

**SOUTHWESTERN WILLOW FLYCATCHER
2002 SURVEY AND NEST MONITORING REPORT**

Alexander B. Smith, Nongame Birds Biologist
April A. Woodward, Nongame Birds Biologist
Patrick E.T. Dockens, Nongame Birds Biologist
Johnida S. Martin, Nongame Birds Biologist
Tracy D. McCarthy, Southwestern Willow Flycatcher Coordinator

Nongame Branch, Wildlife Management Division
Arizona Game and Fish Department

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Current address: ¹Upper Souris NWR, 17705 212th Ave NW, Berthold, ND 58718
²ACS Ltd. 424 West Broadway Road, Tempe, Arizona 85282

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EXECUTIVE SUMMARY

Purpose. The southwestern willow flycatcher (flycatcher) was federally listed as endangered in 1995. Probable factors contributing to population declines are: loss, alteration, and fragmentation of native riparian breeding habitat; loss of wintering habitat; nest predation; and brood parasitism by brown-headed cowbirds. Prompted by concern for population declines, statewide surveys for the flycatcher were initiated in 1993. Information was gathered in a standardized, systematic, interagency approach to provide a basis for management recommendations. Results of the 2002 survey and nest monitoring effort are summarized in this report.

Surveys, Detections, and Distribution. The Arizona Game and Fish Department (AGFD) and other cooperators spent 3299 hours surveying 162 sites covering approximately 150 linear km of riparian habitat. Surveyors detected 769 resident flycatchers at 47 sites. They located 430 flycatcher territories; in which 343 paired were documented at 43 sites. Flycatchers were documented along 11 drainages. The major concentrations in low elevations (<1115 m) occurred in the Winkelman Study Area, (near the confluence of the Gila and San Pedro rivers), Roosevelt Lake (Salt River and Tonto Creek study areas), Topock Marsh, Gila River-Safford, Alamo Lake, Big Sandy River, and Verde River. Two high-elevation (>2400 m) sites with flycatchers were documented: 1 site on the Little Colorado River (Greer River Reservoir) and 1 on the San Francisco River (Alpine Horse Pasture).

Nesting Attempts and Nest Success. Statewide surveyors documented 286 flycatcher nesting attempts at 37 sites throughout Arizona. Of these, 184 were monitored and contained eggs. Outcomes (success or failure) were determined for 173 nests within AGFD study areas (Roosevelt Lake and Winkelman) and other cooperators' nest monitoring study sites (Alamo Lake, Monkey's Head, Cave Wash, and Topock Marsh). Of the 173 nests, 46 (25%) were successful.

In AGFD study areas, we were able to calculate Mayfield nest success for 140 nests. Mayfield nest success was 28%. We estimated that 70 flycatcher young fledged from 33 successful nests. Ninety-eight nests were depredated, 9 deserted, 5 failed due to brown-headed cowbird parasitism, and 11 failed due to other causes. Statewide, 21 flycatcher nests had documented parasitism, all at nest monitoring sites. Brown-headed cowbirds were documented at all sites where flycatcher nests or fledglings were observed. Cowbird trapping was conducted at 9 flycatcher breeding sites. Average seasonal productivity was 0.43 for the 68 females (71 nests) that AGFD intensively monitored for the breeding season.

Nesting Habitat Characterization. Tamarisk was the predominant nesting substrate (161 nests). Nests were also found in willow (82 nests), cottonwood (11 nests), mesquite (1 nest), seep willow (1 nest), and netleaf hackberry (1 nest). Mean nest height was 5.89 m ($s = \pm 2.78$; $n = 42$) at the Winkelman Study Area and 3.96 m ($s = \pm 1.52$; $n = 44$) at the Roosevelt Lake Study Area.

Management/Recommendations. The highest conservation priority is protection of occupied habitat through partnerships with land management agencies and private landowners. The secondary conservation priority is surveying of potential areas of occurrence. Extensive surveys

have been performed since 1993 to identify flycatcher populations, yet little or no survey data exist for some riparian areas where potentially suitable habitat exists. These areas must be identified and surveys implemented and coordinated through state, federal, Native American, and private partnerships.

Knowledge of habitat relationships and their influence on reproductive success must be a primary component of recovery, conservation, and management strategies. Only through detailed demographic research, surveys, nest monitoring, vegetation sampling, and habitat measurements can these relationships be described. Sharing of data will be needed to identify similarities and differences between local population characteristics. Conservation and recovery of the flycatcher is not only dependent on federal and state agency direction, but also on cooperation and support of private landowners, Native American nations and non-governmental organizations. Recovery goals should include the protection, restoration, and maintenance of riparian ecosystem integrity.

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INTRODUCTION

The willow flycatcher (*Empidonax traillii*) is a widely distributed summer resident of much of the United States and southern Canada (Brown 1988). The 4 (or 5) subspecies of willow flycatchers recognized in North America (Fig. 1) are distinguished from each other by subtle differences in color and morphology and breeding range (Phillips 1948; Aldrich 1953; Hubbard 1987; Unitt 1987; Browning 1993). The current breeding range of the southwestern willow flycatcher (*E.t. extimus*; flycatcher) includes Arizona, southern California, New Mexico, southern Nevada, southern Utah, and southwestern Colorado. There are only a few breeding records for extreme northwestern Mexico (Unitt 1987; Wilbur 1987).

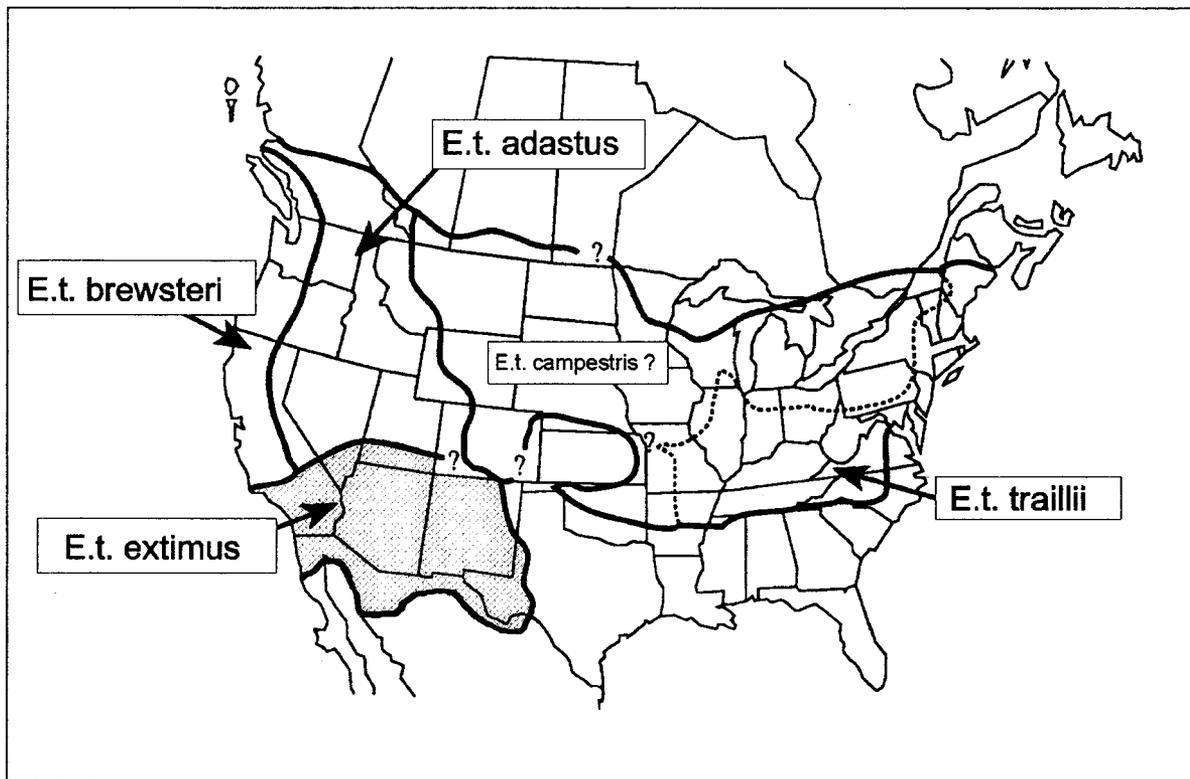


Figure 1. Distribution of willow flycatcher subspecies. Adapted from Unitt (1987) and Browning (1993).

The southwestern willow flycatcher is a riparian obligate breeder, restricted to dense, mesic habitats. Concern over declining populations and degradation of native riparian habitat prompted Arizona Partners in Flight, an interagency program dedicated to conserving land birds, and the Arizona Game and Fish (AGFD), as the coordinating agency, to initiate statewide flycatcher surveys in 1993 (Muiznieks and others 1994). At that time, the primary objective was to survey suitable and/or historical riparian and wetland habitat, using standardized methods, to determine status of the flycatcher in Arizona. As a result of that survey effort, collection of habitat and nest productivity information was identified as important. In 1994, statewide surveys continued, but few breeding sites were documented and most of these were composed of 5 or fewer territories.

In 1995, the southwestern willow flycatcher was federally listed as endangered (events leading to listing and designation of critical habitat are described in U.S. Fish and Wildlife Service 1991, 1992, 1993, 1995, 1996, and 1997). The flycatcher is also included in the AGFD list, *Wildlife of Special Concern in Arizona* (in prep). AGFD began an intensive nest monitoring effort to locate and monitor nests at 4 of the large breeding areas (Alamo Lake Study Area, Tonto Creek and Salt River study areas [Roosevelt Lake], and Winkelman Study Area) to collect detailed local population estimates and nest productivity data. This effort has continued through 2002 at Roosevelt Lake and the Winkelman Study Area.

This document serves as the AGFD summary report on 2002 activities. It also contains a summary of related work by cooperators, which fall into one of 2 categories: 1) the effort to systematically search riparian habitat to record the presence of flycatchers in Arizona (surveys); and, 2) the intensive effort at a few select breeding areas to estimate nest success and productivity, and to record vegetation characteristics at some or all of the nests (monitoring).

Specifically, the 2002 AGFD objectives were as follows:

1. Coordinate survey and monitoring efforts with agency and private cooperators.
2. Survey habitat at Alamo Lake. Survey sites along the Little Colorado and San Francisco rivers in the Greer/Alpine area. Survey suitable and potentially suitable habitat within 40 km of occupied habitat at Roosevelt Lake. Survey suitable and potentially suitable habitat (where land owner permission was obtained) on the San Pedro River from Redington to its confluence with the Gila River and from Dripping Springs Wash upstream of Winkelman to 3 km downstream of the Florence-Kelvin Highway Bridge along the Gila River (Winkelman Study Area).
3. Monitor nests to determine nest success and productivity at 3 breeding areas: the Winkelman Study Area, and Tonto Creek and Salt River study areas (Roosevelt Lake).
4. Band flycatchers at the Winkelman Study Area to allow for determination of female fecundity.
5. Record and report color-band information to U.S. Geological Survey Southwest Science Center, Colorado Plateau Field Station at Northern Arizona University (CPFS), U.S. Bureau of Reclamation (USBR), and U.S. Fish and Wildlife Service (USFWS).
6. Document the presence or absence of brown-headed cowbirds (*Molothrus ater*) at survey sites and determine impacts of cowbird parasitism on nest success.
7. Characterize vegetation at nest sites.

8. Compile statewide data into an annual report.
9. Incorporate survey, monitoring, and geographical data into a comprehensive statewide database.
10. Develop management recommendations for the southwestern willow flycatcher.

As noted above, this report includes only the 2002 survey and monitoring data. Prior Arizona survey and monitoring data can be found in Sferra and others (1995), Spencer and others (1996), Sferra and others (1997), McCarthy and others (1998), Paradzick and others (1999, 2000, and 2001), and Smith and others (2002). Our work complements that of CPFS (see Paxton and Sogge 1996, Langridge and Sogge 1997, Paxton and others 1997, Netter and others 1998, English and others 1999, Luff and others 2000, Kenwood and Paxton 2001, Koronkiewicz and others 2002), and other ongoing research projects. More in-depth discussions on willow flycatcher natural history, demography, and associated threats can be found in Paxton and others (1996), SWCA, Inc., Environmental Consultants (1997), Whitfield and Enos (1996), Sogge and others (1997b), Finch and Stoleson (2000), Sedgwick (2000), and Owen and Sogge (2002).

METHODS

STATEWIDE SURVEYS

Prior to the breeding season, cooperators were asked to identify their intended survey sites. We compiled this information and worked to coordinate surveys with agencies and organizations to limit overlap of areas. We conducted a flycatcher training workshop in May, which all new surveyors were required to attend to receive a federal permit.

Surveys were to be performed according to established protocol (Sogge and others 1997a). Survey sites were identified by agency and private cooperators in the field on 7.5-minute topographical maps or with Global Positioning System (GPS) units. At a minimum, 1 tape-playback survey was to be performed at each site in each of the following 3 periods: 15 May to 31 May, 1 June to 21 June, and 22 June to 10 July. For areas requiring USFWS project clearance, a minimum of five surveys were performed. Surveys had to be performed at least 6 days apart, from 1 hour prior to sunrise to 10:00 AM while birds were most active.

Flycatchers were considered territorial (or resident within a site) if they were detected between 15 June and 25 July, regardless of whether a possible or known mate was observed. Additionally, birds were considered territorial if observations of nesting activity or nests were found outside these dates. Flycatchers documented prior to 15 June, but not detected in subsequent visits or the last survey period, were considered migrants. Birds initially detected after 25 July were also considered migrants. An "unknown" designation was given to birds if follow-up surveys were not completed according to protocol or if not enough information was available to determine resident or migrant status. AGFD and cooperators with nest monitoring permits performed intensive nest searches when flycatcher pairs were documented.

Flycatcher survey data were recorded on a standardized form (Appendix A) and returned to AGFD and USFWS. To keep site designations and reporting consistent in future years, all sites were geographically defined using a set of start and stop Universal Transverse Mercator coordinates. This information was then compiled and entered into the Nongame and Endangered Wildlife Program Willow Flycatcher Database and made available to be electronically transferred to the Willow Flycatcher Information Management System. Willow flycatchers and other species of concern detected during surveys were recorded in the AGFD Heritage Data Management System.

AGFD SURVEY TECHNIQUES

All AGFD surveys were conducted according to established survey protocol (Sogge and others 1997a). Additionally, when flycatchers were detected, repeat visits were conducted until pair status was confirmed. For resident adult flycatchers at AGFD sites, we assumed that pairs were monogamous, unless evidence from color-banded individuals indicated that polygyny was occurring. When time permitted, AGFD surveyors conducted nest searches and nest checks to document breeding activity.

AGFD NEST MONITORING TECHNIQUES

Nest monitoring methods used by AGFD followed the Southwestern Willow Flycatcher Nest Monitoring Protocol (Rourke and others 1999), a modification of the Breeding Biology Research and Monitoring Database (BBIRD) field protocol (Martin and others 1997). Nest searches were conducted from mid-May through August. Nests were primarily located by watching adults return to a nest or by systematically searching suspected nest sites. Nests were monitored every 2 to 4 days after incubation was suspected. During incubation, nest contents were observed directly using a mirror pole or miniature video camera. After hatching, the nestling number was also confirmed using these same techniques. Once nestlings were confirmed, nests were observed from a distance to reduce the risk of nest predation and the possibility of premature fledging. If no activity was observed at a previously active nest, the nest was checked directly to identify nest contents and a search of the general area was conducted to locate possible fledglings.

We considered a nest successful if any of 4 conditions was 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 (defensive behavior and/or adults agitated) when the nest was empty; or, 4) nestlings were observed in the nest within 2 days of the estimated fledge date (12 days). This assumption is based on observations of southwestern willow flycatchers fledging at 10 days of age. Assuming fledging when we were unable to confirm fledglings might cause nest success calculations to be overestimated, however, excluding these nests may cause underestimation.

We considered a nest to have failed if any of 6 outcomes was documented: 1) the nest was found empty or destroyed more than 2 days prior to the estimated fledge date (depredated); 2) the nest fledged no flycatcher young but contained cowbird eggs or young (parasitized); 3) the nest was deserted with eggs remaining (deserted); 4) the nest was abandoned prior to egg laying

(abandoned); 5) the nest was destroyed due to weather (weather); or, 6) the entire clutch was incubated for more than 20 days (infertile).

The method for selecting nest monitoring areas within the Roosevelt Lake and Winkelman Study areas was changed in 2001. From 1995 to 2000, we monitored all flycatcher nests at a select number of sites within each study area; these sites were designated as nest monitoring sites in the Roosevelt Lake Biological Opinion (USFWS 1996). In 2001, we began a 5-year study to more closely examine female productivity to be able to detect year to year differences as well as compare productivity between study sites. In order to accomplish this, we needed a set number of marked females to be monitored each year. To obtain a statistically valid sample, we needed to monitor 35 females in the Winkelman Study Area, 35 at Salt River Inflow and 15 at Tonto Creek Inflow. Females were selected from all study sites and not just the nest monitoring sites used from 1995-2000. All nests were monitored until color bands were either confirmed or the females selected were banded. The females selected were monitored for the entire breeding season, which allowed us to calculate individual female seasonal fecundity, a better indicator of population nest success and productivity than nest-based measurements (Pease and Grzybowski 1995; Thompson and others 2001). Although we concentrated efforts on nests of the selected females, additional nests were monitored as time permitted. These changes in monitoring techniques must be accounted for when making comparisons with years prior to 2001. For example, the number of fledglings per study area cannot be compared directly without taking into account the number of nests monitored in that area.

AGFD NEST MONITORING STUDY AREAS

Three study areas were surveyed and monitored by AGFD during 2002: the Salt River and Tonto Creek study areas at Roosevelt Lake and the Winkelman Study Area.

Roosevelt Lake

The Roosevelt Lake area included the Salt River and Tonto Creek inflows to the lake. Both areas are approximately 640 m elevation and within the Tonto National Forest. Riparian habitat was surrounded by Arizona Upland as described by Brown (1994). We surveyed suitable habitat within 40 km of the Salt River and Tonto Creek inflows.

Salt River Study Area. The Salt River study area has expanded in recent years, as flycatchers were found in habitat that developed as lake levels receded. Vegetation varied from monotypic tamarisk (*Tamarisk* spp.) to nearly monotypic Goodding's willow (*Salix gooddingii*). Patch height varied from 4 m to 10 m. The Salt River was perennial in 2002.

Tonto Creek Study Area. The Tonto Creek Inflow to Roosevelt Lake contained numerous patches of riparian habitat. Vegetation varied from a tamarisk-dominated understory with patchy Fremont cottonwood (*Populus fremontii*) and/or Goodding's willow overstory to stands of monotypic tamarisk. Patch height varied from 4 m to 12 m. Portions of the Tonto Creek Study Area had standing water through most of the breeding season.

Winkelman Study Area

We surveyed and conducted nest monitoring along 86 km of suitable habitat (where landowner access was granted) on the San Pedro River from Redington downstream to the confluence with the Gila River and from Dripping Springs Wash, upstream of Winkelman, to 3 km downstream of the Florence-Kelvin Highway Bridge along the Gila River. Elevation ranged from 549 m at the Florence-Kelvin Highway Bridge to 695 m at Cascabel. Riparian forests along this reach varied from monotypic tamarisk to stands of native Goodding's willow and Fremont cottonwood. Patch height varied from 4 m to 15 m. Riparian habitat was surrounded by Arizona Upland as described by Brown (1994). Due to decreased releases from San Carlos Reservoir, Gila River flows declined during the season from constant flows to only portions having standing water. The San Pedro River varied from constant flows to intermittent flows in reaches.

COOPERATOR NEST MONITORING

The San Bernardino County Museum monitored nests at Monkey's Head and Cave Wash along the Bill Williams River and at Topock Marsh along the Colorado River (for monitoring methods see McKernan and Braden 2001). Methods for nest monitoring by cooperators sometimes differed from AGFD protocol (Rourke and others 1999), making comparisons difficult; for cooperator monitoring data only outcomes are included.

COLOR BANDING

AGFD personnel color banded flycatchers at the Winkelman Study Area, while CPFS personnel conducted banding at Roosevelt Lake. AGFD coordinated closely with CPFS to resight previously banded birds, and to locate unbanded birds to be uniquely color banded. For more information regarding the banding methods used and results of the CPFS project, see Koronkiewicz and others (2002).

COWBIRD TRAPPING

Cowbird trapping was coordinated and conducted by cooperators. Traps were placed at 9 sites within 4 areas: Alamo Lake-Brown's Crossing, Camp Verde, Greer/Alpine area (Alpine Horse Pasture and Greer River Reservoir), and Winkelman Study Area (Aravaipa North, Cook's Lake, Dudleyville Crossing, Indian Hills, and Kearny). Cowbird traps may affect parasitism rates at nearby breeding sites. Information regarding trapping can be obtained by contacting the respective agency: Apache-Sitgreaves National Forest (Alpine Horse Pasture and Greer River Reservoir), SWCA (Camp Verde), USBR Phoenix Office (Aravaipa North, Cooks Lake, Dudleyville Crossing, Indian Hills, and Kearny), and USBR Boulder City Nevada Office (Alamo Lake-Brown's Crossing).

HABITAT CHARACTERISTICS

Vegetation at occupied flycatcher sites can be classified into 4 general types (Sogge and others 1997a): 1) high-elevation Geyer willow (*Salix geyeriana*), 2) low-elevation native broadleaf

dominated (commonly willow and/or cottonwood), 3) low-elevation mixed native broadleaf and exotic tamarisk and, 4) low-elevation monotypic tamarisk.

General habitat characteristics (such as nest height, substrate height, DBH of substrate, and distance to water) were to be visually estimated and recorded on survey forms for all survey sites. AGFD personnel also measured habitat variables at nest sites; descriptive statistics were calculated where applicable.

RESULTS

SURVEYS, DETECTIONS, AND DISTRIBUTION

One hundred sixty-two sites were surveyed covering approximately 150 linear km of riparian habitat (Table 1; Appendixes B, C). Sites ranged from 19 m to 2539 m in elevation and 0.06 km to 12.9 km in length. Nineteen of the 162 sites were not surveyed according to protocol. This was due to time, funding limitations, or because habitat was determined unsuitable for flycatchers. Eleven sites were not surveyed previously. New survey sites were located along the Colorado (2 sites), Gila (2 sites), Verde (2 sites), Blue (1 site), San Francisco (1 site), San Pedro (1 site), Santa Cruz (1 site), and Little Colorado rivers (1 site).

Survey hours	3299
Sites surveyed	162
Linear km of habitat covered	150
Sites with resident willow flycatchers	47
Sites with documented pairs	43
Sites with documented breeding	37
Resident willow flycatchers	769
Territories	430
Pairs	343
Nesting attempts	286
Sites with cowbirds detected	136
Breeding sites with cowbirds detected	37

Seven hundred sixty-nine resident flycatchers were documented within 430 territories at 47 sites (Table 1; Appendixes B, C). AGFD personnel and statewide cooperators recorded 343 pairs. The male to female ratio was not 1:1 at all sites, since polygynous and unpaired birds were found at some sites. In some instances insufficient survey effort and other factors may have precluded the documentation of pairs.

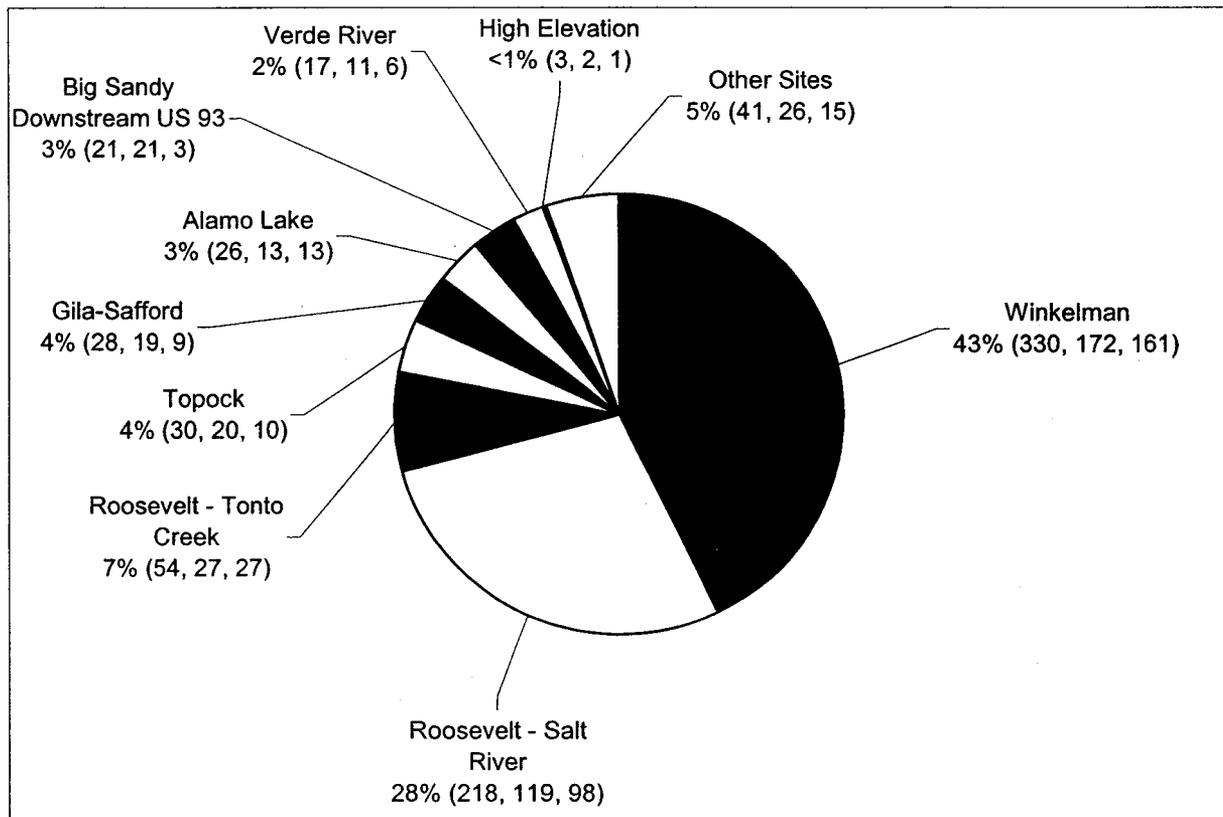


Figure 2. Southwestern willow flycatcher distribution in Arizona, 2002. Survey location, percent of known willow flycatchers (number of resident willow flycatchers, number of territories, number of pairs). Proportions are based on total number of willow flycatchers (see Table 2 for sites within each survey location).

Flycatchers were documented along 11 drainages. The greatest concentrations of flycatchers in Arizona were found at Winkelman Study Area with 43% and Roosevelt Lake with 35% (Salt River 28% and Tonto Creek 7%; Fig. 2; Table 2). Resident flycatchers were detected for the first time at 6 sites that were surveyed at least once in previous years: Capgate Wash, Cave Wash 1, Dysart Road, GRN008, Guthrie, and Soza Wash. Additionally, flycatchers were documented at Davenport and Horseshoe North on the Verde, which were surveyed for the first time this year. Cowbirds were documented at 136 sites including all sites where breeding was detected (Appendix C).

Table 2. Sites with willow flycatchers grouped by survey locations in Arizona, 2002 (see Fig. 2).

Winkelman Study Area	Roosevelt Lake		Gila-Safford Area	Alamo Lake	Verde River	High Elevation	Other Sites
	Salt River	Tonto Creek					
<ul style="list-style-type: none"> ▸ GRN018 ▸ GRS018 ▸ Kearny ▸ GRS012 ▸ GRS011 ▸ GRN010 ▸ GRN009 ▸ GRN008 ▸ GRS007 ▸ GRN004 ▸ CB Crossing Southeast ▸ Indian Hills ▸ Dudleyville Crossing ▸ Malpais Hill ▸ Cook's Lake Cienega/Seep ▸ Aravaipa Inflow North ▸ San Pedro/Aravaipa Confluence ▸ Aravaipa Inflow South ▸ Wheatfields ▸ Capgag Wash ▸ San Manuel Crossing ▸ Catalina Wash ▸ Bingham Cienega ▸ Soza Wash 	<ul style="list-style-type: none"> ▸ Lake Shore ▸ School House Point South ▸ School House Point North ▸ Salt River Inflow 	<ul style="list-style-type: none"> ▸ Tonto Creek Inflow ▸ Orange Peel 	<ul style="list-style-type: none"> ▸ Fort Thomas-Geronimo ▸ Pima East 	<ul style="list-style-type: none"> ▸ Lower Big Sandy River ▸ Alamo Lake-Brown's Crossing 	<ul style="list-style-type: none"> ▸ Horseshoe North ▸ Davenport 	<ul style="list-style-type: none"> ▸ Greer River Reservoir ▸ Alpine Horse Pasture 	<ul style="list-style-type: none"> ▸ Duncan ▸ Littlefield ▸ Miles 51.5-50.5 L GC ▸ Monkey's Head ▸ Cave Wash I ▸ Dysart Road ▸ Gutherie ▸ Hassayampa River Preserve

Migrant flycatchers were detected at 50 sites (Appendix C), 27 of which also had resident birds. Flycatchers of unknown status were documented at 5 sites (14 at Alamo Lake-Brown's Crossing, 10 at Lower Big Sandy River, 5 at Lower Santa Maria River, 2 at Greer Townsite, and 1 at Alpine Horse Pasture).

Topock Marsh (lower Colorado River) was the lowest elevation (140 m) where nesting was documented. Duncan (upper Gila River) was the highest elevation (1112 m) where nesting was documented. However, resident flycatchers were detected at 2 high-elevation sites: Alpine Horse Pasture (2400 m; 2 flycatchers, 1 territory) and Greer River Reservoir (2500 m; 1 flycatcher, 1 territory). Resident flycatchers were not detected between 1150 m and 2400 m.

NEST MONITORING

Statewide Effort

We documented 286 nesting attempts statewide at 37 sites (Appendix C). Of these, 184 were monitored and contained eggs. Forty-six (25%) monitored nests fledged young, 127 (69%) failed, and 11 (6%) had unknown outcomes (Table 3). Predation was the major cause of nest failure (Table 4). The earliest documented flycatcher egg laying events in 2002 were two nests on 22 May at Aravaipa Inflow North. The first hatching date and the first fledging date were 4 June and 18 June respectively at Aravaipa Inflow North. The last documented fledging event occurred after 22 August at School House Point North.

Table 3. Willow flycatcher nest monitoring results in Arizona, 2002.

Site		Pairs ^a	Nests	Successful nests	Failed nests	Unknown outcome ^b	Parasitized nests ^c
Roosevelt Lake	Tonto Creek	10	10	0	10	0	4
	Salt River	32	33	2	31	0	12
	Total	42	43	2	41	0	16
Winkelman Study Area ^d		105	120	31	79	10	4
Alamo Lake ^d		12	12	8	4	0	0
Topock Marsh		5	5	3	1	1	0
Monkey's Head		4	4	2	2	0	1
All sites		168	184	46	127	11	21

^a Number of pairs contributing to the number of monitored nests.

^b Nests monitored only for a portion of nesting cycle, were given unknown outcome.

^c Includes all parasitized nests, those that both fledged willow flycatcher young or failed.

^d Cowbird trapping occurred in the area during the breeding season.

Table 4. Causes of nest failure for willow flycatchers at monitoring areas in Arizona, 2002.

Site		Depredated ^a	Deserted	Parasitized ^b	Infertile clutches	Weather	Other
Roosevelt Lake	Tonto Creek	4	3	1	0	0	2
	Salt River	22	4	1	0	0	4
	Total	26	7	2	0	0	6
Winkelman Study Area ^c		72	2	4	0	0	1
Alamo Lake ^c		3	0	0	0	1	0
Topock Marsh		0	0	0	0	0	1
Monkey's Head		0	2	0	0	0	0
All sites		101	11	6	0	1	8

^a Includes 6 parasitized nests that were later depredated.

^b Includes only those nests that failed directly due to cowbird parasitism (nests subsequently abandoned with eggs or fledged only cowbird young).

^c Cowbird trapping occurred in the area during the breeding season.

Parasitism

Twenty-one nests were parasitized at nest monitoring areas (Tables 3, 5). Seven nests were abandoned due to cowbirds and are included in the parasitism totals (Tables 3, 4, and 5). Cowbirds may have caused, or contributed to, abandonment at other nests but direct evidence was not found. Nest parasitism was greatest at Roosevelt Lake (37%: 16 of 43 nests), but was also high at Monkey's Head (25%: 1 of 4 nests).

Outcome	Number of nests
Abandoned with eggs	7
Depredated	13
Fledged one flycatcher	1
Total parasitized nests	21

AGFD Study Areas

Nest Success

Mayfield (1961, 1975) nest success for all AGFD nests combined was 28.39% (Table 6). Mayfield nest success for Roosevelt and Winkelman study areas was 15.06% and 33.44%, respectively. A total of 12 reneests were documented; no reneests were initiated after a successful nest (double brood attempt).

Site		Mayfield nest success (No. of observation days)	Number of young fledged (nests)	Mean number of young fledged per nest (n) ^a	Mean number young fledged per successful nests (n) ^a
Roosevelt Lake	Tonto Creek	11.63 (93)	0 (7)	0 (7)	N/A
	Salt River	15.98 (403)	2 (28)	0.07 (28)	1.00 (2)
	Total	15.06 (496)	2 (35)	0.06 (35)	1.00 (2)
Winkelman Study Area ^b		33.44 (1895)	68 (105)	0.65 (105)	2.19 (31)
All sites		28.39 (2391)	70 (140)	0.50 (140)	2.12 (33)

^a n = number of nests

^b Cowbird trapping occurred in the area during the breeding season.

Nest Productivity

Seventy young fledged from 140 nests, where Mayfield estimates were calculated, at AGFD study areas with 68 fledging from the Winkelman Study Area (Table 6). This total does not include 4 additional fledglings at the Salt River Study Area, which were detected in 3 territories where no nests were found. Forty-seven percent of young fledged were confirmed after leaving the nest. Mean clutch size (includes only complete clutches) was 2.46.

Female Productivity

Sixty-eight females were followed through all nesting attempts (n=71) to determine female productivity at AGFD study areas. Average seasonal fecundity and the average seasonal productivity were both 0.43 (Table 7). Fifty-four females failed to successfully fledge any young. Ninety-five percent had only one nesting attempt (Table 8). Three renests were documented, after the initial nesting attempt failed. No renests were initiated after a successful nest.

Site		No. of females	Nests	Average seasonal fecundity ^a	Average seasonal prod. ^b
Roosevelt Lake	Tonto Creek	8	8	0	0
	Salt River	28	28	0.07	0.07
	Total	36	36	0.06	0.06
Winkelman Study Area		32	35	0.84	0.84
All Sites		68	71	0.43	0.43

^a Mean fledges per female

^b Mean fledges per nesting attempt per female [Average of (# Fledges /# Nests for each female)]

Site		No. of females	Percent of females with 1 nest (No. of females)	Percent of females with 2 nests (No. of females)
Roosevelt Lake	Tonto Creek	8	100 (8)	0
	Salt River	28	100 (28)	0
	Total	36	100 (36)	0
Winkelman Study Area		32	91 (29)	9.4 (3)
All Sites		68	95.6 (65)	4.4 (3)

COLOR BANDING

In 2002, we banded 30 flycatchers at the Winkelman Study Area to aid in our nest monitoring efforts (Table 9). One was a recapture that had only a USFWS band, which was replaced and unique color bands were added. Two were captures of males where only a USFWS band was used. For banding results at Roosevelt Lake see Koronkiewicz and others (2002).

Table 9. AGFD banding effort at the Winkelman Study Area, 2002. (D = Blue, G = Green, K = Black, O = Orange, R = Red, V= Violet, W= White Y = Yellow, and Z = Gold)

Site	Date banded	USFWS band number	Color band left leg	Color band right leg
Kearny	05/30/02	2240-84017	DD	OR
Aravaipa North	06/02/02	2240-84018	DD	GR
Aravaipa North	06/03/02	2240-84019	KK	DD
Aravaipa North	06/04/02	2240-84020	DD	KG
Aravaipa North	06/04/02	2240-84021	DD	VW
Aravaipa North	06/13/02	2240-84022	DD	GO
Aravaipa North	06/18/02	2240-84023	DD	OW
Aravaipa North	06/18/02	2240-84024	DD	OK
Dudleyville Crossing	06/24/02	2240-84025	OY	DD
Dudleyville Crossing	06/24/02	2240-84026	DD	OG
Malpais Hill	06/25/02	2240-84027	DD	OD
Malpais Hill	06/25/02	2240-84028	KW	DD
Malpais Hill	06/26/02	2240-84029	OO	DD
Malpais Hill	06/27/02	2240-84030	VW	DD
Malpais Hill	06/28/02	2240-84031	YK	DD
Malpais Hill	06/30/02	2240-84032	VG	DD
Malpais Hill	06/30/02	2240-84033	OW	DD
Malpais Hill	06/30/02	2240-84034	DD	
Aravaipa North	07/02/02	2240-84035	WV	DD
Aravaipa North	07/02/02	2240-84036	DD	
Aravaipa North	07/11/02	2240-84037	RO	DD
Aravaipa North	07/12/02	2240-84038	DO	DD
Aravaipa North	07/13/02	2240-84039	GO	DD
Aravaipa North	07/13/02	2240-84040	GV	DD
Wheatfields	07/16/02	2240-84041	OR	DD
Wheatfields	07/17/02	2240-84042	DD	WZ
Wheatfields	07/17/02	2240-84043	DD	OV
Aravaipa North	07/25/02	2240-84044	DD	KYK
Aravaipa North ^a	07/26/02	2240-84045	DD	OY

^a Recapture where a USFWS band was changed to add color bands. Originally banded as 1710-20546.

HABITAT CHARACTERISTICS

Although vegetation composition varied, most sites where flycatchers were documented shared landscape characteristics. Occupied sites were in broad floodplains where dense riparian habitat existed and water or saturated soil was present sometime during the breeding season. In Arizona, these broad riparian areas frequently occur below 1115 m and above 2400 m.

Sites within a mid-elevation band (1115–2400 m) were surveyed, but resident flycatchers were not detected (see Appendix C). Vegetation at these intermediate elevations was often in narrow drainages with high-gradient streams prone to frequent scouring by flood. Vegetation at these sites typically occur in a narrow linear band, often dominated by an overstory of Arizona sycamore (*Platanus wrightii*).

Most nesting sites (26 of the 37) were characterized as mixed native/exotic associations. However, the amount of tamarisk varied within and between sites. Five nesting sites (GRN004, GRS007, GRS018, School House Point South, and Wheatfields) were composed of dense monotypic stands of tamarisk, forming a nearly continuous closed canopy. Six sites (Aravaipa Inflow North, Bingham Cienega, Catalina Wash, Lake Shore, Pima East, and San Pedro/Aravaipa Confluence) were classified as native broadleaf dominated.

Tamarisk and Goodding's willow were the primary nesting substrates. At Bingham Cienega, on the San Pedro River, we documented the first record a nest in a netleaf hackberry (*Celtis reticulata*; Table 10). At Soza Wash on the San Pedro River we documented a nest in mesquite, the second record in the state. Mean nest height at Roosevelt Lake and Winkelman study areas were 3.96 m ($s = \pm 1.52$; $n = 44$) and 5.89 m ($s = \pm 2.78$; $n = 42$), respectively (Appendix C).

Substrate	No. of nests
<i>Baccharis glutinosa</i>	1
<i>Celtis reticulata</i>	1
<i>Populus fremontii</i>	11
<i>Prosopis</i> spp.	1
<i>Salix exigua</i>	4
<i>Salix gooddingii</i>	78
<i>Tamarisk</i> spp.	161
Total	257

DISCUSSION

SURVEYS

Annual statewide surveys provide critical information concerning the distribution and abundance of flycatchers in Arizona. This data allows agency resource managers, private organizations, and the public to make data driven decisions regarding present and future research and conservation efforts. Many areas occupied in 2002 had similar abundance reports in 2001, with 78% of flycatchers concentrated within two areas of the state (Roosevelt Lake and Winkelman). However, the 2002 breeding season did show a statewide increase in abundance (430 compared to 346 territories in 2001; Smith and others 2002). Territorial birds were detected for the first time on the Gila River near the confluence with the Salt River in an area that had been surveyed once before. Four other areas differed noticeably from previous years (Winkelman Study Area, Verde River, lower Grand Canyon, and Gila-Safford area).

The statewide increase in abundance was in large part attributed to the Winkelman Study Area (which increased from 118 to 172 territories). Continuing regeneration of habitat along the San Pedro River contributed to a large increase in flycatchers at the Aravaipa Inflow North and

Dudleyville Crossing sites (from 22 to 37 and 14 to 26 territories, respectively). The increase in flycatchers at Dudleyville Crossing occurred exclusively on The Nature Conservancy San Pedro River Preserve section of this site (an increase from 1 to 17 territories). Increases in abundance also occurred on the Gila River. Low flows on the river improved surveyor access to the habitat, which may have contributed to the increased detections at GRS018 (from 2 to 7 territories).

Territorial flycatchers were detected for the first time since 1997 on the lower Verde River near Horseshoe Dam (11 territories documented). Flycatchers occurred in new vegetation that has grown in the lakebed following the drying of the lake, as well as in vegetation below the dam.

Although the overall abundance of flycatchers increased in Arizona this year, there were sites that had notable decreases. The lower Grand Canyon area of the Colorado River (miles 246 to 272) had no residents for the first time since surveys began in 1997. Although numbers of flycatchers have fluctuated in this area, there were 12 territories in 2001. The reasons for the absence of residents, and only a few migrants, this year are not yet understood. We are not aware of any drastic changes in habitat in the area, thus it is probable that birds will use this reach in future years.

There was also a decrease in detections on the Gila River near Safford. Surveyors documented 19 territories this year. This was a decrease from 21 territories and an additional 24 birds of unknown status (surveyors were unable to return to the site to confirm residency status) during the 2001 breeding season.

NEST MONITORING

In 1995, AGFD began monitoring nests to record and evaluate factors affecting nest success and document habitat attributes influencing productivity. Since 1995, we recorded differences in annual estimates of nest success and productivity. The low reproductive success of the 2002 season was in contrast to 2001, which either equaled or surpassed previous productivity estimates for AGFD study areas. Additionally, this year a higher than normal percentage of pairs did not attempt to nest.

Mayfield estimates of nest success this year were the lowest recorded at our 3 study areas (Tonto Creek – 11%, Salt River – 16%, and Winkelman – 33%) since monitoring began. Nest success at the Salt River Study Area had previously increased yearly from 28% in 1997 to a high of 75% in 2001, but declined sharply in 2002 (Figure 3). Average seasonal fecundity declined from a high of 2.42 in 2001 to a low of 0.06 in 2002 at Roosevelt Lake. Tonto Creek Study Area had the largest decline in fecundity from 2.5 to 0.0. One factor contributing to this decline in fecundity was a decrease in renesting attempts. For AGFD monitored females, only 4% renested in 2002 whereas in 2001 48% attempted to reneest. All of these factors contributed to a decrease in total number of fledglings at AGFD study areas, from 431 in 2001 to 70 in 2002.

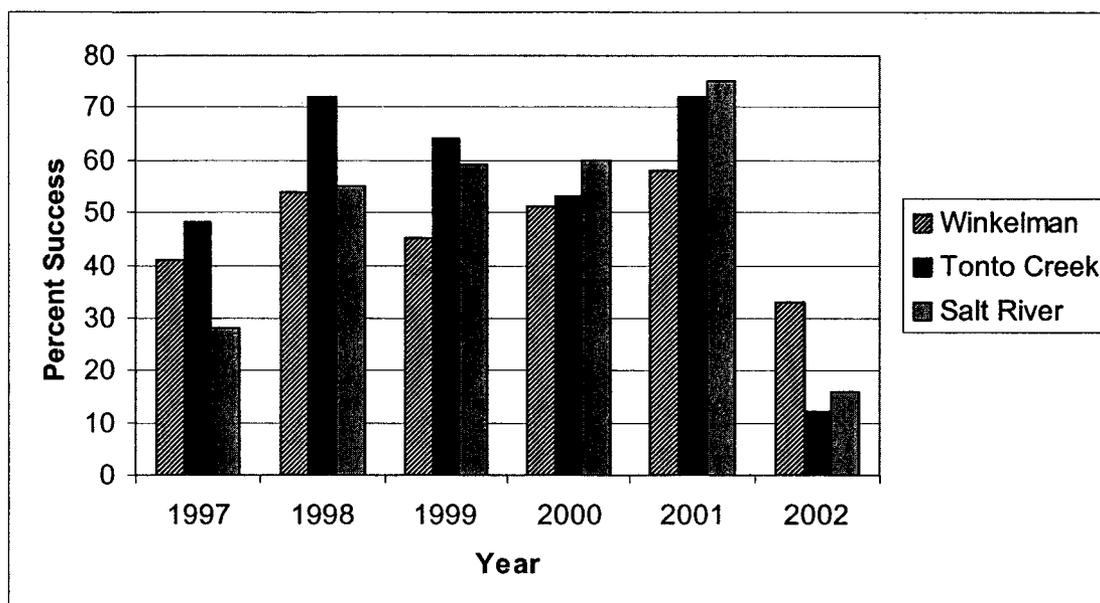


Figure 3: Mayfield nest success at Winkelman, Tonto Creek, and Salt River study areas, 1997-2002.

Productivity was also affected by an increase in brown-headed cowbird parasitism at Roosevelt Lake, with 37% (16 of 43) of nests parasitized. In comparison, the previous high was 4% (2 of 46) in 1997 (McCarthy and others 1998). The 2002 breeding season was the first year that cowbird trapping did not occur at the Roosevelt Lake study areas since trapping began in 1997. However, trapping at Roosevelt was scaled back from 4 to 2 traps for 2001 and there was no increase in parasitism (Smith and others 2002). Thus, the increase in 2002 may not be solely due to the lack of trapping. The low rainfall amounts this year may have affected food availability as well as parasitism opportunities in the uplands, thus collapsing the cowbird population into riparian areas. Continued monitoring is needed to explore this completely.

Variation in productivity over the eight-year period of our study (1995-2002) appears to be at least loosely associated with winter rainfall. Years with lower than average winter rainfall, like 2002; tend to have lower productivity than years with higher than average winter rainfall, such as 1998 and 2001. The low lake level at Roosevelt Lake this season (between 21% of full capacity on 1 May and 10% on 1 September; data obtained from Salt River Project) and the increased average distance to water from nests may have contributed to decreases in productivity by reducing humidity. Annual and site variations in some, or all, of these demographic parameters identify the need for long-term monitoring data. This information can be integrated to assess health and status of populations and to develop management strategies.

HABITAT

The southwestern willow flycatcher occupies a wide variety of riparian habitats across its range (Skaggs 1996; Whitfield and Enos 1996; McCarthy and others 1998). The majority of occupied sites are of mixed native/exotic vegetation with tamarisk continuing to play an important role in

flycatcher habitat. The importance of riparian vegetation for this species has continuously been at the forefront of recovery discussions. The variety of occupied habitats suggests that flycatchers may rely on structure of vegetation as much as, or more than, particular species of vegetation. A recent study conducted by USGS suggested that, on a physiological level, native and exotic habitats do not greatly differ in quality for flycatchers (Owen and Sogge 2002). We have also observed flycatchers using unusual nesting substrates, as was shown this year by the use of mesquite, hackberry, and seep willow.

This year the proximity to flowing water near habitat at the Winkelman Study Area appeared to outweigh some other habitat requirements. Flycatchers were found in somewhat atypical habitats, using relatively narrow strips of riparian vegetation that occurred near flowing river systems. This year at the Winkelman Study Area average distance to water for nests decreased from 52.55 m in 2001 (Smith and others 2002) to 12.25 m in 2002. Although flycatchers continued to occupy traditional sites, they suffered from reduced water flow this year. Thus, the number of nesting attempts was greatly reduced and the breeding season was shorter than in previous years. In those sites with flowing water, flycatchers were more likely to nest, to initiate a re-nest, and to remain on the breeding grounds for a greater amount of time. Landscape-level factors such as patch area and arrangement, and general habitat type, as well as varying local and regional water regimes may be predictors of site occupancy. Habitat variables at numerous scales affect flycatcher site selection and reproduction and need to be considered in future research.

Knowledge of habitat relationships and their influence on reproductive success must be a primary component of recovery, conservation, and management strategies for the flycatcher. Only through detailed demographic research, nest monitoring, surveys, vegetation sampling, and habitat measurements can these parameters be described. This information will affect management decisions on both the local and range-wide level. Conservation and recovery success of the willow flycatcher is not only dependent on federal and state agency direction, but also must include cooperation and support of nongovernmental organizations, private landowners, and Native American nations.

RECOMMENDATIONS

SURVEYS

1. Conduct statewide surveys in areas that:
 - a. have not been surveyed but appear to have suitable habitat
 - b. contain previously occupied habitat
 - c. are adjacent to occupied habitat
 - d. were previously unsuitable habitat but have had recent vegetation growth
2. Conduct multiple years of surveys to adequately describe between-year fluctuations of occupied habitat.
3. Priority areas for more intensive or continued survey effort include:
 - a. Alamo Lake/ lower Big Sandy River/lower Santa Maria River
 - b. Gila River from Duncan to the Kelvin Bridge

- c. Gila River from the Salt River inflow to Gillespie Dam
 - d. Havasu Creek drainage
 - e. Little Colorado River and tributaries with suitable habitat
 - f. Lower Colorado River between river mile 260 and Yuma
 - g. Lower Grand Canyon area of the Colorado River between miles 246 and 272
 - h. Salt River and Tonto Creek upstream from Roosevelt Lake
 - i. San Francisco River from the New Mexico border to Clifton
 - j. San Pedro River from Redington to its confluence with the Gila River
 - k. Santa Cruz River from Tubac to Rio Rico
 - l. Verde River from Cottonwood to the confluence with the Salt River
 - m. White River and tributaries with suitable habitat
4. Encourage federal, state, Native American, and private partners to maintain or increase funding for statewide surveys and develop partnerships with private landowners to survey suitable habitat.
 5. Continue training workshops to improve surveyor knowledge of survey techniques, and also to standardize data reporting, protocol adherence, and interagency communication.

NEST MONITORING

1. Continue to monitor nests within small and large populations of flycatchers to evaluate reproductive success, productivity, cowbird parasitism, predation, and impacts of human and other disturbances.

MANAGEMENT

1. Protect areas with extant flycatcher populations.
2. Create and enforce exclosures on flycatcher breeding areas where feasible to minimize impacts of land uses (for example grazing, water diversion and inundation, and OHV use) on flycatcher breeding habitat.
3. Monitor areas where regeneration of riparian vegetation is occurring and consider for future surveys.
4. Trap cowbirds at the Salt River and Tonto Creek inflows to Roosevelt Lake, and Winkelman Study Area. Initiate trapping at high-risk areas unless there is no evidence of parasitism. Investigate trapping options at corrals, feedlots, and roost sites near flycatcher breeding sites impacted by parasitism.
5. Work with the Arizona Bird Conservation Initiative to encourage and create private/public partnerships for fencing and habitat restoration through federal, state, and non-government programs (for example USFWS Partners for Wildlife, the AGFD Stewardship Program, and the Federal Landowner Incentive Program).
6. Continue and increase communication with federal and state agencies, Native American, and private organizations conducting flycatcher surveys, monitoring, and research, to develop region-wide conservation strategies.

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Appendix A. Survey and detection form for Arizona willow flycatcher surveys, 2002.

Willow Flycatcher Survey and Detection Form (rev. 4/98)

Site Name _____ Was site surveyed in previous year? Yes No
 If yes, what site name was used? _____

County _____ State _____ USGS Quad
 Name _____

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

Site Coordinates: Start: N _____ E _____ UTM
 Stop: N _____ E _____ UTM Zone _____

Elevation _____ feet / meters (circle one)

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

Survey # Observer(s)	Date (m/d/y) Survey time	Number of WIFLs Found	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N	Cowbirds Detected? Y or N	Presence of Livestock, Recent sign Y or N	Comments about this survey
1 _____ _____	Date start stop total hrs _____							
2 _____ _____	Date Start Stop total hrs _____							
3 _____ _____	Date Start Stop total hrs _____							
_____ _____	Date Start Stop total hrs _____							
_____ _____	Date start stop total hrs _____							
Overall Site Summary (Total only resident WIFLs) 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		

Name of Reporting Individual _____ Date Report completed _____

Submit the original of this form. Retain a copy for your records.

Appendix A (continued). Survey and detection form for Arizona willow flycatcher surveys, 2002.

Fill in the following information completely. Submit original form. Retain copy for your records.

Name of reporting Individual _____ Phone # _____

Affiliation _____ Email _____

Site Name _____

Did you verify that this site name is consistent with that used in previous years? Yes No (circle one)

Management Authority for Survey Area (circle one): Federal Municipal/County State Tribal Private

Name of Management Entity or Owner (for example, Tonto National Forest) _____

Length of area surveyed: _____ (specify units, for example, miles=mi, kilometers=km, meters=m)

Did you survey the same general area during each visit to this site this year? Yes/No If no, summarize in comments.
If site was surveyed last year, did you survey the same general area this year? Yes/No If no, summarize in comments.

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) 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/shrubs species: _____

Average height of canopy: _____ (specify units)

Was surface water or saturated soil present at or adjacent to the site? Yes No (circle one)

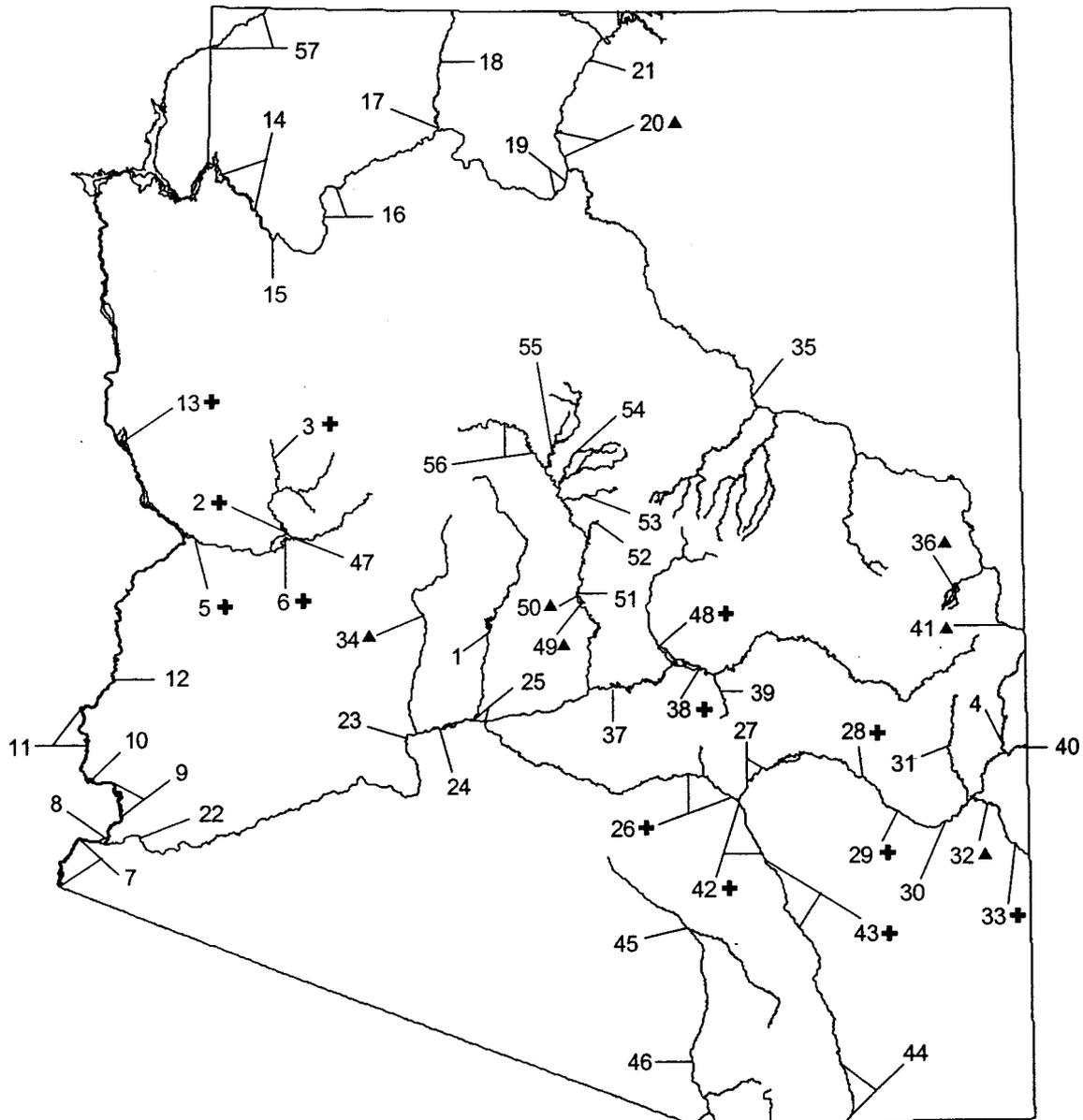
Distance from the site to surface water or saturated soil: _____ (specify units)

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 xerox copy of a USGS quad/topographical map (REQUIRED) of the survey area, noting the survey site and location of WIFL detections. You may 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.

Comments (attach additional sheets if necessary):

Appendix B. Map of sites in Arizona and sites along adjoining water bodies surveyed for willow flycatchers, 2002. (see Appendix C for site names);
+ = Resident willow flycatchers detected and breeding documented, ▲ = Resident willow flycatchers detected (no breeding documented).



Sitename County, Elevation (m), Survey Hours		Map Number	Individual Surveys				Site Summary					
			Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
Waddell Dam Maricopa, 438, 4.25		1	5/24/02 6/14/02 7/10/02	1 0 0	0	0	0	0	0	0	1	Y
Morgan City Maricopa, 445, 4.25		1	5/24/02 6/14/02 7/10/02	0 0 0	0	0	0	0	0	0	0	Y
Lower Big Sandy River Mohave, 357, 4.5		2	6/11/02	12	2	1	1	1	1	10	0	Y
Big Sandy River Downstream US 93 Mohave, 555, 44.58		3	5/23/02 5/24/02 5/30/02 6/6/02 6/13/02 6/14/02 6/28/02 7/2/02 7/9/02 7/15/02	8 4 13 21 5 4 9 21 15 14	24 ^e	21	3	1	0	0	0	Y
Pat Mesa Greenlee, 1326, 20		4	5/15/02 5/16/02 5/31/02 6/10/02 6/11/02 7/1/02 7/2/02	0 0 0 0 0 0 0	0	0	0	0	0	0	0	Y
Monkey's Head La Paz, 143, 168.6		5	Monitored 5/02 to 8/02	N/A	17	9	8	7	0	0	4	Y

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys		Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d
Cave Wash 1 La Paz, 152, 113.25	5	Monitored 5/02 to 8/02	N/A	10	6	4	3	0	2	Y
		Monitored 5/02 to 8/02	N/A	24	12	12	17	0	0	Y
COLORADO STATE										
Hunter's Hole Yuma, 30, 15	7	5/20/02	2							
		5/27/02	4							
		6/5/02	4							
		6/12/02	2	0	0	0	0	0	4	Y
		6/25/02	0							
		7/1/02 7/12/02	0 0							
Gadsden Bend Yuma, 30, 25	7	5/20/02	2							
		5/27/02	6							
		5/30/02	5							
		6/12/02	4							
		6/19/02	2	0	0	0	0	0	6	Y
		6/22/02 6/25/02 6/27/02 7/1/02 7/23/02	0 0 0 0 0							
County 13th St. to County 12th St. Yuma, 35, 1.8	7	5/29/02	1	0	0	0	0	0	1	Y
		6/20/02	0							
		7/5/02	0							
County 12th St. to County 11th St. Yuma, 30, 2.8	7	5/29/02	0	0	0	0	0	0	0	Y
		6/20/02	0							
		7/5/02	0							

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys					Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d			
Adobe Lake La Paz, 61, 14.25	10	5/31/02	2										
		6/4/02	4										
		6/11/02	1										
		6/21/02	1	0									Y
		6/24/02	0										
		7/1/02	0										
		7/7/02	0										
Cibola Lake La Paz, 65, 12.2	11	5/29/02	1										
		6/4/02	1										
		6/18/02	1	0									Y
		6/27/02	0										
		7/10/02	0										
		7/24/02	0										
Cibola Restoration La Paz, 70, 41.6	11	5/17/02	0										
		5/24/02	0										
		5/29/02	0										
		5/31/02	0										
		6/7/02	0										
		6/10/02	1										
		6/14/02	0										
		6/20/02	0										
		6/26/02	0										
		7/1/02	0										
		7/3/02	0										
7/9/02	0												
7/12/02	0												
7/23/02	0												
Ehrenberg La Paz, 79, 13	12	5/29/02	2										
		6/4/02	2										
		6/18/02	2										
		6/27/02	0	0									Y
		7/4/02	0										
7/11/02	0												
Topock Marsh Mohave, 140, 576.5	13	Monitored 5/02 to 8/02	N/A	30	20	10	10	0	0	2	0	Y	

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys			Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
Miles 56.5 to 56.0 R Kwagunt Marsh GC Coconino, 853, 1.1	20	5/17/02	0	0	0	0	0	0	0	N	
		6/5/02	0								
		6/27/02	0								
Miles 51.5 to 50.5 L GC Coconino, 853, 2.6	20	6/5/02	1	2	1	1	0	0	0	N	
		6/27/02	2								
Miles 50.0 to 49.0 R GC Coconino, 853, 1.2	20	5/15/02	0	0	0	0	0	0	0	N	
		6/5/02	0								
		6/27/02	0								
Miles 46.9 to 46.6 R GC Coconino, 853, 1.2	20	6/5/02	0	0	0	0	0	0	0	N	
		6/27/02	0								
Miles 43.8 to 38.8 L GC Coconino, 884, 2.85	20	5/15/02	0	0	0	0	0	0	0	N	
		6/4/02	0								
		6/25/02	0								
Mile 5.2 R GC Coconino, 969, 1.3	21	5/13/02	0	0	0	0	0	0	0	N	
		6/1/02	0								
		6/23/02	0								
[REDACTED SECTION]											
Dome Powerline Yuma, 52, .8	22	6/1/02	0	0	0	0	0	0	0	Y	
		6/19/02	0								
Arlington South Maricopa, 244, 12.25	23	5/25/02	0	0	0	0	0	0	0	Y	
		6/21/02	0								
		7/3/02	0								
West of Airport Road Maricopa, 259, 5.75	24	5/23/02	0	0	0	0	0	0	0	Y	
		6/19/02	0								
		7/3/02	0								

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Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys			Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
Dysart Road Maricopa, 280, 79.5	25	6/17/02	2	2	0	0	0	0	0	Y	
		6/18/02	0								
		6/19/02	0								
		6/25/02	2								
		6/26/02	0								
		7/2/02	0								
		7/3/02	0								
7/10/02	0										
7/11/02	0										
Gila River 123 rd to 107 th Ave Maricopa, 288, 38.75	25	6/18/02	0	0	0	0	0	0	0	Y	
		6/19/02	0								
		6/25/02	0								
		6/26/02	0								
		7/2/02	0								
		7/3/02	0								
7/11/02	0										
7/12/02	0										
GRSN023 Pinal, 536, 4.83	26	5/18/02	0	0	0	0	0	0	0	Y	
		6/1/02	0								
		6/26/02	0								
GRN020 Pinal, 549, 3.68	26	5/16/02	0	0	0	0	0	0	1	Y	
		6/1/02	1								
		6/30/02	0								
GRN018 Pinal, 561, 8	26	Monitored 5/02 to 8/02	N/A	14	7	7	0	0	1	Y	
GRS018 Pinal, 543, 13.25	26	Monitored 5/02 to 8/02	N/A	14	7	7	0	0	3	Y	
GRS015 Pinal, 555, 1	26	5/18/02	0	0	0	0	0	0	0	N	
		6/4/02	0								
		7/1/02	0								

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys			Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
GRN015 Pinal, 550, 4.75	26	5/17/02	0	0	0	0	0	0	0	0	Y
		6/7/02	0								
		7/13/02	0								
Keamy Pinal, 555, 12	26	Monitored 5/02 to 8/02	N/A	27	14	14	0	0	2	0	Y
GRS014 Pinal, 555, 2	26	5/18/02	0	0	0	0	0	0	0	0	Y
		6/4/02	0								
		7/11/02	0								
GRN013 Pinal, 558, 2.75	26	5/22/02	0	0	0	0	0	0	0	0	Y
		7/10/02	0								
GRS013 Pinal, 558, 7	26	5/22/02	0	0	0	0	0	0	0	0	Y
		6/18/02	0								
		7/10/02	0								
GRS012 Pinal, 555, 6.5	26	Monitored 5/02 to 8/02	N/A	5	3	2	2	0	0	0	Y
GRS011 Pinal, 561, 1.75	26	5/21/02	1	2	1	1	0	0	0	0	Y
		6/4/02	2								
		7/1/02	0								
GRN010 Pinal, 573, 6.4	26	5/16/02	1	1	1	0	0	0	0	0	Y
		6/10/02	1								
		7/12/02	1								
GRS010 Pinal, 561, 2.5	26	5/6/02	0	0	0	0	0	0	0	0	Y
		5/18/02	0								
		6/4/02	0								
GRN009 Pinal, 607, 6.3	26	Monitored 5/02 to 8/02	N/A	4	2	2	0	0	0	0	Y

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys			Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
GRS008 Pinal, 567, 5.83	26	5/22/02	0	0	0	0	0	0	0	Y	
		6/5/02	0								
		7/3/02	0								
GRN008 Pinal, 579, 5.17	26	Monitored 5/02 to 8/02	N/A	3	2	1	1	0	0	Y	
		Monitored 5/02 to 8/02	N/A	14	7	7	6	0	0	Y	
GRN007 Pinal, 579, 4.75	26	5/20/02	0	0	0	0	0	0	0	Y	
		7/10/02	0								
GRS004 Pinal, 600, 2.25	26	5/22/02	0	0	0	0	0	0	0	Y	
		6/12/02	0								
		7/3/02	0								
GRN004 Pinal, 585, 10	26	Monitored 5/02 to 8/02	N/A	4	2	2	2	0	2	Y	
		5/19/02	0	0	0	0	0	0	0	Y	
6/6/02	0										
6/30/02	0										
Dripping Springs Campground Pinal, 610, 2.41	27	5/20/02	0	0	0	0	0	0	0	Y	
		6/18/02	0								
		6/30/02	0								
Dripping Springs Wash Gila, 622, 1.75	27	5/20/02	0	0	0	0	0	0	0	Y	
		6/18/02	0								
		6/30/02	0								
Fort Thomas - Geronimo Graham, 805, 3.67	28	5/16/02	30	11	10	1	1	0	19	Y	
		6/12/02	25								
		7/16/02	11								

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Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys					Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d			
Prima East Graham, 856, 36.07	29	5/16/02	0	17 ^e	9	8	8	0	0	4	Y		
		5/21/02	19										
		6/12/02	5										
		6/19/02	16										
		7/16/02	1										
7/17/02	14												
Earven Flat Graham, 951, 3.17	30	5/20/02	0	0	0	0	0	0	0	5	Y		
		6/12/02	5										
		7/17/02	0										
Eagle Creek Greenlee, 1567, 20	31	5/24/02	0	0	0	0	0	0	0	0	Y		
		5/25/02	0										
		5/28/02	0										
		6/4/02	0										
		7/1/02	0										
Guthrie Greenlee, 1029, 3.25	32	5/20/02	0	3	3	0	0	0	0	2	Y		
		6/12/02	5										
		7/17/02	3										
Duncan Greenlee, 1113, 21.58	33	5/22/02	1	3	2	1	1	0	0	0	Y		
		6/11/02	1										
		7/4/02	0										
		7/10/02	3										
		7/17/02	1										
Hassayampa River Preserve Maricopa, 573, 22	34	6/18/02	3	4	3	1	0	0	0	0	Y		
		6/18/02	1										
		6/18/02	0										
		6/28/02	4										
SR 87 Bridge Navajo, 1490, 14.4	35	5/17/02	0	0	0	0	0	0	0	0	Y		
		6/6/02	0										
		6/26/02	0										
		7/3/02	0										
		7/16/02	0										

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys		Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d
Dudleyville Crossing ^f Pinal, 604, 40.93	42	Monitored 5/02 to 8/02	N/A	51	26	25	19	0	4	Y
<i>San Pedro River Preserve</i> Pinal, 604, 20	42	<i>Monitored</i> 5/02 to 8/02	<i>N/A</i>	33	17	16	9	0	4	Y
Malpais Hill Pinal, 634, 11.67	42	Monitored 5/02 to 8/02	N/A	16	8	8	8	0	1	Y
PZ Ranch Pinal, 634, 2.17	42	5/19/02 6/16/02 7/12/02	0 0 0	0	0	0	0	0	0	Y
PZ Ranch West Pinal, 634, 1.08	42	5/19/02 6/16/02 7/12/02	0 0 0	0	0	0	0	0	0	Y
Cook's Lake Cienega / Seep Pinal, 643, 17.42	42	Monitored 5/02 to 8/02	N/A	26	15	12	3	0	1	Y
Aravaipa Inflow North Pinal, 661, 20.48	42	Monitored 5/02 to 8/02	N/A	72	37	36	46	0	2	Y
San Pedro/Aravaipa Confluence Pinal, 658, 14.5	42	Monitored 5/02 to 8/02	N/A	14	7	7	9	0	0	Y
Aravaipa Inflow South Pinal, 658, 12.8	42	Monitored 5/02 to 8/02	N/A	8	4	4	7	0	0	Y
Wheatfields Pinal, 671, 7.17	42	Monitored 5/02 to 8/02	N/A	26	13	13	16	0	1	Y

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys			Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
Wheatfields South Pinal, 671, 8.25	42	5/16/02	0	0	0	0	0	0	1	Y	
		6/11/02	1								
		7/3/02	0								
Cappage Wash Pinal, 681, 4.5	42	Monitored 5/02 to 8/02	N/A	4	2	2	0	0	0	Y	
		5/17/02	0	0	0	0	0	0	0	N	
Cronley Wash South Pinal, 633, .5	42	5/17/02	0	0	0	0	0	0	0	0	
San Manuel Crossing Pinal, 780, 17.5	43	5/15/02	4	11	7	4	3	0	2	Y	
		6/9/02	12								
		7/4/02	11								
Catalina Wash Pinal, 774, 6.2	43	5/16/02	3	5	3	3	3	0	0	Y	
		6/18/02	3								
		7/13/02	5								
Bingham Cienega Pima, 689, 5.92	43	5/17/02	0	3	2	1	1	0	3	Y	
		6/17/02	6								
		7/10/02	3								
Soza Wash Cochise, 914, 12	43	5/27/02	1	2	1	1	1	0	0	Y	
		6/19/02	2								
Cascabel Cochise, 951, 1.67	43	5/31/02	0	0	0	0	0	0	0	Y	
SPRNCA - 9 Cochise, 1158, 12.8	44	5/30/02	0	0	0	0	0	0	0	Y	
		6/11/02	0								
		7/3/02	0								
Charleston Bridge North Cochise, 1189, 33.47	44	5/29/02	0	0	0	0	0	0	0	Y	
		5/30/02	0								
		6/6/02	0								
		6/11/02	0								
		6/25/02	0								

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys		Site Summary							
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
Santa Maria R.											
Lower Santa Maria River Mohave, 354, 3.58	47	6/12/02	5	0	0	0	0	5	0	0	Y
Tonto Creek											
Orange Peel Gila, 610, 41.20	48	Monitored 5/02 to 8/02	N/A	38	19	19	10	0	2	0	Y
Tonto Creek Inflow Gila, 640, 28.25	48	Monitored 5/02 to 8/02	N/A	16	8	8	6	0	5	0	Y
A-Cross Road South Gila, 678, 9.25	48	5/24/02 6/5/02 7/4/02	1 1 0	0	0	0	0	0	1	0	Y
A-Cross Road North Gila, 678, 7.17	48	5/24/02 6/5/02 7/4/02	0 0 0	0	0	0	0	0	0	0	Y
Bar-X Road Gila, 694, 18.5	48	5/26/02 6/4/02 7/7/02	0 0 0	0	0	0	0	0	0	0	Y
Bar-X											
Davenport Maricopa, 576, 7.5	49	5/18/02 6/21/02 7/21/02 8/21/02 8/22/02	4 4 9 0 0	9	5	4	0	0	0	0	Y

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys			Site Summary						
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
Horseshoe North Yavapai, 604, 83.5	50	5/18/02	6	8	6	2	0	0	0	8	Y
		5/21/02	7								
		5/22/02	0								
		6/4/02	9								
		6/20/02	10								
		6/25/02	8								
		7/22/02	16								
		8/22/02	0								
Ister Flat Maricopa, 609, 3.25	51	5/3/02	0	0	0	0	0	0	0	N	
		5/17/2	0								
		6/20/02	0								
Aquaduct Spring Yavapai, 1085, .5	52	5/22/02	0	0	0	0	0	0	0	Y	
Bull Pen Yavapai, 1122, 1	53	5/30/02	0	0	0	0	0	0	0	N	
Stage Stop - Dry Beaver Creek Yavapai, 1103, 4	54	5/30/02	0	0	0	0	0	0	0	Y	
		6/18/02	0								
		7/3/02	0								
Sheepshead Canyon Yavapai, 1052, 3	55	5/29/02	0	0	0	0	0	0	0	Y	
		6/11/02	0								
		7/3/02	0								
Mingus Ave - Rocking Chair Road Yavapai, 994, 16.53	56	5/29/02	0	0	0	0	0	0	0	Y	
		6/14/02	0								
		6/26/02	0								
		7/3/02	0								
		7/16/02	0								
Tapco Yavapai, 1036, 1.58	56	5/27/02	0	0	0	0	0	0	0	Y	
		6/17/02	0								
		7/5/02	0								
Verde @ Powerline Yavapai, 1061, 2.5	56	5/28/02	0	0	0	0	0	0	0	Y	
		6/21/02	0								
		6/28/02	0								

Appendix C. Arizona willow flycatcher survey results by site, 2002 (map numbers correspond to Appendix B.).

Sitename County, Elevation (m), Survey Hours	Map Number	Individual Surveys		Site Summary							
		Survey Date	WIFL ^a	Resident Adult WIFL	Territories	Pairs	Nests	Unknown Status WIFL ^b	Migrant WIFL ^c	BHCO Present ^d	
Nevada Border Mohave, 487, 6.16	57	6/21/02	0	0	0	0	0	0	0	0	Y
		7/5/02	0								
Little Bend Mohave, 518, 9.84	57	5/29/02	0	0	0	0	0	0	0	0	Y
		6/10/02	0								
Big Bend Mohave, 515, 9.83	57	5/30/02	0	0	0	0	0	0	0	0	Y
		6/12/02	0								
Corral Bluff Mohave, 524, 9.67	57	6/24/02	0	0	0	0	0	0	0	0	Y
		5/31/02	0								
Littlefield Mohave, 579, 10.24	57	6/11/02	0	0	0	0	0	0	0	0	Y
		6/25/02	0								
Black Rock Gulch Mohave, 719, 31.32	57	5/24/02	0	0	0	0	0	0	0	0	Y
		6/7/02	0								
		6/26/02	0								
		5/22/02	0								
		5/23/02	0								
		5/28/02	0								
		6/3/02	0								
		6/4/02	0								
6/6/02	0										
6/17/02	0										
7/2/02	0										
7/3/02	0										

^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 or lack of survey data.

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

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

^e Discrepancies between number of WIFL found on individual surveys and number of WIFL in the site summary can be attributed to not all resident WIFL being seen on one day.

^f San Pedro Preserve is part of the Dudleyville Crossing and included in the total for Dudleyville Crossing.

Appendix D. Habitat measurements recorded at willow flycatcher nests located at low-elevation (<1115 m) study areas in Arizona, 2002.

	Nest height (m)	Nest substrate height (m)	Diameter of nest substrate main stem (cm)	Distance from nest to water (m)
Tonto Creek Study Area				
Number of nests ^a	11			
Mean ± s	4.46±1.87	8.21±2.24	8.51±3.57	192.32±189.26
Median	4.5	7.9	7.1	164.1
Minimum	1.6	5.4	5.3	13.7
Maximum	8.1	13.5	17.5	601.9
Salt River Study Area				
Number of nests ^a	33			
Mean ± s	3.79±1.38	6.66±3.47	6.10±4.89	191.68±170.99
Median	3.7	6.3	4.2	158.4
Minimum	1.8	2.7	1.4	7.2
Maximum	7.3	18.0	20.5	834.6
Roosevelt Lake Total				
Number of nests ^a	44			
Mean ± s	3.96±1.52	7.05±3.26	6.71±4.68	191.84±173.46
Median	3.8	6.8	5.5	159.1
Minimum	1.6	2.7	1.4	7.2
Maximum	8.1	18.0	20.5	834.6
Winkelman Study Area				
Number of nests ^a	42			
Mean ± s	5.89±2.78	9.91±3.64	13.17±7.35	12.25± 7.37
Median	5.4	10.0	13.7	6.0
Minimum	1.7	3.3	1.4	0.0
Maximum	14.0	21.0	31.4	91.4

^a Number of nests used in calculation