Southwestern Willow Flycatcher Surveys and Nest Monitoring along the Gila River between Coolidge Dam and South Butte, 2009

Prepared for

US Bureau of Reclamation, Phoenix Area Office

Prepared by

SWCA Environmental Consultants

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SOUTHWESTERN WILLOW FLYCATCHER SURVEYS AND NEST MONITORING ALONG THE GILA RIVER BETWEEN COOLIDGE DAM AND SOUTH BUTTE, 2009

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EXECUTIVE SUMMARY

The Southwestern Willow Flycatcher was federally listed as endangered in 1995. Probable factors contributing to population declines were believed to be loss, alteration, and fragmentation of native riparian breeding habitat, loss of wintering habitat, nest depredation, and brood parasitism by Brown-headed Cowbirds (USFWS 1995). Prompted by concern for population declines, from 1997–2007 surveys and nest monitoring were conducted along the Gila River by the Arizona Game and Fish Department under a cooperative agreement with the U.S. Bureau of Reclamation. In 2008–2009, Reclamation contracted SWCA Environmental Consultants to continue to survey and monitor the Gila River downstream of Coolidge Dam to document flycatcher abundance and distribution in relation to Coolidge Dam operations. Results of the 2009 survey and nest monitoring effort are summarized in this report.

In 2009, we used recorded broadcasts of willow flycatcher song and calls to elicit responses from willow flycatchers at 52 sites along the Gila River, Arizona, from Dripping Springs Wash downstream past the Kelvin Bridge to South Butte and the Ashurst-Hayden Diversion Dam. We spent 250 hours surveying the sites covering approximately 94 linear km of riparian habitat. We detected 93 flycatcher pairs that had a total of 133 nesting attempts at 20 sites; 121 nests were monitored to determine annual flycatcher productivity. Of nests with known outcomes, 62% were successful. Mayfield nest success was 66%. We estimated 176 young fledged from 74 successful nests. Average seasonal flycatcher fecundity was 2.40 and average seasonal productivity was 2.01. Brown-headed cowbird parasitism was low (4%) and was documented for the first time within the study area since 2004. Nesting substrate was documented for 133 nests, with tamarisk the primary nesting substrate documented (124 nests).

We continued streamflow analyses conducted from 1998 to 2008 by Weddle et al. (2007) and Graber and Koronkiewicz (2009) and we concur with Weddle et al. (2007) that increased streamflow positively influences habitat quality at flycatcher sites within the study area. We found that increased streamflow from the beginning of the previous monsoon season to the beginning of the flycatcher breeding season (July–April) had a positive effect on the number of flycatcher territories from 1998 to 2009 at the Gila River study area and explained 50% of the variation in the number of flycatcher territories.

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INTRODUCTION

PROJECT HISTORY

The Southwestern Willow Flycatcher was placed on the federal endangered species list on February 17, 1995 (USFWS 1995), and critical habitat was designated on July 22, 1997 (USFWS 1997) and again in 2005 (USFWS 2005). A Southwestern Willow Flycatcher recovery plan was published in August 2002 (USFWS 2002).

From 1996 to 2005, the Arizona Game and Fish Department (AGFD) conducted flycatcher surveys and nest monitoring along the Gila and San Pedro Rivers and Roosevelt Lake as part of a long-term demographic study under a cooperative agreement with the U.S. Bureau of Reclamation (Reclamation) regarding the 1996 Biological Opinion on Roosevelt Dam (USFWS 1996). At the request of Reclamation, this effort continued in 2006 and 2007 with the exception that AGFD did not conduct field work at the San Pedro River or Roosevelt Lake study areas, and nest monitoring effort was reduced at the Gila River study area. In 2008 and 2009, Reclamation contracted SWCA Environmental Consultants (SWCA) to continue to survey and monitor the Gila River downstream of Coolidge Dam to document flycatcher abundance and distribution in relation to Coolidge Dam operations. These surveys provide Reclamation with baseline flycatcher abundance and distribution data downstream of Coolidge Dam. Results of the 2009 survey and nest monitoring effort are summarized in this report.

This document serves as the summary report for 2009 study activities at the Gila River study area, including: 1) surveys: the systematic search of riparian habitat to record the presence and abundance of flycatchers at the study area; and 2) nest monitoring: the estimation of flycatcher nest success and productivity. SWCA's contract specifies the following field tasks:

At approximately 50 sites along the Gila River, complete the following:

a. where landowner permission can be obtained, survey suitable and potentially suitable habitat on the Gila River from Dripping Springs Wash downstream past the Kelvin Bridge to South Butte and the Ashurst-Hayden Diversion Dam;
b. conduct presence/absence surveys, as recommended in the U.S. Fish and Wildlife Service (USFWS) Southwestern Willow Flycatcher Protocol (USFWS 2000), and general survey methods outlined in Sogge et al. (1997);
c. attempt to locate flycatchers visually, focusing on determining whether the bird has leg bands, and recording the band combination if the bird is banded (as per permitting requirements);
d. conduct nest searches if territorial flycatchers are located and monitor nests; calculate Mayfield nest success (Mayfield 1961, 1975) for the study area;
e. document the presence absence of Brown-headed Cowbirds (*Molothrus ater*) at survey sites;
f. provide a general site description for each site, recording and providing all required information on standardized survey and detection forms;
g. document regeneration and loss of flycatcher habitat within the study area, highlighting the response of flycatchers to habitat change;
h. implement photo points at a subset of known flycatcher breeding sites to further examine future losses and regeneration of habitat and corresponding fluctuations in flycatcher numbers; and,
i. compile all data into an annual report.

SPECIES INTRODUCTION

The Southwestern Willow Flycatcher, *Empidonax traillii extimus*, is one of four subspecies of willow flycatcher currently recognized (Unitt 1987), although Browning (1993) posits a fifth subspecies (*E. t. campestris*) occurring in the central portions of the United States (Figure 1). The Southwestern Willow Flycatcher breeds in dense, mesic riparian habitats at scattered, isolated sites in New Mexico, Arizona, southern California, southern Nevada, southern Utah, southwestern Colorado, and, at least historically, extreme northwestern Mexico and western Texas (Unitt 1987). While other subspecies of the Willow Flycatcher may breed away from surface water (Bent 1942, King 1955, McCabe 1991), the southwestern subspecies only breeds near surface water or saturated soil along rivers and streams, reservoirs, cienegas, and other wetlands (Sogge and Marshall 2000; USFWS 2002, 2005; Allison et al. 2003).

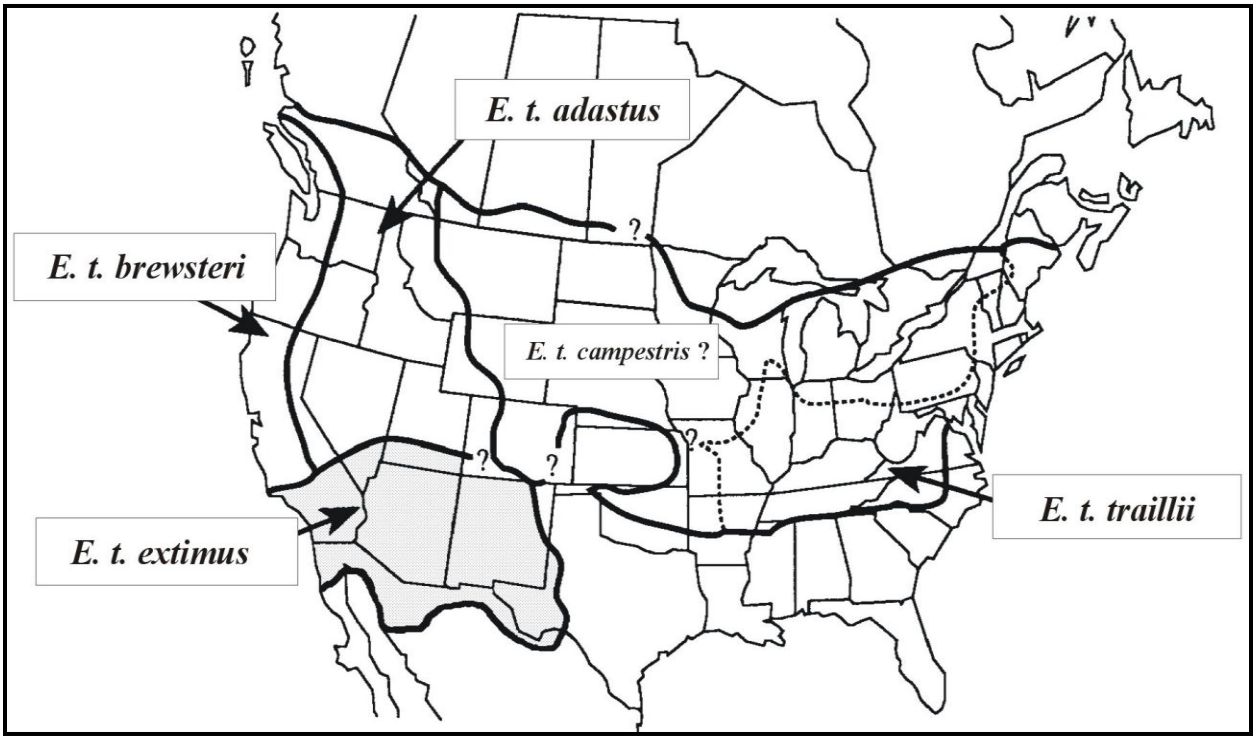

Figure 1. Breeding distribution of willow flycatcher subspecies. Question marks represent areas where actual location of the subspecies boundary is unknown. Adapted from Unitt (1987), Browning (1993), and Sogge et al. (1997).

In the Southwest, most willow flycatcher breeding territories are found within small breeding sites containing five or fewer territories (Durst et al. 2007). One of the last long-distance Neotropical migrants to arrive in North America in spring, Southwestern Willow Flycatchers have a short, approximately 100-day breeding season, with individuals typically arriving in May or June and departing in August or September (Sogge et al. 1997). All four subspecies of willow flycatchers spend the non-breeding season in portions of southern Mexico, Central America, and northwestern South America (Stiles and Skutch 1989, Ridgely and Tudor 1994, Howell and Webb 1995, Unitt 1997), with wintering ground habitat similar to the breeding grounds (Lynn et al. 2003). Willow flycatchers have been recorded on the wintering grounds from central Mexico to southern Central America as early as mid-August (Stiles and Skutch 1989, Howell and Webb 1995), and wintering, resident individuals have been recorded in southern Central America as late as the end of May (Koronkiewicz et al. 2006).

METHODS

STUDY AREA

The Gila River study area (Figures 2, 3 and 4) is located approximately 20 km below San Carlos Reservoir, extending from Dripping Springs Wash (upstream of the town of Winkelman) approximately 71 km downstream to South Butte and the Ashurst-Hayden Diversion Dam. Flows are variable on the Gila River, regulated by releases from Coolidge Dam and natural flow from the San Pedro River. The Gila Water Commissioner (www.gilawater.org) is appointed by the U.S. District Court to administer the Globe Equity 59 Decree which controls use of the waters of the Gila River in the reach from above Virden, New Mexico downstream to the confluence with the Salt River west of Phoenix. The San Carlos Irrigation Project controls releases from Coolidge Dam based on downstream water orders. Flycatcher breeding season (April–August) streamflow below Coolidge Dam averaged 525 cubic feet per second (cfs) from 1996 to 2001, but from 2002 to 2004 periods of little or no streamflow (average of 81 cfs) were recorded due to drought conditions and Central Arizona Project water exchanges (Weddle et al. 2007). Since 2005 to present, streamflow has averaged 567 cfs during the breeding season (USGS 2009). Riparian habitat along this reach varies from monotypic tamarisk (*Tamarix* spp.) to mixed native and exotic vegetation (primarily tamarisk, Goodding's willow [*Salix gooddingii*]), and Fremont cottonwood [*Populus fremontii*]). Riparian habitat is surrounded by Arizona Upland, a subdivision of the Sonoron Desertscrub biome (Turner and Brown 1994). The study area is subdivided into survey sites of distinct habitat patches 0.18–9.69 km in length. Elevation at survey sites range from 485 m to 622 m and average canopy height ranges from 5 to 9 m.

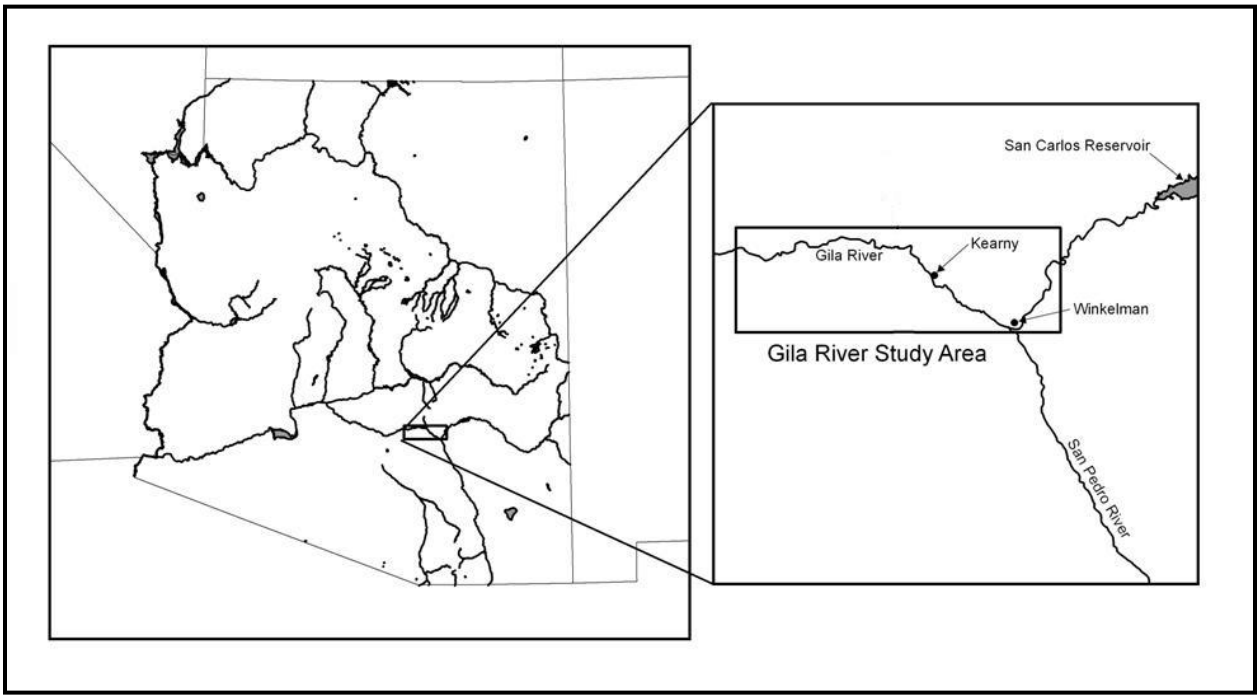

Figure 2. Project Area for 2009 Southwestern Willow Flycatcher Surveys, Gila River, Arizona.

SURVEYS

Site Selection

Reclamation provided the Universal Transverse Mercator (UTM) coordinates for survey sites, and sent letters to private landowners requesting right-of-way access prior to the flycatcher breeding season. Landowner permission was acquired for all survey sites prior to the 2009 breeding season.

In coordination with Reclamation, survey sites were evaluated and selected using a combination of existing knowledge, on-foot and boat reconnaissance, and high-resolution aerial photographs. Surveys were not conducted in habitat determined to be unsuitable for flycatchers after initial field reconnaissance. All sites within the project area were visited at least once to determine suitability for flycatchers. Sites were determined to be unsuitable if vegetation clearly lacked the structural complexity necessary to support flycatchers (e.g., vegetation was dead or habitat was too narrow, such as 1–2 trees wide with sparse foliage). Sites consisting of mature native or exotic woody riparian vegetation with high canopy closure (>50%) and standing water or saturated soil under or adjacent to the vegetation were considered to be the most suitable habitats for flycatchers. Early successional stands of young riparian vegetation >3 m in height in proximity to surface water or saturated soil were also considered suitable flycatcher habitat.

Survey Technique

Unless sites were inaccessible by foot or boat (e.g., low streamflows, flooding), we completed a minimum of three broadcast surveys at each site deemed potentially suitable, as recommended in the USFWS Southwestern Willow Flycatcher Protocol (USFWS 2000), and general survey methods outlined in Sogge et al. (1997). We completed at least one survey between 15 and 31 May, at least one survey between 1 and 21 June, and at least one survey between 22 June and 17 July. All surveys were spaced a minimum of 5 days apart. We conducted additional site visits as needed to determine territory numbers and locations, and the presence of pairs.

To minimize time-of-day effect (i.e., varying rates of detectability due to changes in activity levels or other behavioral traits) surveys were conducted primarily between 60 minutes before sunrise and 10:00 am and we used broadcasts of recorded conspecific vocalizations to elicit responses from flycatchers. The standard broadcast used for flycatcher surveys consisted of a series of *fitz-bew* (primary song) and *breet* calls. The call sequence at each survey point consisted of a 10-20 second pre-broadcast listening period, a 15-30 second broadcast period, and a 1-2 minute listening period. Additional vocalizations (*whitt*, *wheoo*, *brrr/kitter*, and interaction calls) were also included on the survey recording. These vocalizations were used to try to elicit a *fitz-bew* or *wheeo* response, which were used to confirm the bird as a willow flycatcher, from *Empidonax* flycatchers that were silent or that had not given a diagnostic *fitz-bew* or *wheeo* call. Wherever possible, surveys were conducted from the interior of the site, with broadcasts occurring approximately every 30 meters. In the few cases where surveys within the site were difficult or inefficient because of extremely dense vegetation, surveys occurred along the periphery of the site.

Field personnel combined walking and boat (kayak) survey transects in all potentially suitable flycatcher habitats adjacent to and on the terrace above the Gila River. Sites away from the river's edge were surveyed by foot alone, sites with substantial interior habitat as well as habitat adjacent to the river were surveyed by foot and by boat, and sites consisting of only narrow and linear riparian vegetation (3–6 trees wide) along the river were surveyed by boat alone (for details see Appendix H enclosed on CD). For broadcast surveys conducted by boat, fast-moving current in some areas precluded broadcasts every 30 meters, however, survey coverage was increased by increasing the number of survey visits.

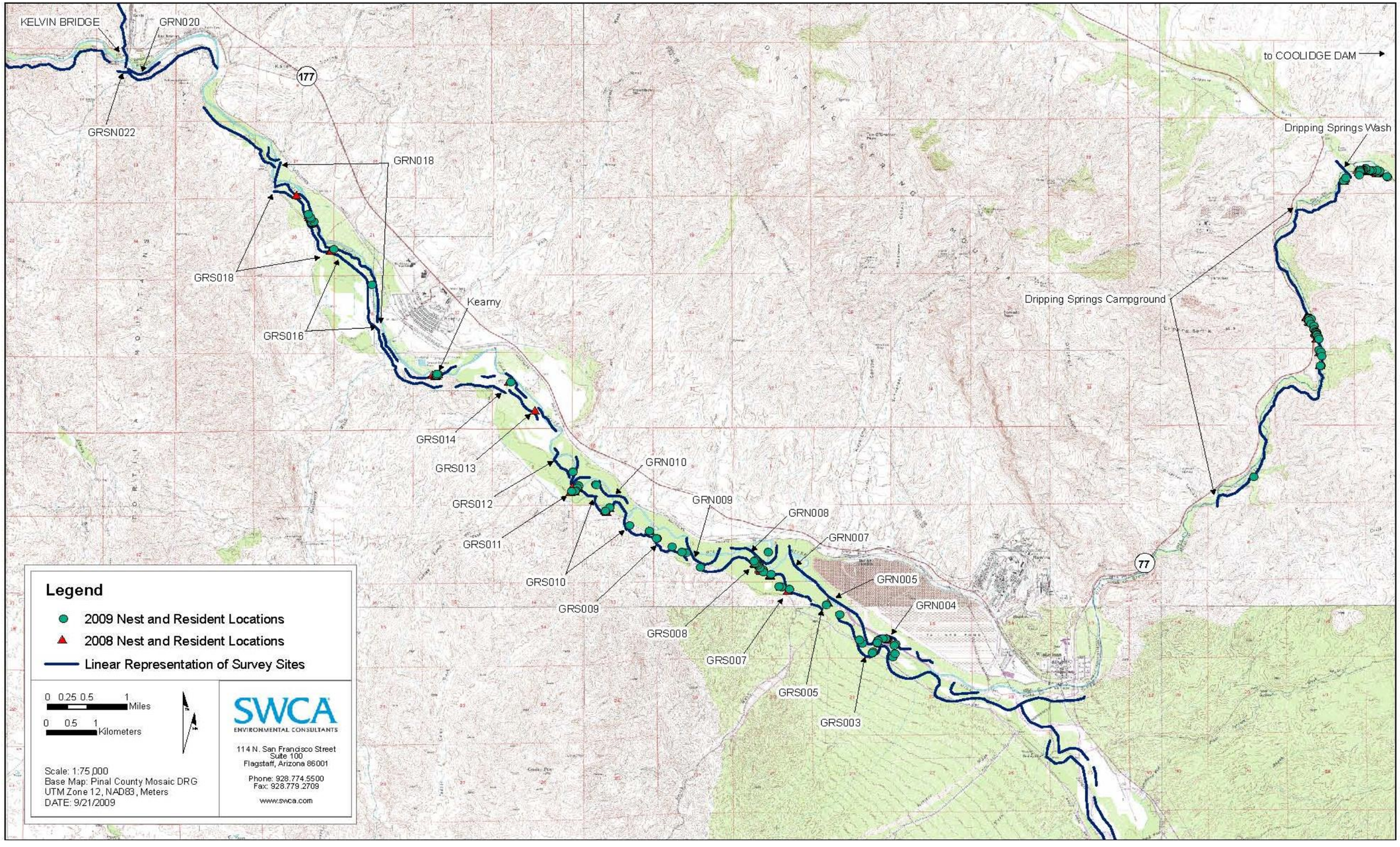

Figure 3. Gila River Study Area between Dripping Springs Wash and the Kelvin Bridge depicting 2008 and 2009 flycatcher nest and resident locations

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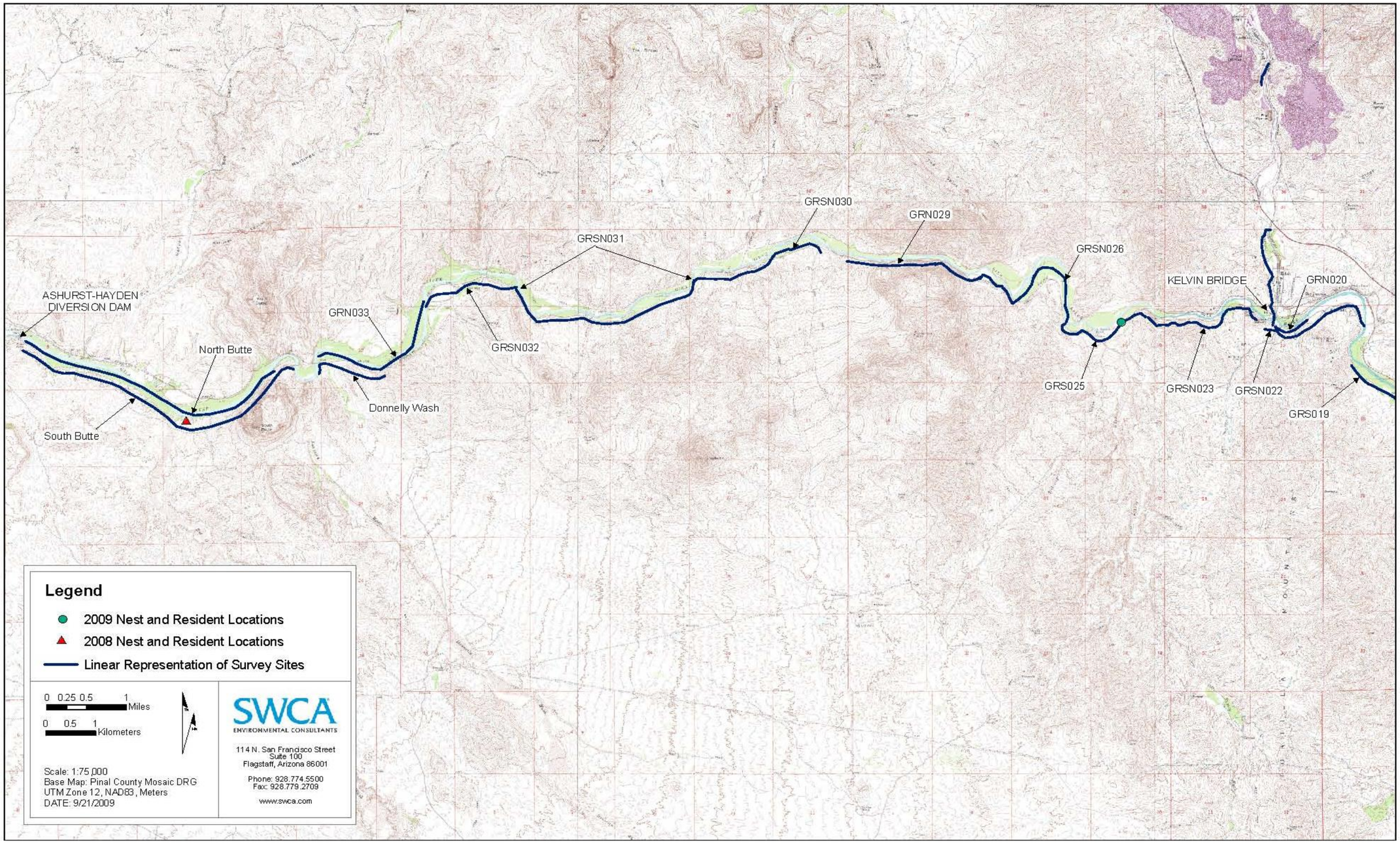

Figure 4. Gila River Study Area between the Kelvin Bridge and the Ashurst-Hayden Diversion Dam depicting 2008 and 2009 flycatcher nest locations.

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Flycatcher Residency and Breeding Status

When a willow flycatcher was detected, field personnel attempted to locate the bird visually, focusing on determining whether the bird had leg bands, and recording the band combination if the bird was banded (as per permitting requirements). Field personnel also noted general behavior of the bird, focusing on documenting evidence of territorial and breeding behavior (e.g., extended, unsolicited song; counter-singing with a neighboring male; presence of an unchallenged flycatcher within a known male territory [indicating female present]; soft *whitt* calls between two flycatchers; or any behavior that would indicate nesting, such as a flycatcher repeatedly *whitting* in a specific location or carrying nesting material or food). Field personnel recorded the GPS coordinates of each flycatcher detected, or, if the location of the flycatcher was not accessible, the location of the observer along with distance and direction to the responding bird; a flag was also placed in a visible location for ease in locating the territory in subsequent visits. Wherever a territorial flycatcher was detected, further visits to that area focused on territory and nest monitoring (see below). Broadcast surveys were not conducted in that immediate area to minimize disturbance to known territorial or breeding birds. We continued to survey portions of a site not determined to be occupied by territorial flycatchers.

Flycatchers were considered territorial or resident within a site if detected within the 15 June and 20 July "residency window", regardless of whether a possible or known mate was observed. Additionally, flycatchers were considered territorial if observations of nesting activity or nests were found before or after the "residency window". Flycatchers detected only during the first few days of the "residency window" were considered migrants based on additional field observations (i.e., they were not seen on repeated visits). Flycatchers documented prior to 15 June, but not detected in subsequent visits during the end of the second survey period or anytime during the third survey period, were considered migrants[1]. An "unknown" designation was given to birds if not enough information was available to determine resident or migrant status or if questions arose regarding inability to distinguish neighboring territories[2].

Site Descriptions

For each survey site, surveyors recorded and provided all required information on standardized AGFD and USFWS-approved survey and detection forms. Surveyors recorded the overall vegetation type of the site (native broadleaf, >90% native; mixed native and exotic, 50–90% native; mixed exotic and native, 50–90% exotic; or exotic, >90% exotic); management authority, entity, or owner of survey site; length of area surveyed; 2–3 predominant trees/shrubs; average canopy height; whether the site contained surface water or saturated soil; and, if the site contained no surface water, distance to surface water. The surveyor also recorded any major hydrological changes across visits. Site descriptions included a detailed narrative description of the site and surrounding areas.

Interim Survey Updates

At the end of each of the three survey periods, we submitted typewritten reports summarizing all field and post-field activities to Reclamation. These reports were in the form of an e-mail field update and summarized flycatcher detections, residency, and breeding data by site, as well as reporting notable bird sightings and any issues or concerns (e.g., loss of sites due to fire).

[1] This definition for "migrant" could also include resident floaters (non-territorial adults) or adults that are later detected as residents in the study area at a different location after they settle at a site.

[2] This definition for "unknown" could also include resident floaters or territorial flycatchers detected outside the bounds of their known territory.

Survey Data

All survey data were recorded on standardized AGFD and USFWS approved survey and detection forms (Appendix A). Site names remained consistent with those used during previous years of the study, and all sites were geographically defined using start and stop UTM coordinates and previously used site codes and names. Copies of completed survey and detection forms were submitted to USFWS and AGFD.

NEST MONITORING

Nest Monitoring Technique

Once a territorial flycatcher was detected as part of surveys, territory and nest monitoring commenced following methods described by Rourke et al. (1999) and Martin et al. (1997). In general, territories consisting only of a lone male were monitored every 4 days, whereas territories consisting of pairs were monitored every 2–8 days, depending on nest stage. Nests were located primarily by observing adult flycatchers return to a nest or by systematically searching suspected nest sites. During incubation and after hatching, nest contents were observed directly using a telescoping mirror pole to determine nest contents and transition dates. Nest monitoring during nest building and egg laying stages was limited to reduce the chance of abandonment during these periods. To reduce the risk of depredation (Martin et al. 1997), brood parasitism by the Brown-headed Cowbird, and premature fledging of young (Rourke et al. 1999), we observed nests from a distance with binoculars once the number and age of nestlings were confirmed. Nests too high to be monitored with a mirror pole were observed with binoculars, and adult behavior, along with observation of any young in the nest, were used to determine nest stage. If no activity was observed at a previously occupied nest, the nest was checked directly to determine nest contents and cause of failure. If no activity was observed at a nest close to or on the estimated fledge date, we conducted a systematic search of the area to locate possible fledglings.

A nest was considered successful if any of four conditions were documented: 1) one or more young were visually confirmed fledging from the nest or located near the nest; 2) adults were seen feeding fledglings; 3) parents behaved as if dependent young were nearby (feeding trips, defensive behavior, and/or adults agitated [*whitting* consistently]) when the nest was empty; or 4) nestlings were observed in the nest within two days of the estimated fledge date, with nestlings 10 days of age indicative of nest success (Rourke et al. 1999). Condition four was not upheld if subsequent visits to the territory provided evidence that fledging did not occur.

A nest was considered failed if any of six outcomes were documented: 1) depredated: the nest was found empty or destroyed more than 2 days prior to the estimated fledge date; 2) parasitized: the nest fledged no flycatcher young but contained cowbird eggs or young; 3) deserted: the nest was deserted with eggs remaining; 4) abandoned: the nest was abandoned prior to documented egg laying; 5) weather: the nest was destroyed, eggs addled, or nestlings dead due to storm, flooding, fire, or heat exposure; or 6) infertile: the entire clutch was incubated unsuccessfully for more than 20 days. An “unknown outcome” was designated if success or failure could not be determined. All failed nests were inspected to determine the condition of the nest and to record the presence of eggs, eggshells, or dead nestlings in or around the nest. These data were used to aide in determining the stage and cause of nest failure.

Mayfield nest success (Mayfield 1961, 1975) was calculated for the study area. Exposure days were determined using the midpoint method for failed and successful nests and the last active date for nests of unknown fate, because this method has been demonstrated to provide the least biased Mayfield estimate (Manolis et al. 2000).

Nest Monitoring Data

All nest monitoring data were recorded on standardized data sheets (territory/nest record forms; Appendix A) approved by AGFD. Site names remained consistent with those used during previous years of the study, and all nest locations were recorded using UTM coordinates. Copies of the territory/nest record forms were submitted to USFWS and AGFD.

DOCUMENTATION OF REGENERATION AND LOSS OF FLYCATCHER HABITAT

For several years, documentation of the regeneration and loss of flycatcher habitat within the project area has been documented (see Graber et al. 2007, Weddle et al. 2007, Graber and Koronkiewicz 2009). We followed up on these topics, highlighting the response of flycatchers to habitat change within the project area. Specifically, we described regeneration of habitat at Kearny (following a fire in 2004) and sites between GRN004 and the Kelvin Bridge (following a flooding event in 2006). We also documented habitat regeneration associated with the continued presence of water in the project area since 2004 (e.g., Dripping Springs Wash and Campground). In 2008, we implemented photo points at a subset of known flycatcher breeding sites to further examine future losses and regeneration of habitat and corresponding fluctuations in flycatcher numbers. In 2009, we continued this effort (see Appendix I enclosed on CD).

HYDROLOGICAL CHARACTERISTICS

Per the methods of Weddle et al. (2007), we evaluated the influence of variation in streamflow on the abundance of flycatchers in the Gila River study area. This enabled comparisons of hydrological and flycatcher occupancy data from previous years of study (1998–2008) within the study area with 2009 data. We performed a series of linear regressions on the number of flycatcher territories per breeding season as related to Gila River streamflow from 1998 to 2009.

Condition of habitat at the time of flycatcher settlement (late April to early June) is likely an important determining factor of flycatcher occupancy at sites. The Arizona Sonoran Desert experiences a bimodal rainfall pattern defined as a light winter and spring rainfall, a dry early summer, and heavy rainfall from July to September (Brown and Li 1996, Adams 1997, Xu et al. 2004, Diem and Brown 2006); at least 50% of this region's annual precipitation occurs between July and September (Adams 1997). Surface and ground-water availability (influenced by rainfall and dam discharge) have been found to positively affect woody and herbaceous species richness and cover on the San Pedro River near its confluence with the Gila River (Lite et al. 2005). We concur with Weddle et al. (2007) that there could be cumulative improvement of riparian habitat along the Gila River with increased streamflow prior to flycatcher settlement that could make the habitat more appealing to flycatchers and increase occupancy. However, the exact time period of increased streamflow that is important for the development and persistence of suitable flycatcher habitat is unknown. Therefore, we performed regressions on streamflow over a variety of time periods:

a. Annual streamflow (May of the previous year through April);

b. Beginning of previous monsoon season to the beginning of the flycatcher breeding season (July of the previous year through April);

c. Breeding season streamflow (April–August); and

d. Winter and spring streamflow (December–March).

We used mean monthly Gila River streamflow data collected at U.S. Geological Survey gauging stations located upstream (Gauging Station #09469500, Gila River Below Coolidge Dam; USGS 2009) and downstream (Gauging Station #09474000, Gila River at Kelvin; USGS 2009) of breeding flycatchers. When mean monthly data was not available, we calculated monthly means using daily data provided on the USGS site. Monthly streamflow data collected at the two gauging stations were averaged and used to calculate the sums used in the linear regressions based on the above delineations of time (Appendix B).

RESULTS

SURVEYS, DETECTIONS, AND DISTRIBUTION

From 15 May to 18 August 2009, we spent 250 hours surveying 52 sites covering approximately 94 linear km of riparian habitat. We detected 183 resident flycatchers occupying 96 territories (93 pairs) at 21 sites (Table 1; Appendix C). Resident flycatchers were detected for the first time at GRS025. Among sites that were surveyed in both 2008 and 2009, there were three sites that had at least one resident flycatcher in 2008, but no residents in 2009 (North Butte, GRS013, and GRN011), and seven sites that had at least one resident flycatcher in 2009, but no residents in 2008 (GRS025, GRS016, GRS012, GRN010, GRS009, GRS005, and GRN004). We documented cowbirds at each of the 52 survey sites. We detected migrant flycatchers at 12 sites: Kearny, GRS014, GRN014, GRS013, GRS012, GRN010, GRS010, GRN009, GRN008, GRS006, GRN004, and Dripping Springs Campground (Appendix C). Nine of the 12 sites where migrant flycatchers were detected also supported breeding flycatchers (Kearny, GRS014, GRS012, GRN010, GRS010, GRN009, GRN008, GRN004, and Dripping Springs Campground). There were six flycatchers of unknown status documented at four sites: GRN018, GRN013, GRN008, and Dripping Springs Wash.

NEST MONITORING

We documented 133 nesting attempts at 20 sites (Table 2; Appendix C); 70 nests were found in building stage, 11 in laying stage, 31 in incubation stage, 14 in nestling stage, two after fledging, and five with stage unknown. Of the 133 nesting attempts, 121 nests were documented containing flycatcher eggs or nestlings and were used in calculating nest success and productivity. For nests where complete clutches could be confirmed (112), mean flycatcher clutch size was 2.74 eggs. The earliest observed occurrence of egg laying was on 23 May at Dripping Springs Campground, followed by the first hatching event on 6 June and first fledging event on 19 June at the same nest. The last documented fledging event occurred on 15 August at GRN004. There were 3 nests still active on the last day of monitoring (18 August)—each containing nestlings.

Table 1. Willow Flycatcher Survey Effort, Detections, and Nesting Attempts at the Gila River Study Area, 2009

Survey hours	250
Sites surveyed	52
Linear km of habitat covered	94
Sites with resident willow flycatchers	21
Sites with documented pairs	20
Sites with documented breeding	20
Resident willow flycatchers	183
Territories	96
Pairs	93
Nesting attempts	133
Sites with cowbirds detected	52
Breeding sites with cowbirds detected	20

Table 2. Results of Nesting Attempts at the Gila River Study Area, 2009[3]

Site	Pairs	Nests	Successful Nests	Failed Nests	Unknown Outcome[4]
GRS025	1	1	1	0	0
GRN018	2	2	2	0	0
GRS018	4	8	3	4	1
GRS016	1	1	1	0	0
Kearny	3	4	2	2	0
GRS014	1	1	0	0	1
GRS012	1	1	1	0	0
GRS011	5	7	3	3	1
GRN010	2	3	0	2	1
GRS010	3	4	2	2	0
GRS009	2	3	2	1	0
GRN009[5]	1	2	1	1	0
GRS008	5	7	4	2	1
GRN008	8	14	6	7	1
GRS007	3	3	2	1	0
GRS005	1	1	1	0	0
GRN004[6]	4	6	3	2	1
GRS003	7	10	6	4	0
Dripping Springs Campground	21	32	17	15	0
Dripping Springs Wash	18	23	20	3	0
Total	**93**	**133**	**77**	**49**	**7**

Nest Success

Of the 121 monitored nests, 75 (62%) fledged, 39 (32%) failed, and 7 (6%) had unknown outcomes. We were able to determine exposure days to calculate Mayfield nest survival probability (Mayfield 1961, 1975, Manolis et al. 2000) for 115 of 133 flycatcher nests. We calculated[7] a 66% chance that a flycatcher nest fledged at least one young (Appendix D).

Depredation was the major cause of nest failure, accounting for 82% of all failed nests (Table 3), and predation events occurred almost equally in incubation (45%) and nestling stages (55%). On 29 July, we incidentally observed a California Kingsnake (*Lampropeltis getula californiae*) depredating a nest (82B;

[3] Includes non-monitored nests.

[4] Nests monitored for only a portion of the nesting cycle or insufficient evidence for determining outcome.

[5] A nesting pair assigned to GRS009 (territory 118) placed nests at both GRS009 and GRN009; this pair is not counted under the column for 'Pairs' for GRN009 to avoid double counting.

[6] A nesting pair assigned to GRS003 (territory 53) placed nests at both GRS003 and GRN004; this pair is not counted under the column for 'Pairs' for GRN004 to avoid double counting.

[7] Daily survival probability = 1 – (failed nests/exposure days). Survival probability for nesting period = daily survival probability; nesting period = 28 days (Ellis et al. 2008).

GRN010) containing a Brown-headed Cowbird nestling (estimated at 6 days of age) and a dead flycatcher nestling.[8] Besides this one instance, specific predators were not identified.

Table 3. Causes of Nest Failure at the Gila River Study Area, 2009[9]

Site	Depredated	Deserted[10]	Abandoned[11]	Infertile	Parasitized	Weather	Other[12]
GRS018	1	0	1	0	0	0	2
Kearny	2	0	0	0	0	0	0
GRS011	3	0	0	0	0	0	0
GRN010	1	0	0	0	1	0	0
GRS010	0	0	1	0	1	0	0
GRS009	1	0	0	0	0	0	0
GRN009	1	0	0	0	0	0	0
GRS008	2	0	0	0	0	0	0
GRN008	5	1	0	0	0	0	1
GRS007	1	0	0	0	0	0	0
GRN004	1	0	0	0	0	0	1
GRS003	3	0	1	0	0	0	0
Dripping Springs Campground	8	0	1	1	0	1	4
Dripping Springs Wash	3	0	0	0	0	0	0
Total	**32**	**1**	**4**	**1**	**2**	**1**	**8**

Nest and Female Productivity

We estimated 176 young fledged from 74 of 115 nests used for calculating Mayfield nest survival probability (Appendix D). Average seasonal fecundity (mean fledges per female) was 2.40 and average seasonal productivity (mean fledges per nesting attempt per female) was 2.01.

Among 48 monitored females, we documented 27 (56%) with one nesting attempt, 17 (35%) with two nesting attempts, three (6%) with three nesting attempts, and one (2%) with four nesting attempts. Two females renested in the same nest cup as the first attempt and two females nested in 2008 nest cups. Of the 21 females with renesting attempts, six attempted a double-brood (nesting attempt following a successful nest); two of the six successfully fledged young from both nesting attempts. We documented six females that failed to fledge any young successfully.

Parasitism

Brown-headed cowbird parasitism was low—detected at 5 (4%) of the 121 monitored nests—and was documented for the first time at the Gila River study area since 2004 (Ellis et al. 2008). Parasitism led directly to failure of two flycatcher nests. The fates of the other three parasitized nests were: 1) fledged

[8] Nest was considered failed due to cowbird parasitism prior to the depredation event.

[9] Includes non-monitored nests; monitored nests that failed include the "Depredated", "Deserted", "Infertile", "Parasitized", and "Weather" categories and one nest (GRN004) in the "Other" category.

[10] Nest deserted after egg-laying.

[11] Nest abandoned prior to egg-laying.

[12] Nest failed due to unknown causes or failure cannot be categorized (i.e. unclear if abandoned or depredated).

only flycatcher, 2) depredated, and 3) failed due to other, or unknown, causes. Because one of the three nests was relatively high and egg type (host or cowbird) was difficult to verify, it was unclear if the nest was deserted due to parasitism, failed due to a parasitism event, or if the nest was depredated prior to parasitism. Cowbirds may have contributed to abandonment or desertion of other nests but direct evidence was not found.

HABITAT AND HYDROLOGICAL CHARACTERISTICS

General vegetation characteristics at breeding sites were characterized as mixed native and exotic associations; however, the amount of tamarisk varied within and among sites. Most breeding sites were composed of dense monotypic stands of tamarisk (>90% exotic); however, territories were often situated in areas consisting of mixed native and tamarisk trees (50-90% exotic). Older breeding sites (e.g., GRS007, Kearny, and GRN018) contained mature tamarisk, Goodding's willow, and Fremont cottonwood (50-90% exotic) forming a nearly continuous closed canopy (overstory) while newer breeding sites (e.g., Dripping Springs Wash, Dripping Springs Campground, GRS003, and GRN008) were primarily composed of dense young tamarisk lacking a mature overstory. Although vegetation composition and structure varied, all sites were adjacent to flowing or standing water during the breeding season.

Nesting Substrate Characterization

Nesting substrate was documented for all nesting attempts (133) at the Gila River study area. Tamarisk was the primary nesting substrate documented (124 nests); followed by Goodding's willow (8 nests) and snag (1 nest; tamarisk snag). Mean estimated nest height was 4.4 m.

Streamflow and Number of Flycatcher Territories

All linear regressions showed a positive relationship between Gila River streamflow and the number of flycatcher territories. Streamflow from the beginning of the previous monsoon season to the beginning of the flycatcher breeding season (July–April) had the strongest relationship with the number of territories (R^2 = 0.50, t = 3.14, P = 0.01). July–April streamflow explains 50% of the variation in flycatcher territories from 1998 to 2009. On average, for every additional 100 cubic feet per second (cfs), there was an increase of 1.6 territories.

Annual streamflow (May–April) also had a fairly strong relationship with the number of territories (R^2 = 0.48, t = 3.05, P = 0.01). On average, for every additional 100 cfs, there was an increase of 1.0 territory. Winter and spring streamflow (December–March) had a comparatively weak relationship with the number of territories (R^2 = 0.35, t = 2.32, P = 0.04). On average, for every additional 100 cfs, there was an increase of 0.60 territories. Breeding season streamflow (April–August) had the weakest relationship with the number of territories (R^2 = 0.04, t = 0.669, P = 0.519). On average, for every additional 100 cfs, there was an increase of 0.36 territories.

DISCUSSION

SURVEYS, DETECTIONS, AND DISTRIBUTION

Water exchanges involving the San Carlos Apache Tribe and downstream water users have the potential to decrease releases from Coolidge Dam that would otherwise flow downstream in the Gila River study area. Decreased Gila River streamflow can modify existing and potential flycatcher breeding habitat and therefore has the potential to modify flycatcher abundance, distribution, and nesting success (Graf et al. 2002). From 2002–2004, decreased releases from Coolidge Dam resulted in the Gila River drying by June each year and the number of flycatcher territories declined by nearly half each year (43% decline from 2002 to 2003, 46% decline from 2003 to 2004; Munzer et al. 2005). From 2005–2008, flows within the study area were relatively consistent annually and throughout the flycatcher breeding season[13]. In 2009[14], June–July flows were markedly lower than that of 2005–2008. The number of flycatcher territories doubled from 2004–2005 (14 to 28 territories) and have continued to increase with 39, 62, 63, and 96 territories recorded from 2006–2009, respectively. An overall increase of 82 flycatcher territories (586% increase) has been recorded since 2004 (Appendix E; Weddle et al. 2007, Graber and Koronkiewicz 2009) and this increase may be attributed to higher and more consistent annual flows over that past five years.

We detected more flycatcher territories in 2009 (96) than in any previous year of this study (Appendix E); previous highs were 69, 63, and 62 territories detected in 1999, 2008, and 2007, respectively. In 2009 we detected resident flycatchers at 21 sites, exceeding the previous high of 17 sites occupied in 2008. Comparing sites surveyed in both 2008 and 2009, in 2009 15 sites increased in the number of territories and four sites decreased, albeit only slightly. The largest increases were at Dripping Springs Campground (increased by 10 territories), Dripping Springs Wash, GRS003, and GRN004 (each increased by four territories), while decreases were at GRN011, GRS013, Kearny, and GRN018 (each decreased by one territory). Three sites supported at least one territory in 2008 but none in 2009 (North Butte, GRS013, and GRN011), while seven sites supported at least one territory in 2009 but none in 2008 (GRS025, GRS016, GRS012, GRN010, GRS009, GRS005, and GRN004). Although there are likely multiple environmental and demographic factors related to annual flycatcher distribution and abundance within the study area, three factors stand out that may explain the increase in the number of territories in 2009. Possible explanations include 1) increased flycatcher recruitment related to an exceptionally high number of fledglings produced in 2008 (the highest number recorded in this study prior to 2009), 2) a decrease in suitable flycatcher habitat in nearby locations along the San Pedro River (D. Wolgast, The Nature Conservancy, personal communication) may have facilitated flycatcher immigration into the study area, and 3) continued habitat regeneration within the study area related to consistent and increased flows since 2005.

NEST MONITORING

In 2008, similar to AGFD's nest monitoring effort in 2007, we searched for and monitored nests only as time allowed until 31 July and therefore were unable to determine accurate flycatcher productivity metrics for the breeding season. In 2009, we conducted intensive flycatcher nest searching and monitoring until the end of the flycatcher breeding season, allowing us to determine total number of nesting and re-nesting attempts, nest fate (success or failure), causes of nest failure, brood parasitism rate, Mayfield nest survival

[13] Breeding season (April–July) mean streamflow at the Gila River study area from 2002–2004 was 81 cfs, compared to 590 cfs from 2005–2008 (Appendix B; USGS 2009).

[14] Breeding season (April–July) mean streamflow at the Gila River study area in 2009 was 458 cfs (Appendix B; USGS 2009).

probabilities, seasonal fecundity, and average seasonal productivity. Intensive nest monitoring in 2009 resulted in the recording of 133 flycatcher nesting attempts, the highest number recorded since 1996.

Results of several productivity measures calculated for 2009 are similar to those reported in a 10-year flycatcher study by Ellis et al. (2008): simple nest success, Mayfield nest probability, average seasonal fecundity, renesting and double-brood attempts, and hatching success. Ellis et al. (2008) reported an average 56% simple nest success over 10 years (range 24%–68%). In 2009, simple nest success was 66%. Mayfield nest survival probability over 10 years ranged from 35% to 100% (mean 62%). Mayfield nest probability in 2009 was 66%, similar to the 10-year mean.

Average seasonal fecundity in 2009 was 2.40, slightly higher than the 10-year mean (1.96 ± 0.14 fledges). In 2009, females successfully reared 176 fledglings, the highest number of fledglings documented in this study. In 2009, 42% of monitored females attempted a second nest and 29% of females with a successful first attempt made a double-brood attempt. Ellis et al. (2008) reported 33% of females renested and 21% of females with a successful first attempt made a double-brood attempt. Hatching success for eggs that survived incubation period—an indicator of resource availability—was 87% in 2009; Ellis et al. (2008) reported 86.3% ± 0.08.

For the sixth consecutive year, there was no Brown-headed Cowbird trapping at the Gila River study area. Five nests (4%) in 2009 were documented with cowbird eggs or nestlings; the first time parasitism has been documented since 2004 (Ellis et al. 2008). Parasitism rates at the Gila River study area have always been low (2.8% overall parasitism rate among AGFD study populations; Ellis et al. 2008) relative to other flycatcher populations (e.g., 15%–32% on the Lower Colorado River from 2003–2006; Koronkiewicz et al. 2004, 2006; McLeod et al. 2005, 2007).

HABITAT AND HYDROLOGICAL CHARACTERISTICS

The flycatcher occupies a variety of riparian habitats across its range (Sogge and Marshall 2000, USFWS 2002, 2005). Like the Gila River study area, many occupied sites in Arizona are mixed exotic and native vegetation, with tamarisk stands being the dominant vegetation type. The importance of high quality riparian vegetation for this species has continuously been at the forefront of recovery discussions (USFWS 2002). Diversity in species composition within occupied habitats suggests that flycatchers rely on structure of vegetation as much as, or more than, specific species of vegetation. Recent studies of flycatcher physiology, immunology, site fidelity, productivity, and survivorship suggest native and exotic habitats do not differ in quality for flycatchers (Owen et al. 2005, Sogge et al. 2006, Paxton et al. 2007, McLeod et al. 2008).

The presence of water and/or saturated soil immediately adjacent to and/or under river bank vegetation is likely the primary habitat feature that drives flycatcher colonization and breeding. When flycatchers arrived to the study area in May and early June 2009, river water levels were up relative to previous years, and this may have contributed to the observed population increase (52% increase). “Improved” habitat conditions were especially notable at Dripping Springs Wash where relatively more habitat was inundated in May; this site increased by four territories in 2009. As the season progressed, cooling monsoon rains were mostly suppressed due to a developing El Niño resulting in hot and dry spells. Average streamflow in June–July was markedly lower than that of 2005–2008, and no overbank flooding occurred as in 2006. Due to lack of precipitation we noted desiccation to tamarisk within known territories. Despite lower flows, decreased precipitation, and minor effects to habitat as the season progressed, seasonal indicators of productivity (e.g., hatching success, late season nesting success, renesting attempts) were similar to previous years of this study. June–July flows averaged 413 cfs and were much higher than, for example,

2002 when June–July flows averaged 1 cfs and seasonal indicators of productivity were the lowest recorded for this study.

Sustained flycatcher occupancy within the Gila River study area is largely dependent on continued streamflow. The affinity of breeding flycatchers with standing water and saturated soil is noted consistently in the literature, and presence of water may be a factor in sustaining particular vegetation features at breeding sites (Paradzick 2005) and providing a more suitable microclimate for raising offspring (Sogge and Marshall 2000, McLeod et al. 2008). Moreover, the fluctuating availability of surface water at flycatcher breeding sites is likely the primary factor influencing residency and breeding at a site in any given year, with flycatchers breeding in years when sites contain standing water (Weddle et al. 2007, McLeod et al. 2008).

Similar to previous years, we found that the streamflow from the beginning of the previous monsoon season through the beginning of the flycatcher breeding season (July–April) explained the most variability (50%) in the number of flycatcher territories from the following breeding season (an increase of 1.6 flycatchers per 100 cfs). We concur with Weddle et al. (2007) that there is a cumulative effect of increased streamflow during the approximately 10 months prior to flycatcher settlement. Although breeding season streamflow (April–August) had the weakest relationship in the number of territories as related to streamflow, this result is likely a function as to how annual streamflow was categorized. It is likely that adequate streamflow during the flycatcher breeding season is also important to breeding flycatchers, but flycatcher responses may only be apparent once certain low streamflow thresholds are reached. It is important to note that the variability in the number of flycatcher territories as related to streamflow in this analysis explains only the variability in the number of flycatcher territories per time period and streamflow ranges analyzed. Although it can be theorized that a significant increase in July–April streamflow would likely result in more flycatcher territories, quantifiable predictions are difficult and highly contingent on multiple environmental and demographic factors.

Presence of ground and surface water (using streamflow as a relative indicator at the Gila River study area) may also influence factors such as food abundance and riparian microclimate conditions (Reitan and Thingstad 1999). Flycatchers typically complete their first nesting attempt in early July (Ellis et al. 2008); therefore, monsoon rains and the subsequent increase in streamflow and prey abundance are more likely to have an immediate positive effect on fledgling survival and second nesting attempt success. Increased streamflow annually will have a long-term positive effect by encouraging suitable habitat to develop and support pre-existing habitat adjacent to the river, which may encourage immigration and support more flycatchers. Other variables such as rainfall, food abundance, and breeding success, may interact and contribute to the number of flycatcher territories each year. Paxton et al. (2007) found habitat type (native, exotic, or mixed) in which flycatchers breed along the San Pedro and Gila Rivers does not appear to influence adult survivorship. However, Paxton et al. (2007) did find the breeding status of an individual did, with successful breeders having higher survivorship than non-successful breeders, unpaired individuals, and those of unknown status. Sedgwick (2004) found that willow flycatchers maintain a higher rate of site and territory fidelity when they have greater breeding success, which may be directly (e.g., food abundance) or indirectly (e.g., vegetation and habitat quality) affected by increased streamflow and/or moisture availability.

Riparian habitat improvement has been apparent at several sites primarily composed of younger tamarisk (characterized with a canopy height of approximately 3–5 m): GRS011, GRS008, GRN008, GRN004, GRS003, Dripping Springs Wash, and Dripping Springs Campground. Flycatcher territories at these sites have increased from a combined 0 flycatcher territories in 2004 to 68 flycatcher territories in 2009; flycatcher territories increased at each of these sites from 2008–2009. Dripping Springs Wash and Dripping Springs Campground have shown the greatest increase in flycatcher territories since increased and constant streamflow has been restored. These sites are the only sites upstream of Gila River's confluence with the San Pedro River and are, therefore, the areas likely experiencing the greatest benefits

from increased discharges from Coolidge Dam. This could explain the noticeable improvement in habitat at these sites and the larger increase in flycatcher occupancy compared to smaller, more widely distributed increases at other sites in the study area.

Occupied sites within the Gila River study area consisted primarily of tamarisk (50–90% or >90% exotic) with tamarisk being the most common nesting substrate. Young tamarisk used by flycatchers was either inundated with 0.35–1.0 m of flowing water or was associated with saturated soil during at least part of the 2009 season. Many flycatcher territories in young tamarisk were on small islands within the river and several nests were placed in trees overhanging the river. Young tamarisk was primarily found within the floodplain with the only associated overstory occurring on steep eroded banks abutting the floodplain. Occupied mature tamarisk stands were associated with steep eroded banks adjacent to the river with an understory of dying tamarisk. These sites (e.g., Kearny, GRN018, GRS018, GRS013) all supported the same or fewer territories in 2009 compared to 2008. Average canopy height varied among sites, with the densest canopy layer varying between 4 m and 9 m. The range of nest heights (1.5–10 m; average 4.4 m) reflects the diversity of canopy and understory structure among sites.

The importance of continued monitoring along the Gila River was demonstrated this year as previously unoccupied areas became occupied and the largest number of resident territories and young produced were documented. Continued monitoring effort will assist in assessing further flycatcher response to variable annual and seasonal streamflow on the Gila River. Flycatcher habitat historically scours out and regenerates frequently (USFWS 2002). As several sites at the Gila River study area have demonstrated, unsuitable habitat may become suitable within a few years with an increase of streamflow. Habitat at sites now occupied by flycatchers were considered unsuitable as recently as 2004. If streamflow continues to be favorable on the Gila River, future surveys may document flycatchers returning to previously occupied or new sites as habitat develops.

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APPENDIX A

2009 Field Data Forms

Willow Flycatcher Survey and Detection Form (revised April, 2004)

Site Name_____ State_____ County _____
USGS Quad Name _____ Elevation _____ feet / meters (circle one)

Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ☐ *Yes* ☐ *No*

Site Coordinates: Start: N_____ E_____ UTM Datum _____(NAD27 preferred)
Stop: N_____ E_____ UTM Zone _____

***** Fill in additional site information on back of this page *****

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found ? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign, If Yes, Describe Y or N	Comments about this survey (e.g., bird behavior, evidence of pairs or breeding, number of nests, nest contents or number of fledges seen; potential threats)
1_____	Date Start Stop Total hrs ____							
2_____	Date Start Stop Total hrs ____							
3_____	Date Start Stop Total hrs ____							
4_____	Date Start Stop Total hrs ____							
5_____	Date Start Stop Total hrs ____							

Overall Site Summary (Total **resident** WIFLs only) Total survey hrs_____	Adults	Pairs	Territories	Nests	Were any WIFLs color-banded? Yes No If yes, report color combination(s) in the comments section on back of form

Reporting Individual _____ Date Report Completed _____
US Fish and Wildlife Service Permit #_____ AZ Game and Fish Department (or other state) Permit # _____

Submit original form by August 1st. Retain a copy for your records.

Fill in the following information completely. <u>Submit original</u> form by August 1st. Retain a copy for your records.

Reporting Individual _____ Phone # _____
Affiliation _____ E-mail _____
Site Name _____ Date Report Completed _____

Did you verify that this site name is consistent with that used in previous years? Yes / No (circle one)
If name is different, what name(s) was used in the past? _____
If site was surveyed last year, did you survey the same general area this year? Yes / No If no, summarize in comments below.
Did you survey the same general area during each visit to this site this year? Yes / No If no, summarize in comments below.

Management Authority for Survey Area (circle one): Federal Municipal/County State Tribal Private
Name of Management Entity or Owner (e.g., Tonto National Forest) _____

Length of area surveyed: _____ (specify units, e.g., miles = mi, kilometers = km, meters = m)

Vegetation Characteristics: Overall, are the species in tree/shrub layer at this site comprised predominantly of (check one):

☐ Native broadleaf plants (entirely or almost entirely, includes high-elevation willow)

☐ Mixed native and exotic plants (mostly native)

☐ Mixed native and exotic plants (mostly exotic)

☐ Exotic/introduced plants (entirely or almost entirely)

Identify the 2-3 predominant tree/shrub species: _____

Average height of canopy (Do not put a range): _____ (specify units)

Was surface water or saturated soil present at or adjacent to site? Yes / No (circle one)
Distance from the site to surface water or saturated soil: _____ (specify units)

Did hydrological conditions change significantly among visits (did the site flood or dry out)? Yes / No (circle one)
If yes, describe in comments section below.

Remember to attach a copy of a USGS quad/topographical map (REQUIRED) of the survey area, outlining the survey site and location of WIFL detections. Also include a sketch or aerial photograph showing details of site location, patch shape, survey route in relation to patch, and location of any willow flycatchers or willow flycatcher nests detected. Such sketches or photographs are welcomed, but DO NOT substitute for the required USGS quad map. Please include photos of the interior of the patch, exterior of the patch, and overall site and describe any unique habitat features.

Comments (attach additional sheets if necessary)

_____
_____
_____
_____
_____
_____
_____

WIFL Detection Locations:

Date Detected	N UTM	E UTM	Date Detected	N UTM	E UTM

Willow Flycatcher Nest Record Form (2008)

Nest ID:_____

Substrate/Height:_____

Nest Found: _____

First Egg:_____

Clutch Completion:_____

Hatching:_____

Fledged or Failed:_____

Outcome:_____

	Presumed	Confirmed
Eggs		
Nestlings		
Fledglings		

Date	Contents (# eggs/nestlings)	Exposure Days
Total Exposure Days		

Outcome codes:
UN= unknown; **FY**= fledged young, with at least one young seen leaving or in the vicinity of nest; **FP**= fledged young, as determined by parents behaving as if dependent fledgling(s) nearby; **FU**= suspected fledging of at least one young; **FC**= fledged at least one host young with cowbird parasitism; **FD**= Nest partially depredated with confirmed fledging of at least one young; **PO**= predation observed; **PE**= probable predation, nest empty and intact; **PD**= probable predation, damage to nest structure; **PC**= probable predation by cowbird; **AB**= nest abandoned prior to egg(s) being laid; **DC**= deserted with egg(s) or young due directly to cowbird **DE**= deserted with egg(s) or young; **AC**= nest abandoned due to cowbird; **CO**= failure due to cowbird, host attempted to raise cowbird young. No host young were fledged from the nest; **WE**= failure due to weather; **HA**= failure due to human activities; **IN**= failure, entire clutch infertile; **OT**= failure due to other, or unknown, causes.

WILLOW FLYCATCHER TERRITORY & NEST MONITORING CARD

Monitored / Non-monitored

Site Name:____________________**Territory/Nest no:**______________

Official Confirmed Band Combo

(To be filled out by Supervisor)

MP / VP UTM's:_______________E/____________________N

♂combo:__________ to ⊗:_____

Est. HD:______ **Est. FD:**______ **⊗Tree Flagged(Date/Obs):**______________

♀combo:__________ to ⊗:_____

Date	Time In	Time Out	Observer	Mon Type (O/M/V)	Stage	# Adult pres	# WF Egg	# CB Egg	# WF Nstl	# CB Nstl	# WF Fldg	Age of Young (WN Description in Comments)	Estimated Height of Inundated nest (m)	Field Tasks
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														

Exact written description on OP flag	Estimated tree height from water (m).

Draw the nest tree (include tree species)

Site Name:____________________ **Territory/Nest no:**________ **Monitored / Non-monitored**

Directions and map to the territory

Date	Time In	Time Out	Observer	Mon Type (O/M/V)	Stage	# Adult pres	# WF Egg	# CB Egg	# WF Nstl	# CB Nstl	# WF Fldg	Age of Young (WN Description in Comments)	Estimated Height of Inundated nest (m)	Field Tasks
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														
Behaviors & Comments:														

Date: Date checked. **Time:** The time in and out of the terr. **Obs:** Observers initials. **Mon Type:** M = mirrored; V = video camera; O = observation with binoculars. **Stage:** $*$ = Single Male, Δ = Pair, B-# = building-number of days completed; L = egg laying; I = incubating; N = nestling, F = fledgling, NA = No activity. **#Adult pres:** Number of adults present in territory. **#WF Egg:** Number of willow flycatcher eggs. **#CB Egg:** Number of cowbird eggs. **#WF Nstl:** Number of willow flycatcher nestlings. **#CB Nstl:** Number of cowbird nestlings. **Age Yng:** Visual estimate of willow flycatcher nestling age; estimate age in days and write a description in comments (DO NOT just add days on to age at last visit). **Comments (mandatory):** Record any additional info used to determine the stage and/or activity of the nest (e.g. evidence of predation, description of nestlings, feeding of fledglings, etc.). **Field Tasks:** RSM = Resight male, RSF = Resight female, RSB = Resight both, CP = Confirm pair, LN = Locate nest/renest, CI = Confirm Incubation, MP = Mirror pole nest, VP = Video pole nest, MP/VP if I = Mirror/Video Pole Nest if incubating, ON = observe nest, CA = confirm activity or stage, VN# = Verify nestling number, VF# = Verify fledgling number.
Chronology: Nest Building ~ 7 d. - Egg laying ~ 4 d. - Incubation ~ 12 d. - Nestling ~ 12 d.

Appendix B

Table of the Mean Monthly Streamflow at the Gila River Study Area

Table B.1. Mean Monthly Streamflow (cfs) at the Gila River Study Area, Arizona, 1997–2009

Year	Territories	Mean Monthly Streamflow (cfs)[a]											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	33	166	248	677	521	538	672	816	542	83	147	7	165
1998	48	110	208	493	441	610	699	852	923	443	153	44	320
1999	69	90	172	367	166	253	5	100	373	130	72	6	154
2000	52	81	144	278	340	118	8	5	70	22	190	80	216
2001	40	54	154	411	494	540	635	725	481	246	205	5	245
2002	46	107	138	243	25	14	1	1	52	56	103	8	108
2003	26	68	166	338	217	87	6	51	37	4	0	1	55
2004	14	85	141	297	382	230	3	6	110	84	37	11	122
2005	28	208	374	382	609	535	695	818	618	500	226	7	289
2006	39	177	234	224	403	479	480	650	722	351	236	11	294
2007	64	194	194	418	487	542	662	706	467	195	134	8	138
2008	62	334	240	548	666	511	569	629	411	241	236	1	218
2009	96	164	230	491	550	587	371	454	560	–	–	–	–

[a]Mean monthly streamflow calculated by averaging mean monthly streamflow recorded at two U.S. Geological Survey gauging stations: #09469500 (Gila River Below Coolidge Dam; USGS 2009) and #09474000 (Gila River at Kelvin; USGS 2009). Per USGS, mean monthly streamflow for October 2008 to August 2009 are preliminary (i.e., are provisional data and are subject to revision) at the time of the publication of this report.

APPENDIX C

Willow Flycatcher Survey Results by Site in the Gila River Study Area

Table C.1. Willow Flycatcher Survey Results by Site in the Gila River Study Area, Arizona, 2009

Site name County, Elevation (m), Survey Hours	Individual Surveys		Site Summary						
	Survey Date	WIFL[a]	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL[b]	Migrant WIFL[c]	BHCO Present[d]
South Butte [e, f, i] Pinal, 485, 1.98	6/12/2009	0	0	0	0	0	0	0	Y
North Butte [e, f, i] Pinal, 491, 1.76	6/12/2009	0	0	0	0	0	0	0	Y
GRN033 [e, f, i] Pinal, 494, 0.96	6/12/2009	0	0	0	0	0	0	0	Y
Donnelly Wash [e, f, i] Pinal, 495, 0.46	6/12/2009	0	0	0	0	0	0	0	Y
GRS032 [e, f, i] Pinal, 494, 0.66	6/12/2009	0	0	0	0	0	0	0	Y
GRSN031[e, f, i] Pinal, 506, 2.30	6/11/2009	0	0	0	0	0	0	0	Y
GRSN030 [e, f, i] Pinal, 506, 1.60	6/11/2009	0	0	0	0	0	0	0	Y
GRN029 [e, f, i] Pinal, 515, 1.00	6/11/2009	0	0	0	0	0	0	0	Y
GRN028 [e, f, i] Pinal, 518, 0.63	6/11/2009	0	0	0	0	0	0	0	Y
GRN027 [e, f, i] Pinal, 521, 1.00	6/11/2009	0	0	0	0	0	0	0	Y
GRSN026 [e, f, i] Pinal, 536, 1.00	6/11/2009	0	0	0	0	0	0	0	Y
GRS025 [e, f, g, i] Pinal, 536, 1.80	6/11/2009	1	2	1	1	1[g]	0	0	Y
GRSN023 [e, f, i] Pinal, 536, 1.20	6/11/2009	0	0	0	0	0	0	0	Y
GRSN022 [e, f, i] Pinal, 540, 0.12	6/11/2009	0	0	0	0	0	0	0	Y
GRS020 [e, f] Pinal, 543, 2.64	5/18/2009 6/3/2009 6/25/2009	0 0 0 0	0	0	0	0	0	0	Y
GRN020 [e, f] Pinal, 549, 0.83	5/18/2009 6/3/2009 6/25/2009	0 0 0	0	0	0	0	0	0	Y
GRS019 [e, f] Pinal, 555, 2.33	5/18/2009 6/3/2009 6/25/2009	0 0 0	0	0	0	0	0	0	Y
GRN019 [e, f] Pinal, 549, 0.51	5/18/2009 6/3/2009 6/25/2009	0 0 0	0	0	0	0	0	0	Y
GRN018 [e, f] Pinal, 561, 7.10	Monitored 5/09 to 8/09	N/A	4	2	2	2	1	0	Y
GRS018 [e, f, h] Pinal, 543, 4.48	Monitored 5/09 to 8/09	N/A	7	4	4	8	0	0	Y
GRS016 [e, f] Pinal, 549, 4.07	Monitored 5/09 to 8/09	N/A	2	1	1	1	0	0	Y

Table C.1. Willow Flycatcher Survey Results by Site in the Gila River Study Area, Arizona, 2009 (Continued)

Site name County, Elevation (m), Survey Hours	Individual Surveys		Site Summary						
	Survey Date	WIFL[a]	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL[b]	Migrant WIFL[c]	BHCO Present[d]
GRS015 [e, f] Pinal, 555, 4.98	5/19/2009 6/2/2009 6/13/2009 6/26/2009	0 0 0 0	0	0	0	0	0	0	Y
GRN015 [e, f] Pinal, 550, 1.59	5/19/2009 6/2/2009 6/13/2009 6/26/2009	0 0 0 0	0	0	0	0	0	0	Y
Kearny [f] Pinal, 555, 6.30	Monitored 5/09 to 8/09	N/A	6	3	3	4	0	1	Y
GRS014 [e, f] Pinal, 555, 3.99	Monitored 5/09 to 8/09	N/A	2	1	1	1	0	1	Y
GRN014 [e, f] Pinal, 558, 2.64	Monitored 6/09 to 7/09	N/A	0	0	0	0	0	1	Y
GRN013 [e, f] Pinal, 558, 2.98	Monitored 6/09 to 8/09	N/A	0	0	0	0	1	0	Y
GRS013 [e, f] Pinal, 558, 3.96	Monitored 6/09 to 8/09	N/A	0	0	0	0	0	2	Y
GRN012 [e, f] Pinal, 579, 4.08	5/19/2009 6/2/2009 6/13/2009 6/26/2009	0 0 0 0	0	0	0	0	0	0	Y
GRS012 [f] Pinal, 555, 2.86	Monitored 6/09 to 8/09	N/A	2	1	1	1	0	1	Y
GRN011 [e, f] Pinal, 579, 1.58	5/15/2009 6/2/2009 6/17/2009 6/26/2009	0 0 0 0	0	0	0	0	0	0	Y
GRS011 [e, f] Pinal, 561, 4.65	Monitored 5/09 to 8/09	N/A	10	5	5	7	0	0	Y
GRN010 [e, f, h] Pinal, 573, 3.82	Monitored 6/09 to 8/09	N/A	3	2	2	3	0	1	Y
GRS010 [e, f] Pinal, 561, 8.05	Monitored 5/09 to 8/09	N/A	6	3	3	4	0	1	Y
GRS009 [e, f] Pinal, 567, 4.52	Monitored 6/09 to 8/09	N/A	4	2	2	3	0	0	Y
GRN009 [e, f, h] Pinal, 579, 5.41	Monitored 5/09 to 8/09	N/A	4	3	1	2	0	1	Y
GRS008 [e, f] Pinal, 567, 17.23	Monitored 5/09 to 8/09	N/A	10	5	5	7	0	0	Y
GRN008 [f, h] Pinal, 579, 17.16	Monitored 5/09 to 8/09	N/A	15	8	8	14	1	2	Y
GRS007 [f] Pinal, 573, 25.41	Monitored 5/09 to 8/09	N/A	6	3	3	3	0	0	Y
GRN007 [e, f] Pinal, 579, 1.89	5/20/2009 6/10/2009 6/27/2009	0 0 0	0	0	0	0	0	0	Y
GRS006 [e, f] Pinal, 567, 0.35	Monitored 5/09 to 7/09	N/A	0	0	0	0	0	1	Y

Table C.1. Willow Flycatcher Survey Results by Site in the Gila River Study Area, Arizona, 2009 (Continued)

Site name County, Elevation (m), Survey Hours	Individual Surveys		Site Summary						
	Survey Date	WIFL[a]	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL[b]	Migrant WIFL[c]	BHCO Present[d]
GRS005 [e, f, g] Pinal, 567, 0.56	5/20/2009 6/10/2009 6/27/2009	0 0 0	2	1	1	1[g]	0	0	Y
GRN005 [e, f] Pinal, 579, 2.04	Monitored 5/09 to 8/09	N/A	1	1	0	0	0	0	Y
GRS004 [e, f] Pinal, 600, 1.57	5/20/2009 6/2/2009 6/10/2009 6/27/2009	0 0 0 0	0	0	0	0	0	0	Y
GRN004 [e, f] Pinal, 585, 6.10	Monitored 5/09 to 8/09	N/A	8	4	4	6	0	1	Y
GRS003 [e, f] Pinal, 585, 15.12	Monitored 5/09 to 8/09	N/A	14	7	7	10	0	0	Y
GRN003 [e, f] Pinal, 585, 1.03	5/20/2009 6/2/2009 6/10/2009 6/27/2009	0 0 0 0	0	0	0	0	0	0	Y
GRN002 [e, f] Pinal, 585, 0.97	5/20/2009 6/2/2009 6/10/2009 6/27/2009	0 0 0 0	0	0	0	0	0	0	Y
GRS002 [e, f] Pinal, 585, 1.75	5/20/2009 6/2/2009 6/10/2009 6/27/2009	0 0 0 0	0	0	0	0	0	0	Y
GRS001 [e, i] Pinal, 585, 0.45	5/20/2009	0	0	0	0	0	0	0	Y
Dripping Springs Campground [e, h] Pinal, 610, 32.70	Monitored 5/09 to 8/09	N/A	41	21	21	32	0	2	Y
Dripping Springs Wash [e, g, h] Gila, 621, 25.38	Monitored 5/09 to 8/09	N/A	34	18	18	23	3	0	Y
Total	**–**	**–**	**183**	**96**	**93**	**133**	**6**	**15**	**–**

[a] WIFL = adult willow flycatcher (*Empidonax trailii extimus*).

[b] Estimated number of willow flycatchers that could not be classified as resident or migrant due to brief appearance at the site during the breeding season, lack of survey data, or confusion with distinguishing neighboring territories.

[c] Maximum number of migrant willow flycatchers detected during any single survey event.

[d] BHCO = brown-headed cowbirds (*Molothrus ater*).

[e] Surveys were conducted by kayak only.

[f] Survey hours estimated because site was part of a multiple-site kayak survey.

[g] Total nest number includes one instance where fledglings were found and confirmed to a territory but no actual nest was found before fledglings were discovered.

[h] Number of territories + number of pairs does not equal number of residents due to polygyny (one male associated with two females).

[i] Survey did not meet 3-survey period USFWS protocol guidelines due to 'unsuitable habitat' determination or accessibility constraints.

APPENDIX D

Willow Flycatcher Nest Success and Productivity of Monitored Nests at the Gila River Study Area

Table D.1. Willow Flycatcher Nest Success and Productivity of Monitored Nests at the Gila River Study Area, Arizona, 1996–2009

Year	Mayfield nest success, % (exposure days)	Number of young fledged	Mean number of young fledged per nest (*n*)[a]	Mean number of young fledged per successful nest (*n*)
1996	100 (20)	2	2.00 (1)	2.00 (1)
1997	71 (163)	16	1.60 (10)	2.00 (8)
1998	61 (1096)	75	1.39 (54)	2.27(33)
1999	48 (777)	41	1.08 (38)	2.41 (17)
2000	70 (620)	42	1.62 (26)	2.33 (18)
2001	52 (1134)	74	1.32 (56)	2.47 (30)
2002	35 (404)	19	0.83 (23)	2.38 (8)
2003	70 (394)	40	2.00 (20)	2.86 (14)
2004	35 (214)	13	1.00 (13)	2.60 (5)
2005	77 (654)	57	1.90 (30)	2.71 (21)
2006	53 (709)	52	1.27 (41)	2.36 (22)
2007	72 (838)	82	1.86 (44)	2.73 (30)
2008[15]	67 (1576)	90	1.08 (83)	2.31 (38)
2009	66 (2337)	176	1.53 (115)	2.38 (74)

[a] n = number of nests used for calculating Mayfield (Mayfield 1961, 1975) nest survival estimates including nests with unknown outcome

[15] Productivity estimates should not be directly compared because nests (25) were still active when field studies ended.

APPENDIX E

Willow Flycatcher Survey Results for the Gila River Study Area

Table E.1. Willow Flycatcher Survey Results for the Gila River Study Area, Arizona, 1996–2009

Year	No. Sites Surveyed	Survey Hours	Residents[a]	Territories	Pairs	Nests
1996	15	126	13	10	3	4
1997	48	715	63	33	30	26
1998	42	575	94	48	46	71
1999	34	544	119	69	58	94
2000	37	578	97	52	48	69
2001	21	83	77	40	40	63
2002	24	120	88	46	43	45
2003	18	134	49	26	23	24
2004	15	106	26	14	12	14
2005	15	142	54	28	26	34
2006	22	148	73	39	34	54
2007	22	149	119	62	57	54
2008	52	176	120	63	60	95
2009	52	250	183	96	93	133

[a] Number of territories + number of pairs may not equal total number of residents due to polygynous males and non-territorial floaters.

APPENDIX F

Willow Flycatcher Territories by Site within the Gila River Study Area

Table F.1. Willow Flycatcher Territories by Site[a] within the Gila River Study Area

Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
North Butte[b, c]	--	0	0	0	0	--	--	--	--	--	0	--	1	0
GRN033[b, c]	1	0	0	0	0	--	--	--	--	--	0	--	0	0
GRSN031[b, c]	1	0	0	--	--	--	--	--	--	--	0	--	0	0
GRS025[b]	0	0	0	--	--	--	--	--	--	--	0	--	0	1
GRN020[b, c]	2	2	2	5	0	0	0	0	0	0	1	0	0	0
GRS018[b]	--	1	1	4	4	2	7	4	2	9	7	6	4	4
GRN018[b]	--	2	2	5	4	9	7	5	3	6	5	6	3	2
GRS016[b]	--	0	--	--	--	--	--	1	0	1	1	2	0	1
GRN015[b, c]	--	--	--	--	1	0	0	0	--	--	--	--	0	0
GRS015[b, c]	--	1	1	1	1	0	0	0	--	--	--	--	0	0
Kearny	6	8	25	23	19	14	14	9	5	3	5	4	4	3
GRS014[b, c]	--	0	0	0	0	0	0	--	--	--	0	0	1	1
GRS013[b, c]	--	1	0	0	0	0	0	0	--	--	--	--	1	0
GRS012[b]	--	4	6	8	7	5	3	1	0	0	0	0	0	1
GRN011[b, c]	--	2	0	0	0	--	--	--	--	--	--	--	1	0
GRS011[b]	--	0	0	1	2	1	1	0	0	0	0	1	3	5
GRN010[b]	--	5	4	4	2	1	1	0	0	0	0	0	0	2
GRS010[b]	--	3	0	4	0	0	0	0	0	1	1	2	3	3
GRS009[b]	--	0	0	--	--	--	--	--	--	--	1	0	0	2
GRN009[b]	--	0	0	0	0	1	2	0	0	0	1	2	2	3
GRS008[b, c, d]	--	0	0	0	0	0	0	--	--	--	1	3	4	5
GRN008	--	0	0	0	0	0	2	0	0	0	1	4	5	8
GRS007	--	3	6	11	10	5	7	5	4	6	4	6	2	3
GRN007[b, c, d]	--	0	0	0	0	0	0	--	--	--	1	2	0	0
GRS005[b, c, d]	--	0	0	--	--	--	--	--	--	--	1	0	0	1
GRN005[b, c]	--	0	0	--	0	--	--	--	--	--	--	--	1	1
GRN004[b, c, d]	--	1	1	2	2	2	2	1	0	0	1	1	0[e]	4
GRS003[b, c, d]	--	0	--	--	--	--	--	--	--	--	0	0	3	7
Dripping Sprgs Campground[b, c, d]	--	--	0	0	0	0	0	0	0	1	5	14	11	21
Dripping Sprgs Wash[b, c, d]	--	--	0	1	0	0	0	0	0	1	3	9	14	18
Yearly sum of territories	10	33	48	69	52	40	46	26	14	28	39	62	63	96
# of sites with territories	4	12	9	12	10	9	10	7	4	8	16	14	17[e]	21

[a] Sites ordered downstream to upstream; only sites with documented flycatcher residents are included.

[b] Kayak-only surveys conducted in 2009.

[c] Kayak-only surveys conducted in 2008.

[d] Kayak-only surveys conducted in 2006 and 2007.

[e] A nesting pair associated with GRS003 placed nests at both GRS003 and GRN004 in 2008; this territory was designated to GRS003. Both sites were included in the final "sites with territories" number.

APPENDIX G

AGFD and Rangewide Site Names with Total Site Number, Management Unit and County for the Gila River Study Area

Table G.1. AGFD and Rangewide Site Names with Total Site Number, Management Unit and County for the Gila River Study Area

AGFD Site Name	Total Site Number	Rangewide Site Name[16]	Management Unit	County
GRN033	AZGI098	Gila River GRN033	Middle Gila/San Pedro	Pinal
GRSN031	AZGI096	Gila River GRSN031	Middle Gila/San Pedro	Pinal
GRN020	AZGI087	Gila River GRN020 (Kelvin Bridge)	Middle Gila/San Pedro	Pinal
GRN018	AZGI083	Gila River GRN018	Middle Gila/San Pedro	Pinal
GRS018	AZGI082	Gila River GRS018	Middle Gila/San Pedro	Pinal
GRS016	AZGI081	Gila River GRS016	Middle Gila/San Pedro	Pinal
GRS015	AZGI080	Gila River GRS015	Middle Gila/San Pedro	Pinal
GRN015	AZGI113	Gila River GRN015	Middle Gila/San Pedro	Pinal
Kearny	AZGI042	Gila River Kearny Sewage Ponds	Middle Gila/San Pedro	Pinal
GRS013	AZGI076	Gila River GRS013	Middle Gila/San Pedro	Pinal
GRS012	AZGI074	Gila River GRS012	Middle Gila/San Pedro	Pinal
GRN011	AZGI073	Gila River GRN011	Middle Gila/San Pedro	Pinal
GRS011	AZGI072	Gila River GRS011	Middle Gila/San Pedro	Pinal
GRN010	AZGI071	Gila River GRN010	Middle Gila/San Pedro	Pinal
GRS010	AZGI070	Gila River GRS010	Middle Gila/San Pedro	Pinal
GRS009	AZGI068	Gila River GRS009	Middle Gila/San Pedro	Pinal
GRN009	AZGI069	Gila River GRN009	Middle Gila/San Pedro	Pinal
GRS008	AZGI066	Gila River GRS008	Middle Gila/San Pedro	Pinal
GRN008	AZGI067	Gila River GRN008	Middle Gila/San Pedro	Pinal
GRS007	AZGI064	Gila River GRS007	Middle Gila/San Pedro	Pinal
GRN007	AZGI065	Gila River GRN007	Middle Gila/San Pedro	Pinal
GRS005	AZGI061	Gila River GRS005	Middle Gila/San Pedro	Pinal
GRN004	AZGI060	Gila River GRN004	Middle Gila/San Pedro	Pinal
Dripping Springs Campground	AZGI036	Gila River - Dripping Springs Wash	Middle Gila/San Pedro	Pinal, Gila
Dripping Springs Wash	AZGI004	Gila River - Dripping Springs Wash	Middle Gila/San Pedro	Gila

[16] Rangewide site names were only created for sites where flycatchers were detected prior to 2008.