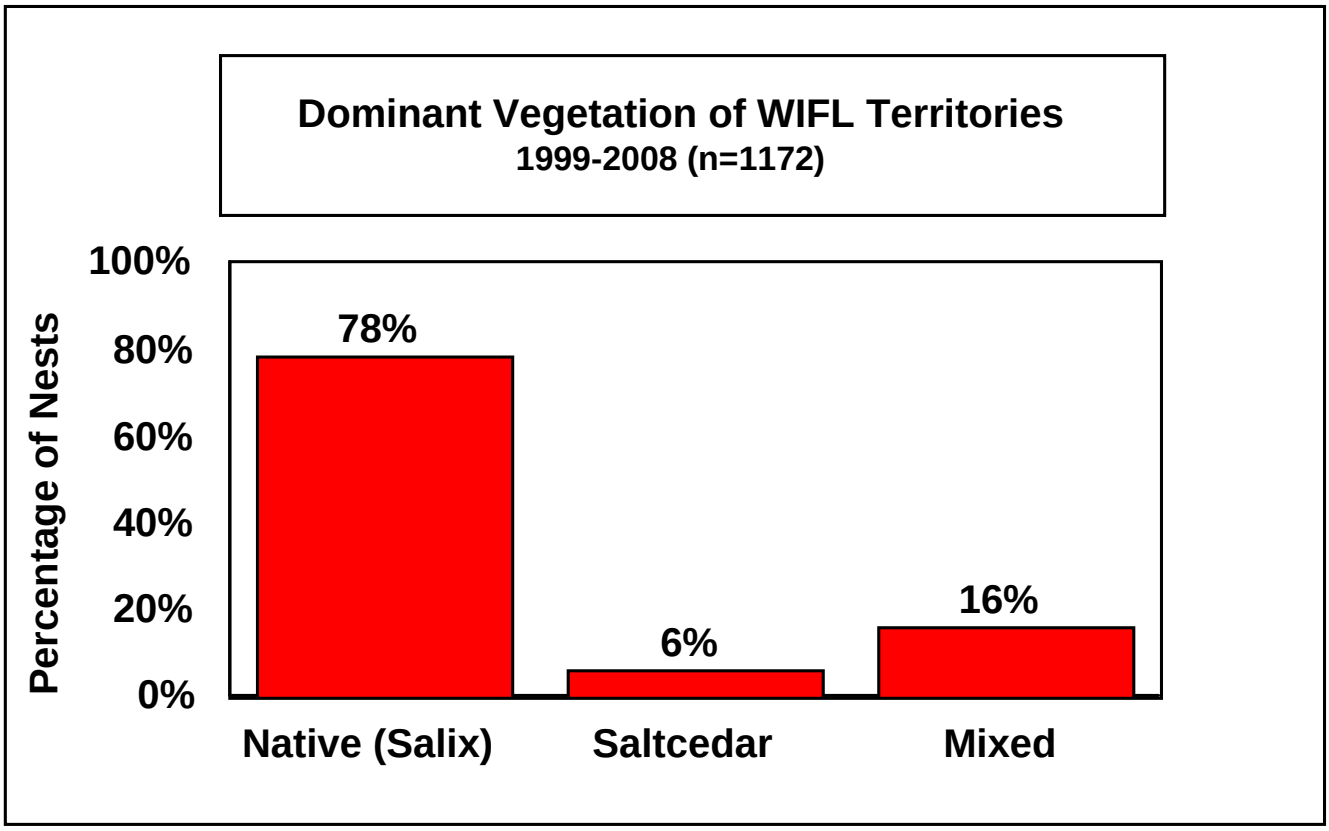
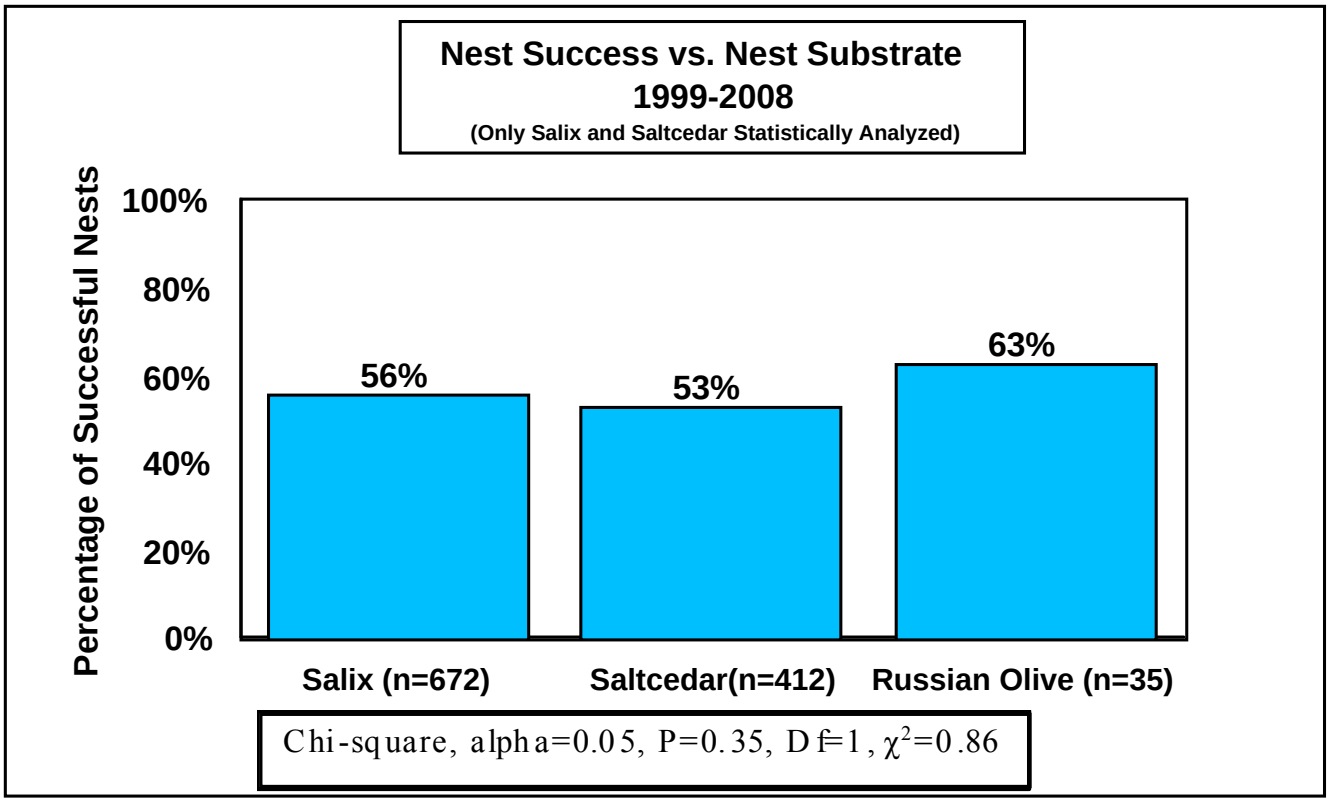
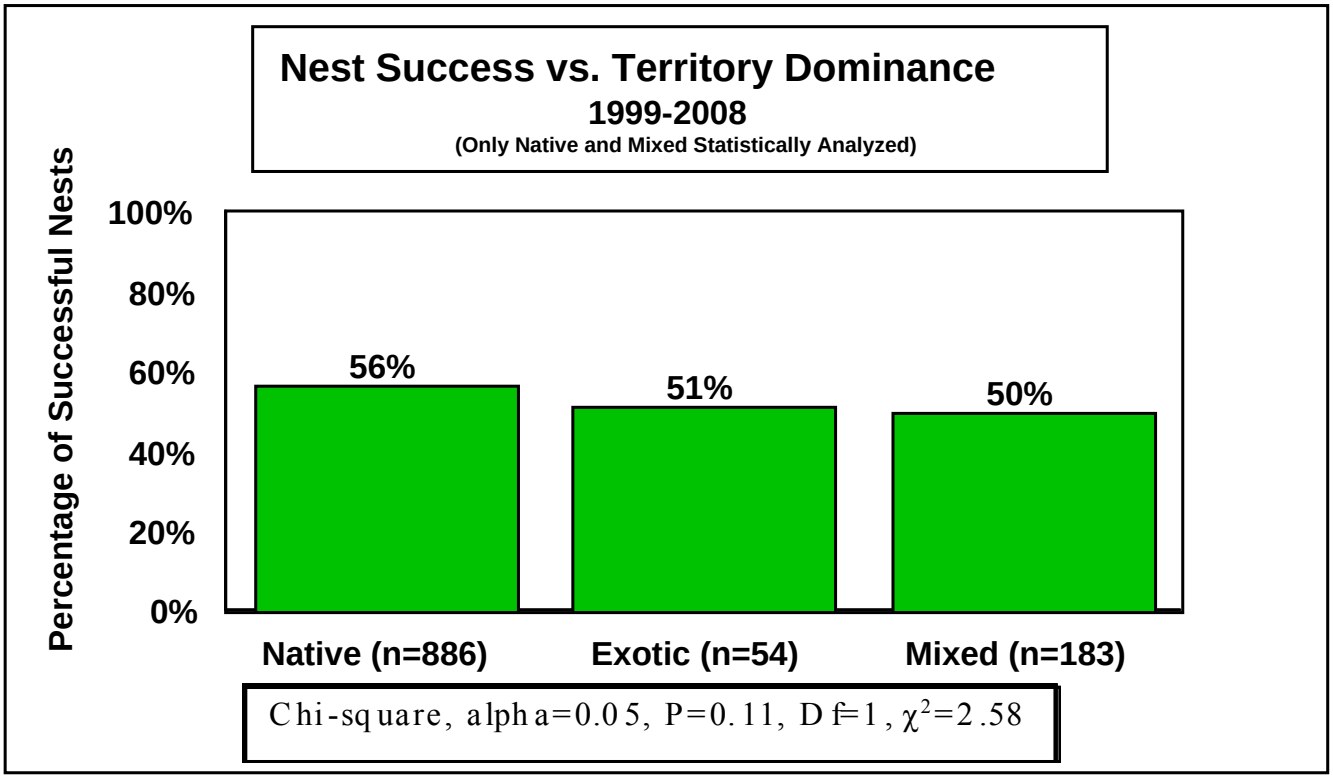
Habitat and Nesting Variable Analysis

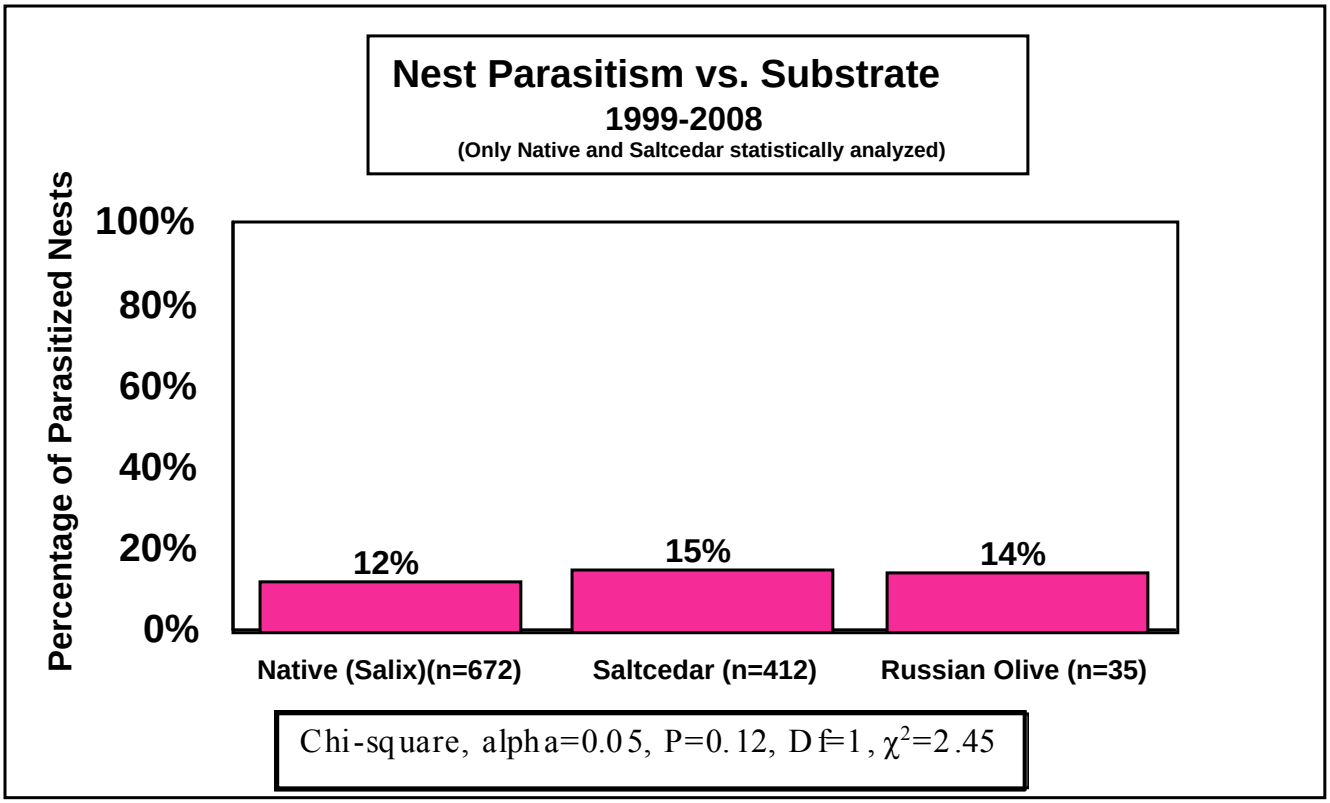
All Nests in Middle Rio Grande

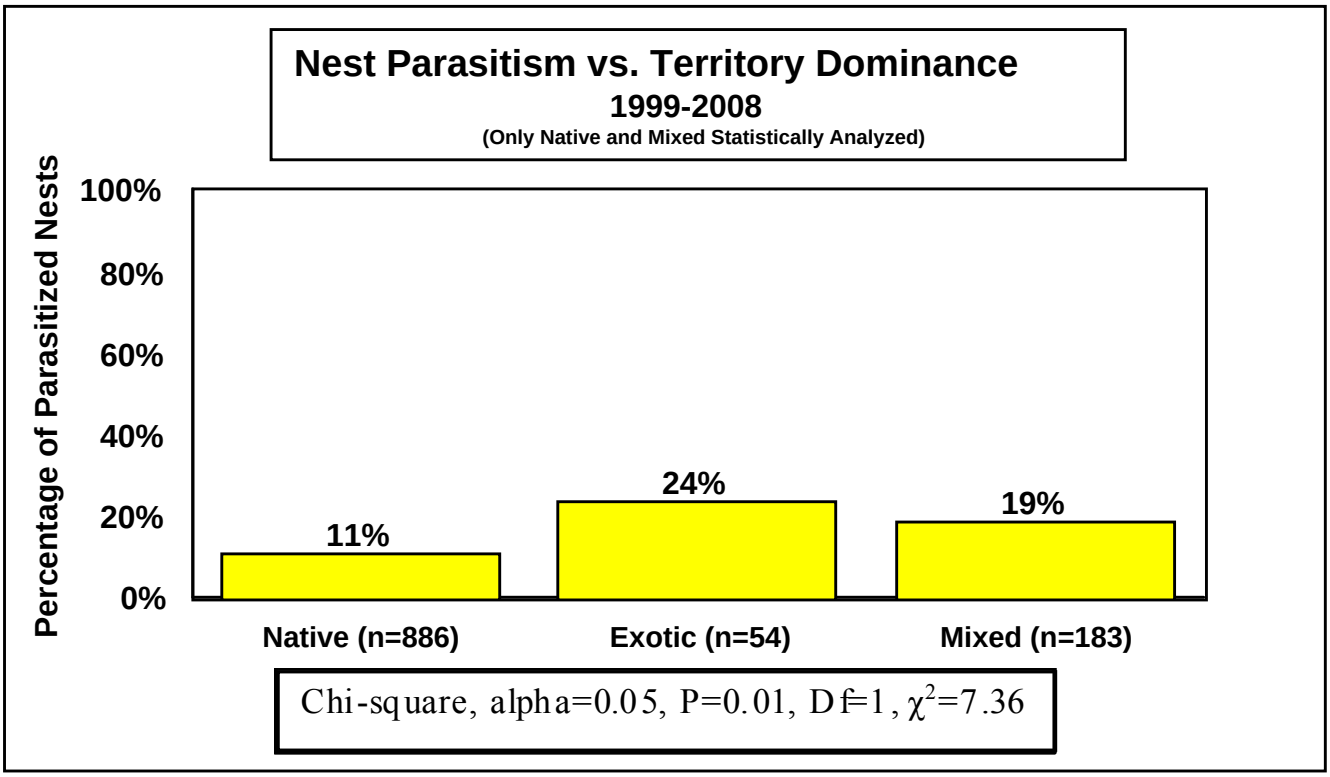

WIFL Nesting Substrate
1999-2008 (n=1172)
Percentage of Nests
100%
80%
60%
40%
20%
0%
59%
37%
3%
Native (Salix)
Saltcedar
Russian Olive

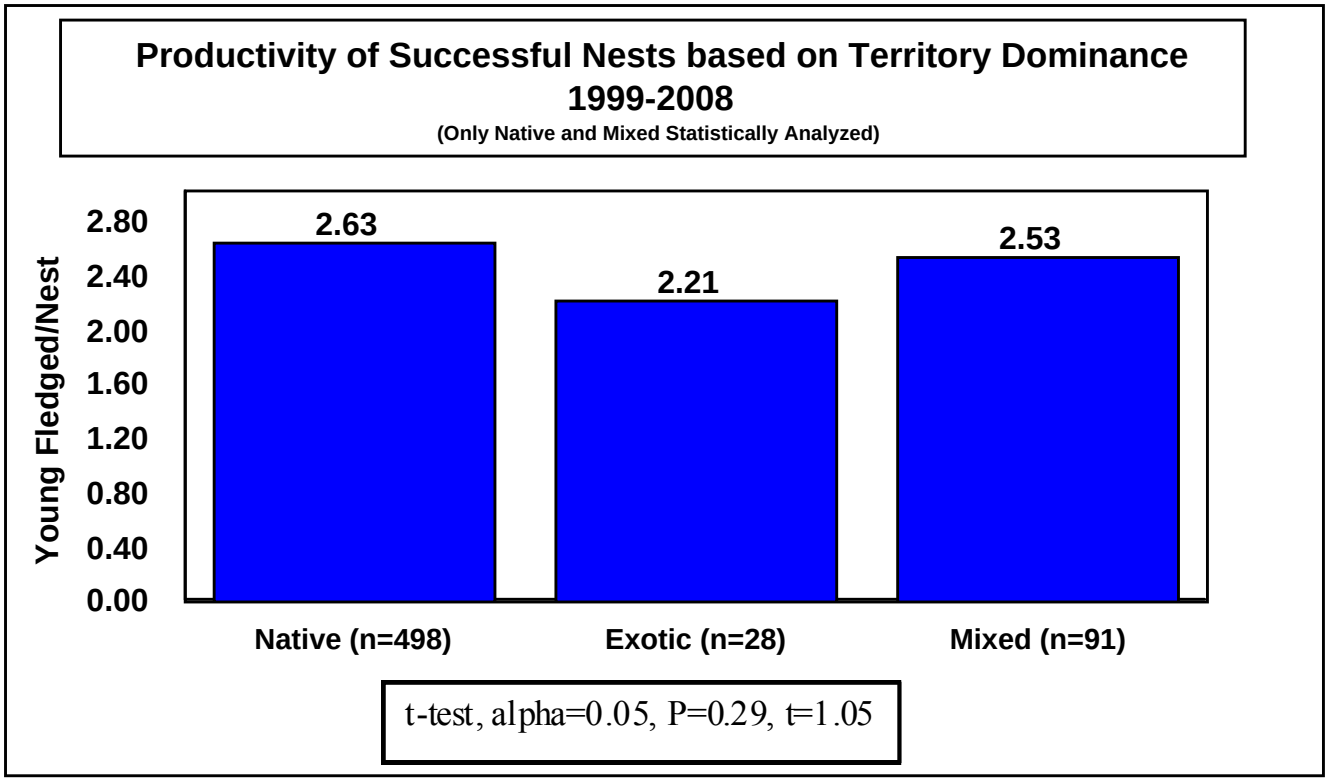

Dominant Vegetation of WIFL Territories
1999-2008 (n=1172)
Percentage of Nests
100%
80%
60%
40%
20%
0%
78%
6%
16%
Native (Salix)
Saltcedar
Mixed

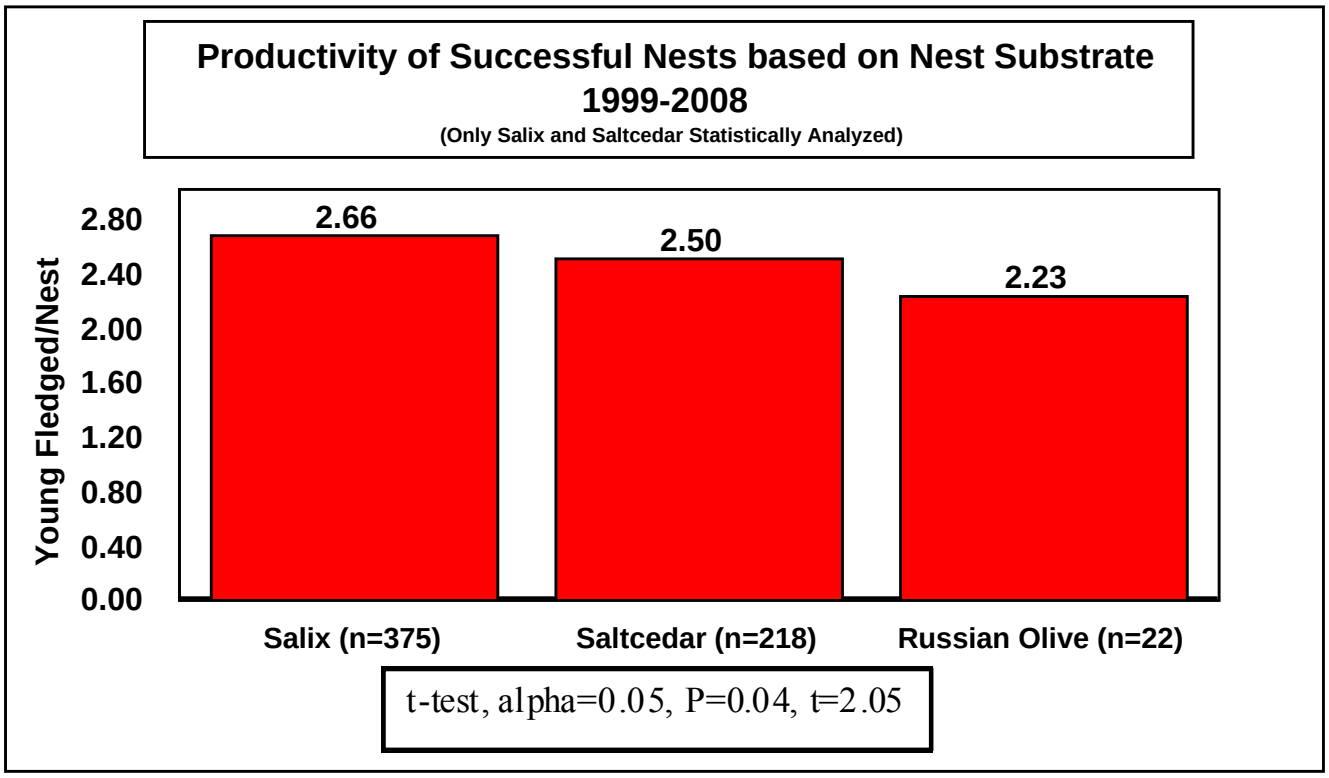

Nest Success vs. Nest Substrate
1999-2008
(Only Salix and Saltcedar Statistically Analyzed)
Percentage of Successful Nests
100%
80%
60%
40%
20%
0%
56%
53%
63%
Salix (n=672)
Saltcedar(n=412)
Russian Olive (n=35)
Chi-square, alpha=0.05, P=0.35, Df=1, χ2=0.86

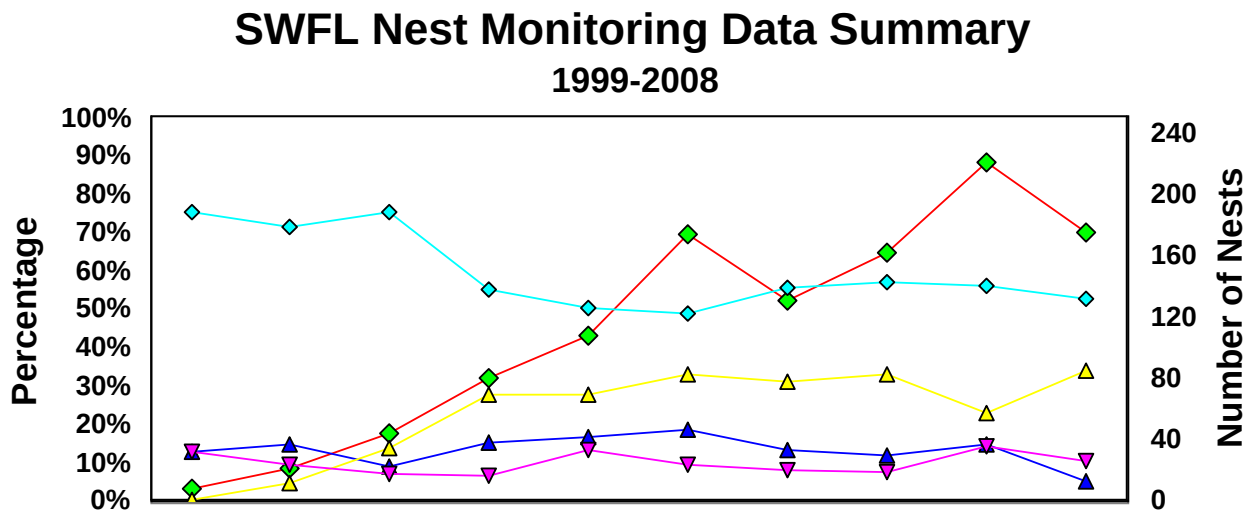

Nest Success vs. Territory Dominance
1999-2008
(Only Native and Mixed Statistically Analyzed)
Percentage of Successful Nests
100%
80%
60%
40%
20%
0%
56%
51%
50%
Native (n=886)
Exotic (n=54)
Mixed (n=183)
Chi-square, alpha=0.05, P=0.11, Df=1, χ2=2.58


Nest Parasitism vs. Substrate
1999-2008
(Only Native and Saltcedar statistically analyzed)
Percentage of Parasitized Nests
100%
80%
60%
40%
20%
0%
12%
15%
14%
Native (Salix)(n=672)
Saltcedar (n=412)
Russian Olive (n=35)
Chi-square, alpha=0.05, P=0.12, Df=1, χ2=2.45

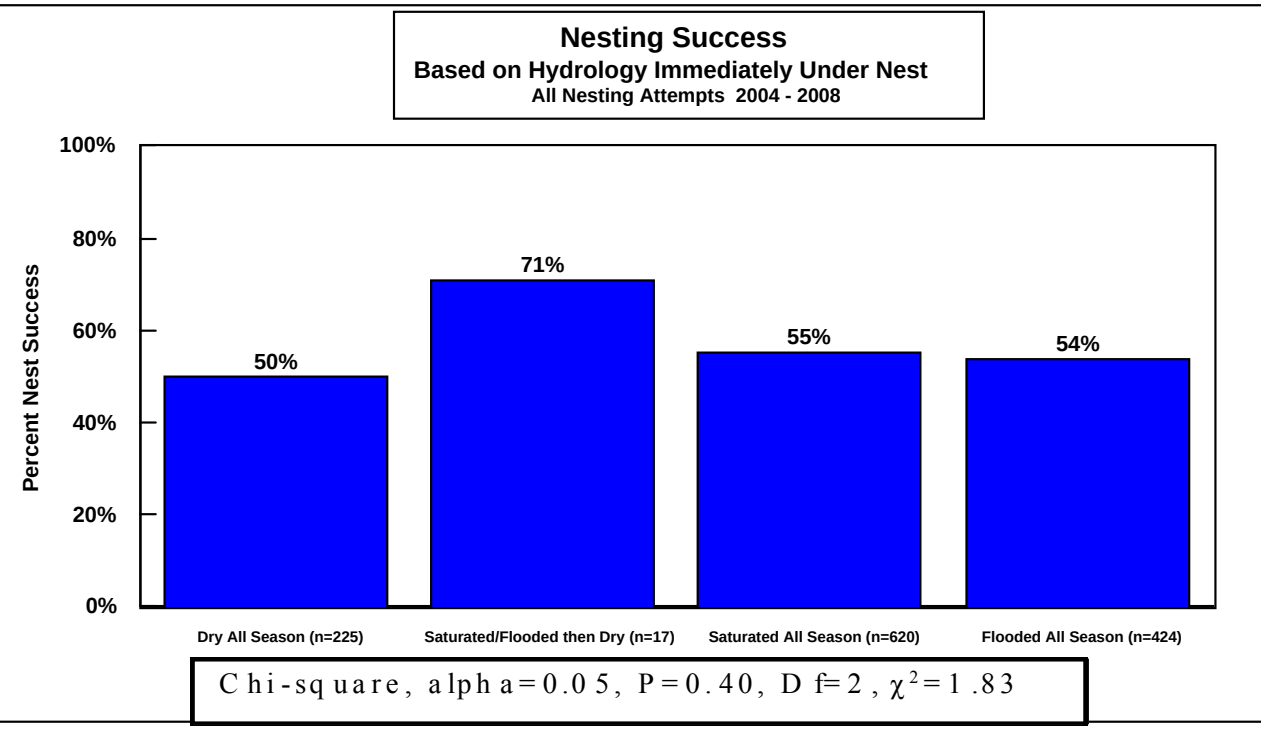

Nest Parasitism vs. Territory Dominance
1999-2008
(Only Native and Mixed Statistically Analyzed)
Percentage of Parasitized Nests
100%
80%
60%
40%
20%
0%
11%
24%
19%
Native (n=886)
Exotic (n=54)
Mixed (n=183)
Chi-square, alpha=0.05, P=0.01, Df=1, χ2=7.36

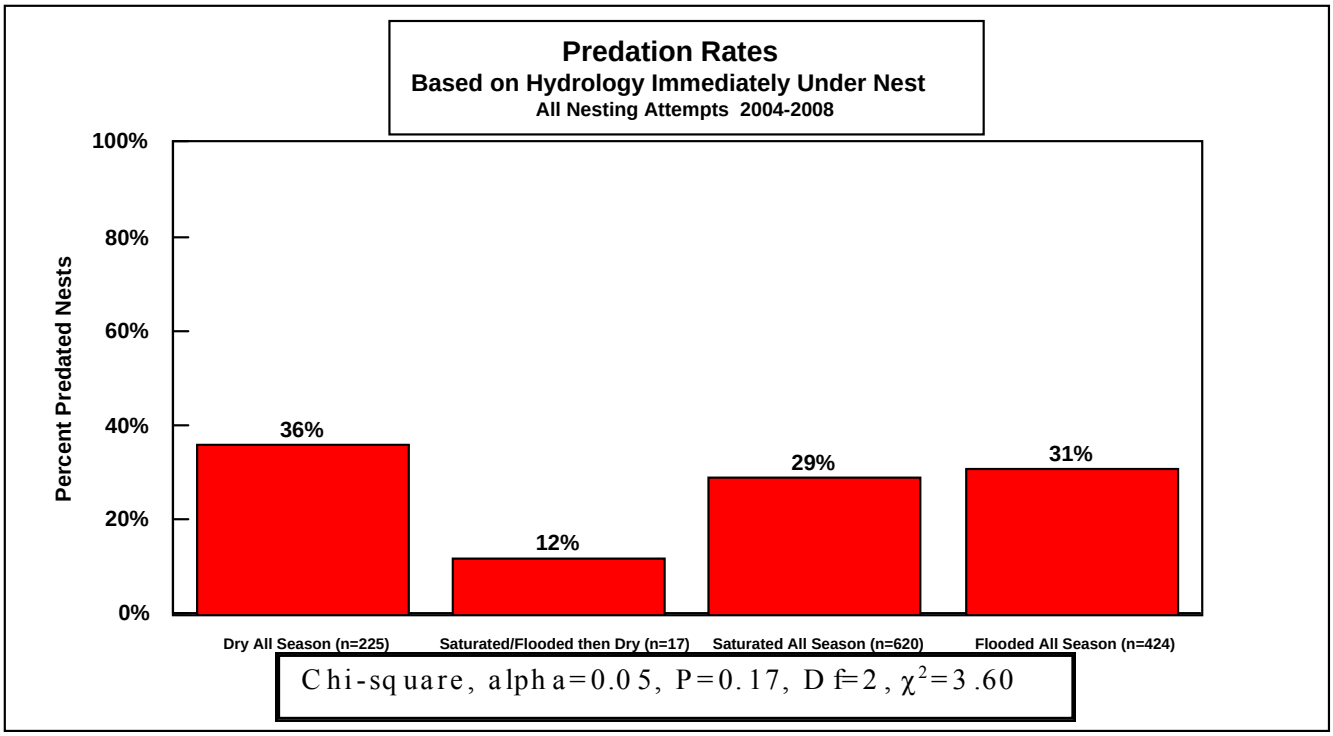

Productivity of Successful Nests based on Territory Dominance
1999-2008
(Only Native and Mixed Statistically Analyzed)
Young Fledged/Nest
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
2.63
2.21
2.53
Native (n=498)
Exotic (n=28)
Mixed (n=91)
t-test, alpha=0.05, P=0.29, t=1.05

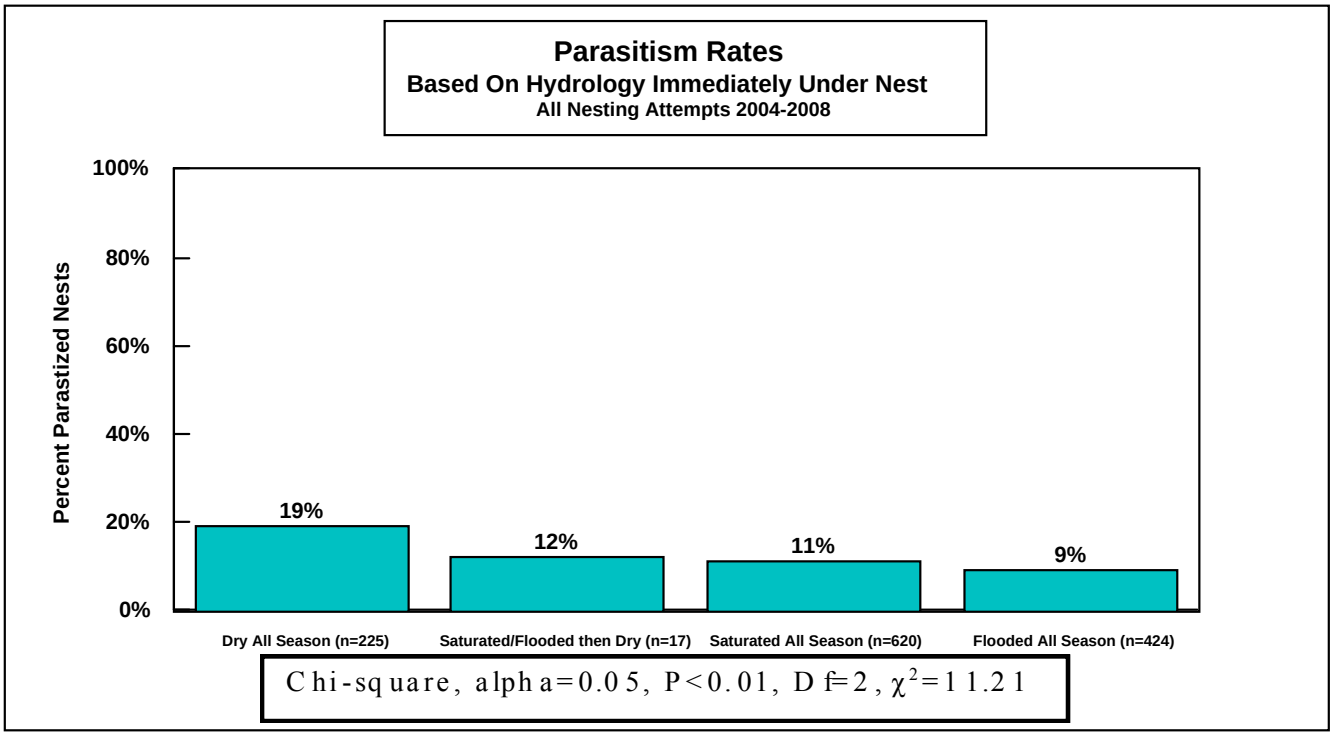

Productivity of Successful Nests based on Nest Substrate
1999-2008
(Only Salix and Saltcedar Statistically Analyzed)
Young Fledged/Nest
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
2.66
2.50
2.23
Salix (n=375)
Saltcedar (n=218)
Russian Olive (n=22)
t-test, alpha=0.05, P=0.04, t=2.05

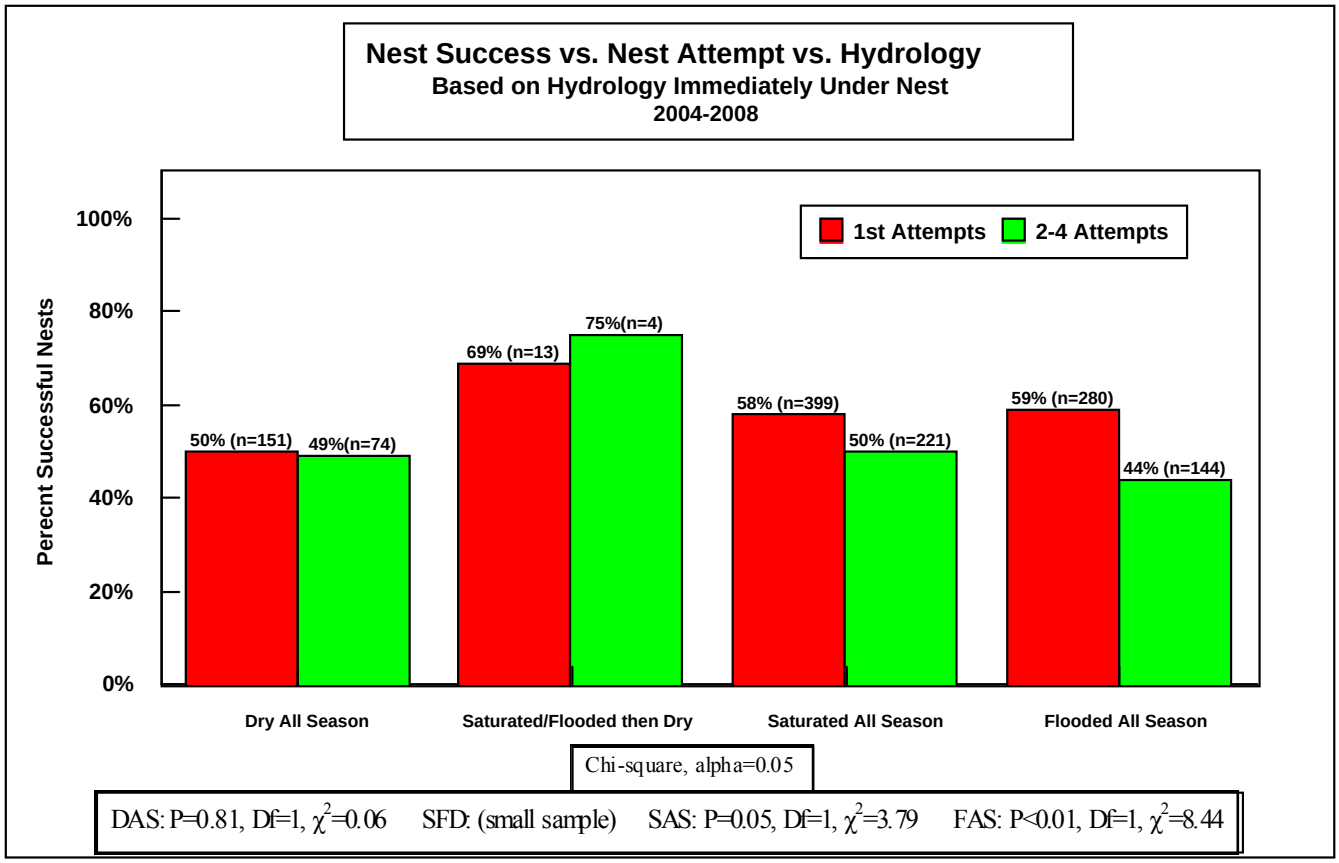


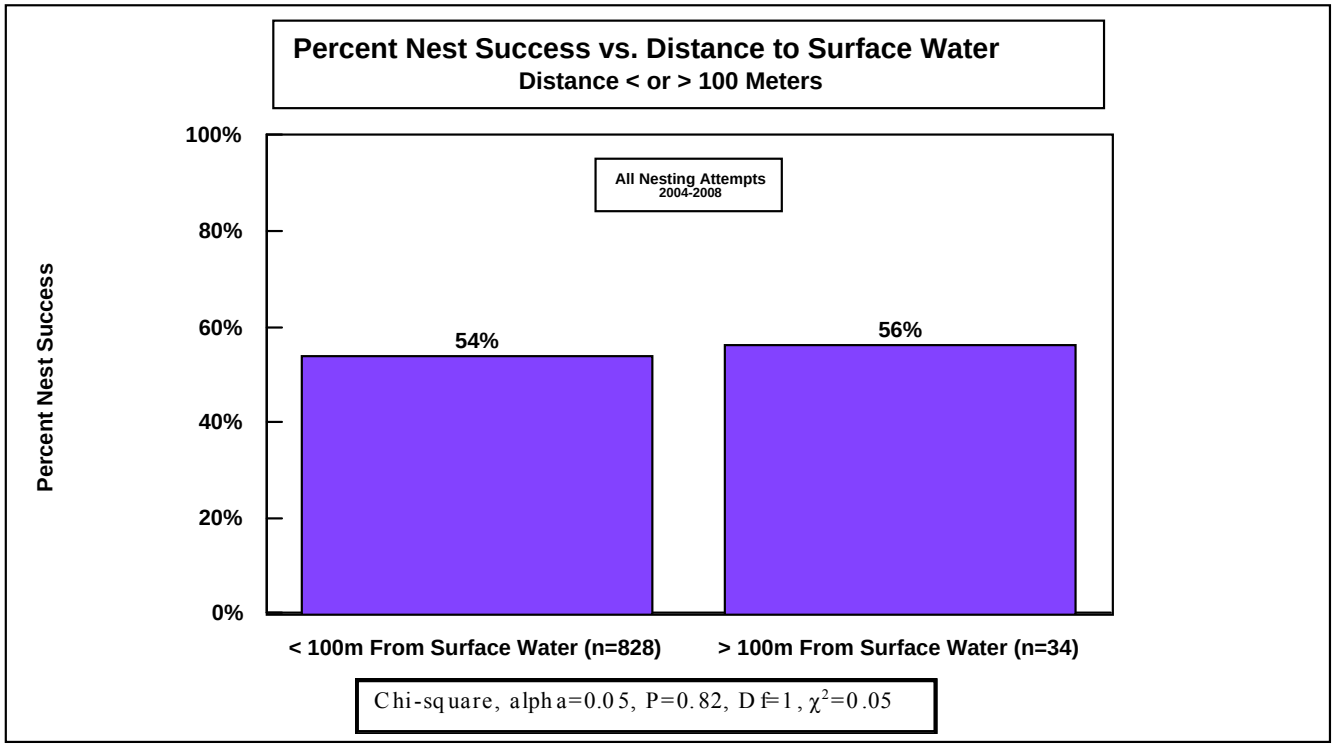
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Nest	8	21	44	80	108	174	130	162	221	175
Parasitism	13%	15%	9%	15%	17%	19%	13%	12%	14%	5%
Predation	0%	5%	14%	28%	28%	33%	31%	33%	23%	34%
Abandonment	13%	10%	7%	6%	13%	9%	8%	7%	14%	10%
Nest Success	75%	71%	75%	55%	50%	49%	55%	57%	56%	53%

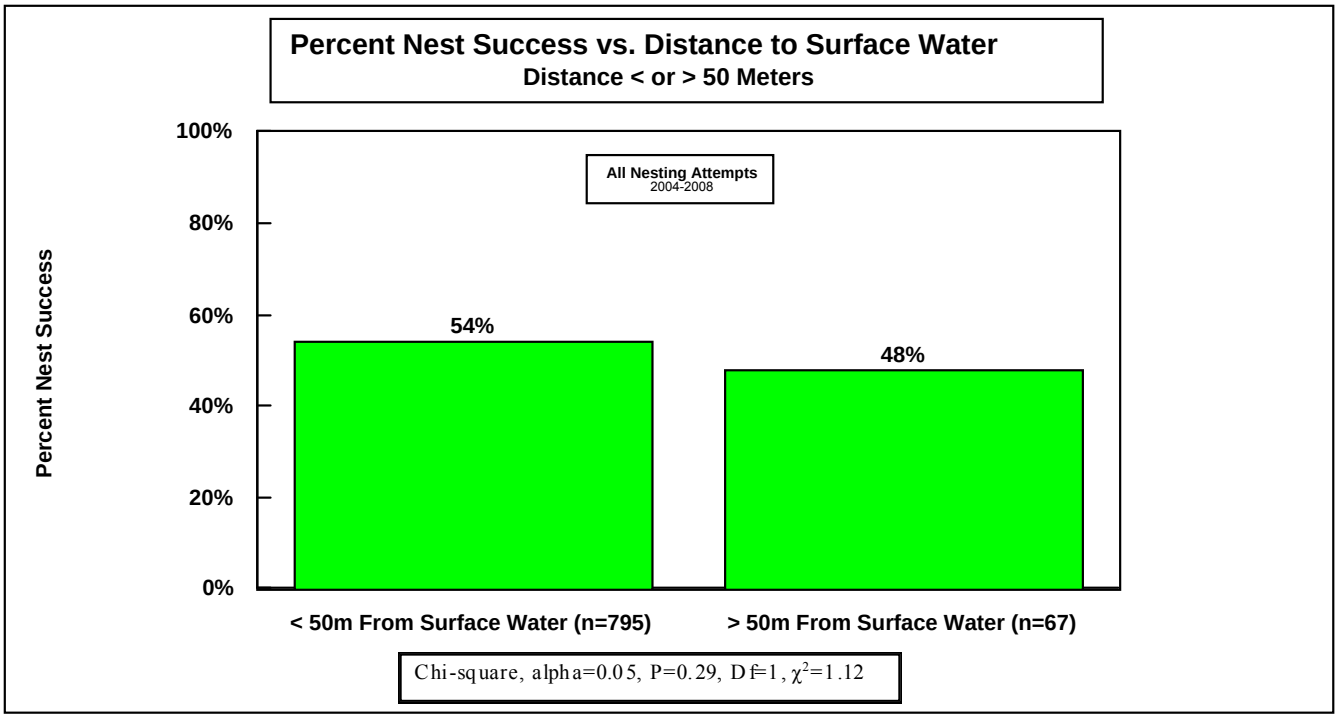


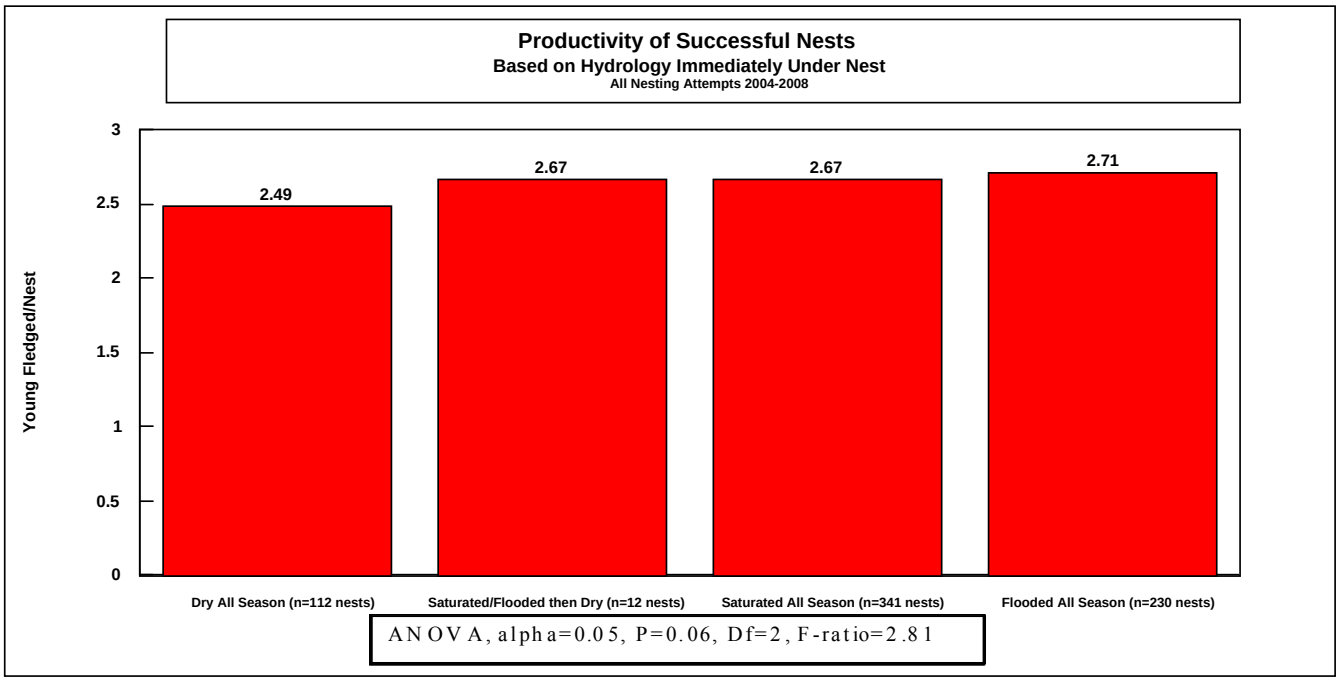

Predation Rates
Based on Hydrology Immediately Under Nest
All Nesting Attempts 2004-2008
Percent Predated Nests
100%
80%
60%
40%
20%
0%
36%
12%
29%
31%
Dry All Season (n=225)
Saturated/Flooded then Dry (n=17)
Saturated All Season (n=620)
Flooded All Season (n=424)
Chi-square, alpha=0.05, P=0.17, Df=2, χ^2=3.60

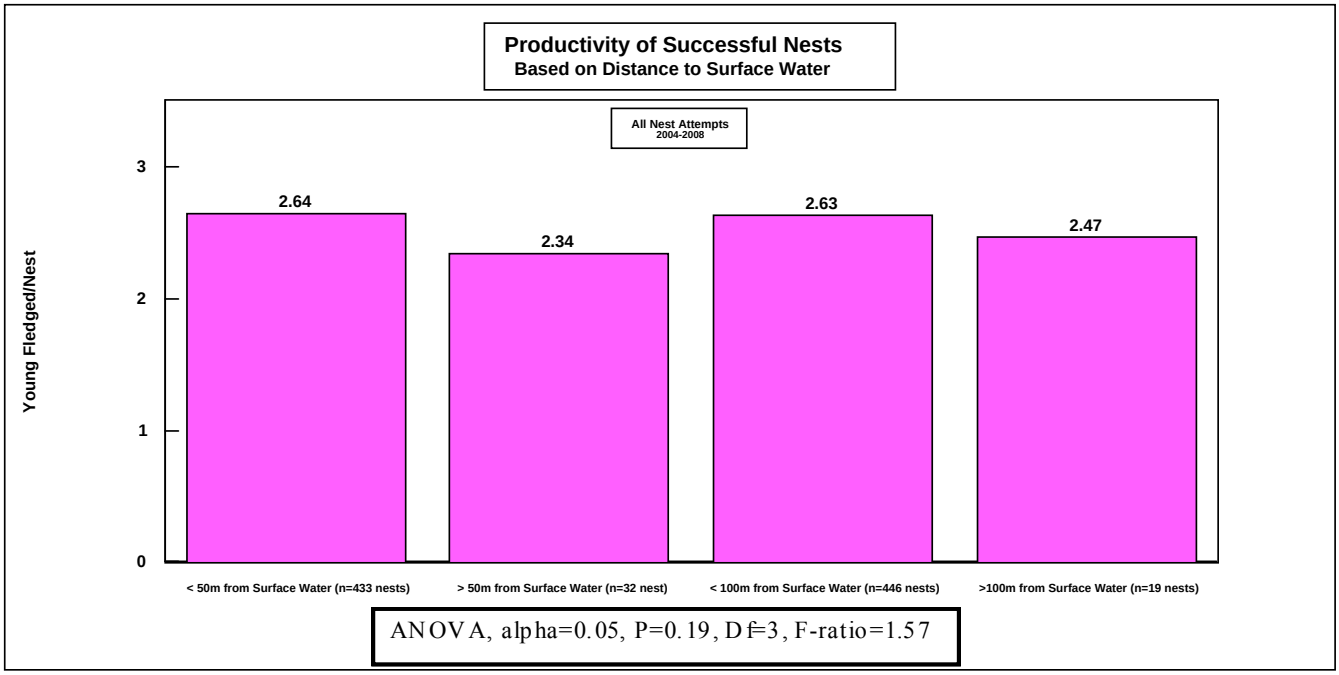

Parasitism Rates
Based On Hydrology Immediately Under Nest
All Nesting Attempts 2004-2008
Percent Parastized Nests
100%
80%
60%
40%
20%
0%
19%
12%
11%
9%
Dry All Season (n=225)
Saturated/Flooded then Dry (n=17)
Saturated All Season (n=620)
Flooded All Season (n=424)
Chi-square, alpha=0.05, P<0.01, Df=2, χ^2=11.21

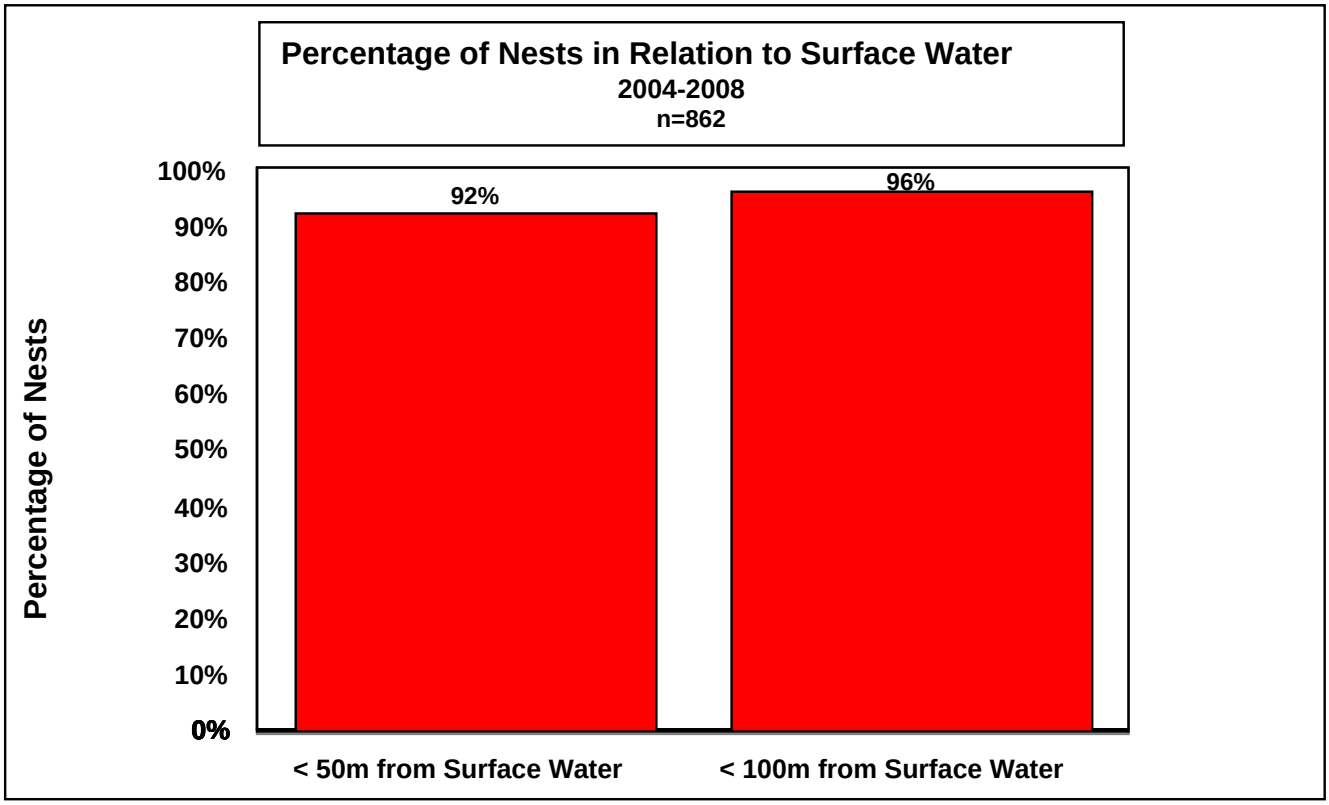

Nest Success vs. Nest Attempt vs. Hydrology
Based on Hydrology Immediately Under Nest
2004-2008
1st Attempts
2-4 Attempts
Perecnt Successful Nests
100%
80%
60%
40%
20%
0%
50% (n=151)
49%(n=74)
69% (n=13)
75%(n=4)
58% (n=399)
50% (n=221)
59% (n=280)
44% (n=144)
Dry All Season
Saturated/Flooded then Dry
Saturated All Season
Flooded All Season
Chi-square, alpha=0.05
DAS: P=0.81, Df=1, χ2=0.06 SFD: (small sample) SAS: P=0.05, Df=1, χ2=3.79 FAS: P<0.01, Df=1, χ2=8.44


Percent Nest Success vs. Distance to Surface Water
Distance < or > 100 Meters
All Nesting Attempts
2004-2008
Percent Nest Success
100%
80%
60%
40%
20%
0%
54%
56%
< 100m From Surface Water (n=828)
> 100m From Surface Water (n=34)
Chi-square, alpha=0.05, P=0.82, Df=1, χ2=0.05


Percent Nest Success vs. Distance to Surface Water
Distance < or > 50 Meters
All Nesting Attempts
2004-2008
Percent Nest Success
100%
80%
60%
40%
20%
0%
54%
48%
< 50m From Surface Water (n=795)
> 50m From Surface Water (n=67)
Chi-square, alpha=0.05, P=0.29, Df=1, χ2=1.12


Productivity of Successful Nests
Based on Hydrology Immediately Under Nest
All Nesting Attempts 2004-2008
Young Fledged/Nest
3
2.5
2
1.5
1
0.5
0
2.49
2.67
2.67
2.71
Dry All Season (n=112 nests)
Saturated/Flooded then Dry (n=12 nests)
Saturated All Season (n=341 nests)
Flooded All Season (n=230 nests)
ANOVA, alpha=0.05, P=0.06, Df=2, F-ratio=2.81


Productivity of Successful Nests
Based on Distance to Surface Water
All Nest Attempts
2004-2008
Young Fledged/Nest
3
2
1
0
2.64
2.34
2.63
2.47
< 50m from Surface Water (n=433 nests)
> 50m from Surface Water (n=32 nest)
< 100m from Surface Water (n=446 nests)
>100m from Surface Water (n=19 nests)
ANOVA, alpha=0.05, P=0.19, Df=3, F-ratio=1.57


Percentage of Nests in Relation to Surface Water
2004-2008
n=862
Percentage of Nests
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
92%
96%
< 50m from Surface Water
< 100m from Surface Water