A Survey Protocol for the Southwestern Willow Flycatcher
(*Empidonax traillii extimus*)

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INTRODUCTION

The southwestern willow flycatcher (*Empidonax traillii extimus*) is a riparian obligate neotropical migrant, nesting in cottonwood-willow associations and structurally similar riparian vegetation associations. The southwestern willow flycatcher has declined through the twentieth century, primarily due to a number of factors, including loss and fragmentation of riparian habitat, brood parasitism by brown-headed cowbirds (*Molothrus ater*), invasion of riparian habitat by the exotic tamarisk (*Tamarix* sp.), and predation (Hunter et al. 1987, Unitt 1987, Hunter et al. 1988, Whitfield 1990, Harris 1991, Rosenberg et al. 1991). In 1991 the U.S. Fish and Wildlife Service (USFWS) designated the southwestern willow flycatcher as a candidate category 1 species (USFWS 1991), indicating that the USFWS had sufficient information to support listing under the Endangered Species Act of 1973, as amended (Act), but that a proposal to list was precluded by other listing actions of higher priority. In July 1993, the USFWS proposed to list *E. t. extimus* as an endangered species and to designate critical habitat under the Act (USFWS 1993). The states of Arizona, New Mexico, and California comprise most of the southwestern willow flycatcher's historic and current range. Each of these states lists the species as endangered [Arizona Game and Fish Department (AGFD) 1988, New Mexico Department of Game and Fish (NMDGF) 1988, California Department of Fish and Game 1991].

Because of the precarious status of the southwestern willow flycatcher (Unitt 1987, USFWS 1993), there is a need to identify as many remaining breeding locations as possible. This survey protocol was developed to facilitate and standardize breeding surveys, and is based primarily on extensive 1992 and 1993 field surveys. It was developed at the request of the Arizona Partners in Flight, an organization of Federal and State agencies, nongovernmental organizations, and individuals. This protocol is intended to be useful throughout the range of the southwestern willow flycatcher. The authors welcome any suggestions on refining this protocol.

NATURAL HISTORY

Description

The southwestern willow flycatcher is a small bird, approximately 15 cm (5.75 in) long. Sexes are alike. The upper parts are brownish-olive; a white throat contrasts with the pale olive breast, and the belly is pale yellow. Two white wing bars are visible, but the eye ring is faint or absent. The upper mandible is dark, and the lower mandible is light. The tail is not strongly forked. When perched, the willow flycatcher often flicks its tail upward. The *Empidonax* flycatchers are renowned as one of the most difficult groups of birds to distinguish by sight alone. Vocalizations and habitat use are critical identification criteria. The song is a sneezy *fitz-bew* , the call a repeated *whitt*. The breeding site is often easily confirmed by the presence of a male singing from an exposed perch, sometimes aggressively attacking other species intruding into its territory.

Taxonomy

The southwestern willow flycatcher (Order Passeriformes; Family Tyrannidae) is a subspecies of one of the 10 North American species in the genus *Empidonax*. The willow flycatcher and alder flycatcher (*E. alnorum*) were once considered the same species, the Traill's flycatcher (*E. traillii*). Some sources [American Ornithologists' Union (AOU) 1983, McCabe 1991)] consider the willow flycatcher and alder flycatcher, and all their subspecies, to constitute a superspecies, the "*traillii* complex." However, the two species are separable by song type, habitat use, structure and placement of nests (Aldrich 1953), ecological separation (Barlow and McGillivray 1983), and genetic differentiation (Seutin and Simon 1988). The breeding range of the alder flycatcher lies generally north of the willow flycatcher, and includes inland Alaska, Canada south of the

Arctic, and the United States in New England and northern portions of the Lake States.

The southwestern willow flycatcher is one of four subspecies of the willow flycatcher most commonly recognized in North America (Hubbard 1987, Unitt 1987). The four subspecies are distinguished primarily by subtle differences in color and morphology, and occupy distinct breeding ranges (Figure 1). The widely distributed *E. t. traillii* breeds across the northern United States and southern Canada, from New England and Nova Scotia west, through northern Wyoming and Montana, and into British Columbia. *E. t. adastus* breeds from Colorado west of the plains, to the west through the intermountain/Great Basin states, and into the eastern portions of California, Oregon, and Washington. The breeding range of *E. t. brewsteri* extends from central/coastal California north, through western Oregon and Washington to Vancouver Island. The breeding range of the southwestern willow flycatcher (*E. t. extimus*) includes southern California (from the Santa Ynez River south), Arizona, extreme southern portions of Nevada and Utah, New Mexico, and western Texas. It may also breed in southwestern Colorado, but nesting records are lacking. Records of probable breeding southwestern willow flycatchers in Mexico are very few and are restricted to extreme northern Baja California del Norte and Sonora (Unitt 1987, Wilbur 1987).

The southwestern willow flycatcher was described by A. R. Phillips (1948), from a collection by G. Monson from the San Pedro River in southeastern Arizona. It is distinguished from other willow flycatchers by color, being somewhat paler, and morphology (primarily wing formula), but not overall size. Observations and recordings made in 1992 and 1993 suggest that *E. t. extimus* may also be distinguished by song dialect (recordings by M. Sogge and J. Travis), and future analysis of dialects is planned. The taxonomic status of *E. t. extimus* was critically reviewed and confirmed by Hubbard (1987), Unitt (1987), and Browning (1993), and is accepted by most authors (e.g., Aldrich 1951, Behle and Higgins 1959, Phillips et al. 1964, Oberholser 1974,

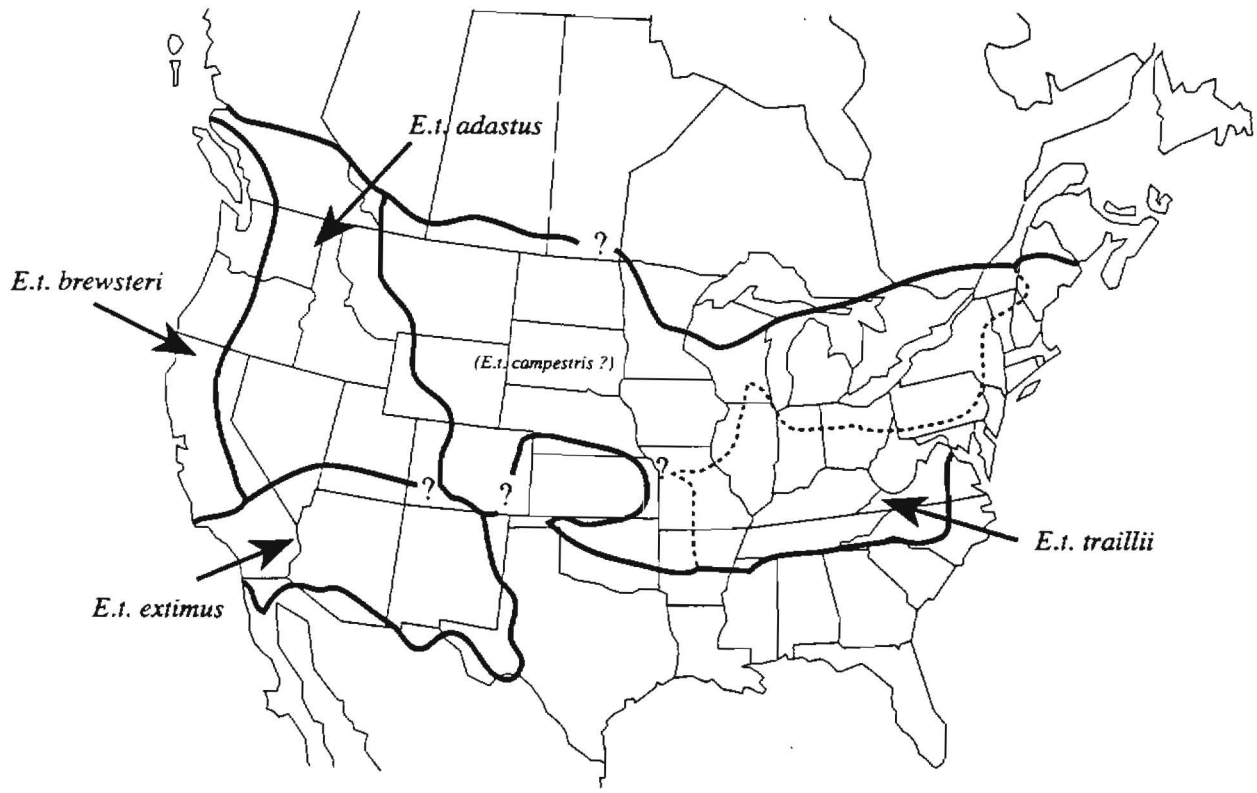


Figure 1. Breeding ranges of the races of the willow flycatcher. Adapted from Unitt (1987), Browning (1993).

Monson and Phillips 1981, Harris et al. 1987, Schlorff 1990, Harris 1991, USFWS 1991 and 1992).

Habitat

The southwestern willow flycatcher breeds in riparian habitats along rivers, streams, or other wetlands, where dense growths of willows (*Salix* sp.), seepwillow (*Baccharis* sp.), arrowweed (*Pluchea* sp.), buttonbush (*Cephalanthus* sp.), or other shrubs and medium-sized trees are present, often with a scattered overstory of cottonwood (*Populus* sp.) (Grinnell and Miller 1944, Phillips 1948, Zimmerman 1970, Whitmore 1977, Hubbard 1987, Unitt 1987, Brown and Trosset 1989, Whitfield 1990). Following modern changes in riparian plant communities in the Southwest, *E. t. extimus* still nests in these native plants where available but is also known to nest in thickets dominated by tamarisk (*Tamarix* sp.) and Russian olive (*Eleagnus angustifolia*) (Zimmerman 1970, Hubbard 1987, Brown 1988). Surface water or saturated soil is virtually always present in or adjacent to nesting thickets (Phillips et al. 1964, Muiznieks et al. 1994). These riparian areas provide nesting and foraging habitat. Throughout the range of *E. t. extimus*, these riparian habitats tend to be rare, widely separated, small and/or linear locales, separated by vast expanses of arid lands.

In general, nests are located in thickets of trees and shrubs approximately 4 - 7 m (13 - 23 ft) tall, with a high percentage of canopy cover, and a large volume of foliage from 0 - 4 m (0 - 13 ft) above ground. However, some variation exists between habitats occupied by southwestern willow flycatchers. Nests and territorial birds have been located in the following general habitats: dense, monotypic stands of willows; dense, monotypic stands of large tamarisk; and dense, diverse associations of cottonwood, willow, boxelder, tamarisk, and ash (Muiznieks et al. 1994). The nest site plant community may be even-aged, or consist of diverse age classes of various plant taxa (Brown 1988, Whitfield 1990, Sedgwick and Knopf 1992, Muiznieks et al. 1994). Sedgwick and Knopf (1992) found that willow flycatchers (*E. t. adastus*) did not use habitat patches composed of very narrow riparian zones, with large distances between willow patches and individual willow plants.

Mesic conditions are an important characteristic of nest sites. Typically, wet conditions (surface water or saturated soil) are adjacent to or underlie nest sites. Nest sites may be associated with large rivers, smaller streams, springs, or marshes (Sogge et al. 1993, Muiznieks et al. 1994). However, some range in mesic conditions is suitable for *E. t. extimus* nesting. Nest sites may be adjacent to active stream channels or may be located at abandoned channels or oxbows where riparian vegetation exists but little or no surface water is present. Some nest sites may have surface water early in the nesting season but dry significantly by mid-summer (Muiznieks et al. 1994; M. Whitfield in litt.). Ultimately, a nest site must have a water table high enough to support riparian vegetation.

Stream gradient may also be an important determinant in the suitability of habitat for *E. t. extimus*. To date, no nest sites have been located along streams of steep gradient, characterized by almost continual riffles, rapids, falls, or other cataracts. This may be because higher-gradient streams tend to form narrower riparian corridors or are confined within narrow, scoured canyons. These riparian habitats may be too narrow to constitute suitable habitat. Also, in many parts of the range of *E. t. extimus*, high-gradient streams are characterized by vegetation which may not be suitable for nesting (e.g., *Platanus* sp.).

At this time, there is not sufficient information to define a minimum habitat patch size capable of supporting nesting southwestern willow flycatchers. Habitat patches used for breeding efforts in the Grand Canyon from 1991 to 1993 varied in size from 0.2 ha (0.5 ac) to 0.9 ha (2.2 ac) (Sogge et al. 1993). Given the limited sample size and the fact that each site supported only a single pair, these figures should be considered very general indications of "suitable" patch size and do not necessarily represent upper or lower limits. The Grand Canyon flycatchers using patches of this size and type (dominated by tamarisk) have declined from 11 pairs to 2 pairs and 3 single birds. At other sites in Arizona, habitat patches supporting multiple breeding pairs were larger (Muiznieks et al. 1994). Throughout its range, the capability of habitat patches to support willow flycatchers is confused by the extreme rarity of the species, unstable populations, and other parameters.

In summary, areas should be considered potential habitat if they provide the following attributes:

- Thickets of willow, buttonbush, seepwillow, tamarisk, or other large shrubs and small trees, possibly with an overstory of cottonwood, boxelder, or other larger trees, with dense vegetation from the ground up to approximately 4 - 7 m (13 ft - 23 ft). Emergent vegetation (e.g., giant reed, cattails, rushes) may also be present.
- Surface water, boggy or swampy conditions, or saturated soil underlying or adjacent to the potential stand during the midsummer breeding season.

Breeding Biology

The southwestern willow flycatcher is a late spring/early summer breeder. It is present and singing on breeding territories by mid-May, although its presence and status is often confused by the migrating, singing individuals of the northern subspecies passing through *E. t. extimus* breeding habitat. Southwestern willow flycatchers build nests and lay eggs in late May and early June, and fledge young in late June or early July (Willard 1912, Brown 1988, Whitfield 1990, Sogge and Tibbitts 1992, Sogge et al. 1993). Some variation in these dates has been observed (Carothers and Johnson 1975, Brown 1988, Muiznieks et al. 1994), and may be related to altitude, latitude, and renesting.

The nest is a compact cup of fiber, bark, and grass, typically with feathers on the rim, lined with a layer of grass or other fine, silky plant material, and often has plant material dangling from the bottom (Harrison 1979). The inside diameter of the nest is approximately 4.5 cm (1.75 in), and 3.8 cm (1.5 in) deep. Outer dimensions are approximately 7.7 cm (3 in) wide and 7.7 cm (3 in) high, excluding dangling material (unpublished notes of Herbert Brown, University of Arizona, Tucson). It is constructed in a fork or on a horizontal branch, approximately 1 - 5 m (3.2 ft - 16 ft) above ground in a medium-sized bush or small tree, typically with dense vegetation above and around the nest (Brown 1988, Whitfield 1990, Muiznieks et al. 1994). Nests sometimes are found with relatively open canopy (Sogge et al. 1993), but this is most often seen in tamarisk stands.

The breeding cycle, from laying the first egg through fledging, is approximately 28 days. Three or four eggs are laid at one day intervals (Bent 1963, Walkinshaw 1966, McCabe 1991). They are incubated by the female approximately 12 days, and the young fledge approximately 13 days after hatching (King 1955, Harrison 1979). Southwestern willow flycatchers typically raise one brood of young per year, but are known to have raised two (Whitfield 1990). Southwestern willow flycatchers are often victims of brood parasitism by the brown-headed cowbird (See "Threats," below).

Territoriality and Feeding Biology

Male flycatchers are territorial during the breeding season, and in California defend areas ranging from approximately 0.065 to 0.38 ha (0.16 to 0.94 ac) (Sanders and Flett 1985). Females settle on territories already occupied by males, and may forage outside the territorial boundaries defended by males. After fledging of young, family groups forage in areas outside the territory (Craig et al. 1992).

The southwestern willow flycatcher is an insectivore. It forages within and occasionally above dense riparian vegetation, taking insects on the wing and gleaning them from foliage (Bent 1963). The flycatcher also forages along water edges, backwaters, and sandbars adjacent to nest stands. No known reports detail specific prey items.

Migration

Willow flycatchers are neotropical migrants. The southwestern willow flycatcher arrives in breeding habitat as early as mid-May (one record of 1 May; Muiznieks et al. 1994) and may be present until mid-August. Migration routes and wintering range are not well known. Willow flycatchers (various subspecies) have been reported to sing and defend winter territories in Mexico and Central America (Gorski 1969, McCabe 1991). Southwestern willow flycatchers most likely winter in Mexico, Central America, and perhaps northern South America. However, the habitats it uses on wintering grounds are unknown. Tropical deforestation may restrict wintering habitat for this and other neotropical migratory birds (Finch 1991).

THREATS

The southwestern willow flycatcher faces threats of extensive loss of breeding habitat, which have occurred due to urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, off-road vehicle and other recreational uses, and hydrological changes resulting from these and other land uses. It is also severely threatened by brood parasitism by the brown-headed cowbird (Unitt 1987, USFWS 1993) and perhaps bronzed cowbird (*Molothrus aenus*).

Large scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats of the southwestern willow flycatcher (Phillips et al. 1964, Johnson and Haight 1984, Katibah 1984, Johnson et al. 1987, Unitt 1987, General Accounting Office 1988, Dahl 1990, State of Arizona 1990). Changes in the riparian plant community have resulted in the reduction, degradation and elimination of nesting habitat for the willow flycatcher, curtailing its range, distribution and numbers (Serena 1982, Cannon and Knopf 1984, Taylor 1986, Unitt 1987, Schlorff 1990).

Present and historic overuse by livestock has been a major factor in the degradation and modification of riparian habitats in the western United States. These effects include changes in plant community structure and species composition, and relative abundance of species and plant density, all of which directly affect the habitat characteristics critical to the southwestern willow flycatcher. Livestock grazing in and near riparian areas may also impact the willow flycatcher through direct mortality. Livestock have been documented making physical contact with nests or nest substrates (*E. t. adastus* and *E. t. brewsteri*, no known records for *E. t. extimus*), resulting in destruction of nests and spilling out eggs or nestlings (Serena 1982, Stafford and Valentine 1985, Valentine et al. 1988). Finally, livestock facilitate brood parasitism by fragmenting habitat and providing foraging sites for cowbirds (Hanna 1928, Mayfield 1977, Flett and Sanders 1987, Valentine et al. 1988). The negative effects of livestock on willow flycatchers are well documented (Klebenow and Oakleaf 1984, Taylor 1986, Taylor and Littlefield 1986, Harris et al. 1987, Valentine et al. 1988).

Another likely factor in the loss and modification of southwestern willow flycatcher habitat is invasion by the exotic tamarisk (*Tamarix* sp.) plant. The spread and persistence of tamarisk has resulted in significant changes in riparian plant communities. Disturbance regimes imposed by humans (e.g., grazing, water diversion, flood control, woodcutting, vegetation clearing) have facilitated the spread of tamarisk (Kerpez and Smith 1987, Rosenberg et al. 1991). The rapid spread of tamarisk has corresponded with the decline of the southwestern willow flycatcher; it is generally absent where the exotic tamarisk has replaced native riparian vegetation. While direct cause-and-effect relationships are not proven, conversion to tamarisk typically corresponds with reductions or complete loss of bird species strongly associated with cottonwood-willow habitats. These include the yellow-billed cuckoo (*Coccyzus americanus*), summer tanager (*Piranga rubra*), northern oriole (*Icterus galbula*), and the southwestern willow flycatcher (Hunter et al. 1987, Hunter et al. 1988, Rosenberg et al. 1991).

Some authors believe tamarisk may not provide the thermal protection that native broadleaf species do (Hunter et al. 1987, Hunter et al. 1988). This could be important at lower elevations in the Southwest, where extreme high temperatures are common during the bird's midsummer breeding season. Nesting southwestern willow flycatchers have been found in tamarisk at middle elevations [approximately 625 - 1200 m (2000 ft - 3500 ft)], on the Colorado River (Brown 1988; Sogge et al. 1993), Salt River area (Muiznieks et al. 1994), the Rio Grande (Hundertmark 1978, Hubbard 1987), and the San Pedro River (Hunter et al. 1987). Conversely, nesting southwestern willow flycatchers are not found in tamarisk at lower elevations, e.g., the lower Colorado River [approximately 100 m (330 ft)]. Territorial birds present in the Yuma area (33m/100 ft) in 1993 were confined to a remnant patch of cottonwood-willow habitat. Invasion by tamarisk may also significantly change the local insect fauna (Carothers and Brown 1991). Another speculated effect of tamarisk is that its branch structure and wispy foliage allow flycatcher nests to be more readily detected, hence parasitized, by cowbirds moving through nest stands. Where nesting

success in tamarisk has been determined, it appears to be low (Brown 1991, Sogge and Tibbitts 1992, Sogge et al. 1993, Muiznieks et al. 1994).

Brood parasitism by the brown-headed cowbird (*Molothrus ater*) also threatens the southwestern willow flycatcher. Cowbird parasitism results in reduction or elimination of reproduction. Cowbirds lay their eggs in the nests of other, usually smaller, songbirds. The cowbird often removes a number of the hosts' eggs from the nest equal to the number laid by the cowbird. The host species then incubates the cowbird eggs, which hatch after a relatively short incubation (12 days), usually prior to the hosts' own eggs. Thus, the young cowbirds have several advantages over the host's young; they hatch earlier, they are larger, and they are also more aggressive than the host's young. Cowbird nestlings typically outcompete those of the host species for parental care, and the number of the host species' own reproduction is reduced or eliminated (McGeen 1972, Mayfield 1977, Brittingham and Temple 1983). Brood parasitism of the southwestern willow flycatcher by brown-headed cowbirds is well documented (Rowley 1930, Garret and Dunn 1981, Brown 1988 and 1991, Whitfield 1990, Harris 1991, Sogge et al. 1993, Muiznieks et al. 1994). The introduction of modern human settlements, livestock grazing, and other agricultural developments have resulted in habitat fragmentation, which facilitates cowbird parasitism. Simultaneously, livestock grazing and other agricultural developments served as vectors for cowbirds, providing feeding areas in or near host species' nesting habitats (Hanna 1928, Mayfield 1977).

SURVEY OBJECTIVES

Primary Objectives

The primary purpose of this document is to provide a standard survey technique that can be used to detect breeding southwestern willow flycatchers. This will provide, at a minimum, documentation of presence or absence of the species in surveyed habitat and allow monitoring of population trends. This should allow land and resource managers to fulfill their basic information needs.

Because specific survey objectives determine the amount, intensity, and timing of survey efforts, these objectives should be defined prior to planning and conducting the surveys. The protocols outlined below can be adapted to meet any of the following objectives:

(1) Determine presence/absence of male willow flycatchers;
(2) Determine breeding status of resident willow flycatchers;
(3) Collect productivity and breeding biology information;
(4) Describe habitat characteristics and habitat use patterns.

Secondary Objectives-Additional Information Needs

Surveys may also be designed to gather additional data, which will be of value in refining our knowledge of the southwestern willow flycatcher and its threats, and addressing management needs. Secondary survey objectives include:

(1) Presence or absence of cowbirds;
(2) Presence or absence of livestock;
(3) Recordings of songs and calls.

SPECIAL CONSIDERATIONS

To avoid any potential impacts on willow flycatchers, some special considerations should be kept in mind while performing all surveys and nest examinations. Although there is some potential for increased predation and parasitism due to observer disturbance at the nest, most studies have shown that careful observation of nests does not increase the incidence of nest predation (Roseberry and Klimstra 1970, Willis 1973, Klimstra and Roseberry 1975, DeSante 1982, Blancher and Robertson 1985). Limited and careful nest site visits by observers generally do not cause nest abandonment in most birds, although excessive visits may cause disturbance (Blancher and Robertson 1985, Sogge unpublished data). However, some general guidelines [detailed in Ralph et al. (1993)] should be used to guarantee the least intrusive approach, consistent with the survey objectives.

(1) Exercise caution while moving through the typically dense vegetation of willow flycatcher habitat. Continuously check the area around you for nests of willow flycatchers and other species, to avoid disturbance.

(2) Exercise caution while examining nests:
   a. Approach nests slowly, to avoid startling birds.
   b. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent.
   c. Use a mirror on a long or telescoping pole to observe nest contents. Again, avoid physical contact between the pole and nest or nest tree.
   d. Never approach and leave a nest by the same route. This leaves a "dead end" trail, which could guide a potential predator to the nest/nest tree.

(3) Do not needlessly elicit vocal responses with taped calls, once willow flycatchers have been located. This may distract resident birds from brooding or feeding young, or defending their territory.

(4) Because of concerns for the flycatcher and potential changes in its legal status, state and/or federal permits may be necessary for some survey and monitoring activities. Consult appropriate agency contacts listed on page 15 for details.

EQUIPMENT

The following equipment is necessary to conduct the surveys:

(1) Light-weight tape player (with adequate volume to carry well)
(2) Extra batteries
(3) Willow flycatcher tapes; recommend two 30-60 second repeating tapes (one for "back-up"). Tapes can be obtained through the agency contacts listed on page 15.
(4) Clipboard and writing implements
(5) Aerial photograph or sketch of site (if available)
(6) USGS topographical maps of the area
(7) Binoculars and bird field guide
(8) Data recording forms
(9) Appropriate clothing, sunscreen, and insect repellent (the survey site may be hot, damp, or marshy)
(10) Camera and film

All survey results should be recorded on data forms. If no willow flycatchers are detected, or habitat is believed to be unsuitable, this is valuable information and should be recorded. Data forms should be designed to prompt surveyors to record all desired information. Examples of data forms are provided in Appendices 1 and 2.

IDENTIFICATION OF WILLOW FLYCATCHERS

Vocalizations

The only sure way to identify willow flycatchers in the field is by their vocalization. Willow flycatchers use two primary vocalizations, both of which may be given in response to tape-playback:

(1) *Fitz-bew*. This is the typical male territorial song. It is typically given by a male, usually from the top of tall vegetation. Males may also sing this while moving about in dense vegetation. The *fitz-bew* song may also be given by females, but this is thought to be rare. The southwestern willow flycatcher's song appears to be slightly protracted, more liquid or trilled, than the songs of other subspecies (as found on commercial bird call tapes). While other subspecies sing a crisp *fitz-bew*, *E. t. extimus* often sings *fitza-bew*, *fit-zabew*, or even *feech-a-bew*, often with a very burry *bew* syllable.

(2) *Whitt*. This is a call often used by birds on their territory, and is commonly given in conjunction with the *fitz-bew*. The *whitt* call appears to be used as a contact call between sexes, and also seems to function as an alarm call, particularly when responding to a tape-playback within the territory boundaries.

The *fitz-bew* and *whitt* calls are the primary vocalizations used to detect and verify presence of willow flycatchers. However, several other willow flycatcher vocalizations may be heard much less commonly. Among the other syllables are a *creeet* and a *wheak-dee-dee*. These vocalizations are typically given during interactions between mates, often near the nest or nest-site-to-be (J. Sedgwick in litt.). Therefore, while these vocalizations are heard rarely, they are of great potential value in locating nest sites.

Male vocalization rates are greatest early in the breeding season (late May - early June), and appear to decline after their eggs hatch (Sanders and Flett 1989, Sogge and Tibbitts 1992). However, in areas with many willow flycatchers, the birds seem to continue vocalizing throughout the season (Craig et al. 1992). Females readily vocalize with *whitt* calls, and may also sing (*fitz-bew*). Unfortunately, even tape-playback songs sometimes fail to elicit any response at locations known to be occupied by nesting southwestern willow flycatchers, particularly late in the breeding season (Sogge et al. 1993, Muiznieks et al. 1994).

Eggs and Young

Southwestern willow flycatcher nests are often parasitized by brown-headed cowbirds. Bronzed cowbirds are also present in portions of southwestern willow flycatcher breeding range and are spreading northward, and may become a problem in the future. Thus, it is important to be able to distinguish the eggs and young of the willow flycatchers from those of the two cowbird species. Fortunately, several characteristics can be used to separate the species, and are described below and in Table 1.

Willow flycatcher eggs are buffy or light tan, approximately 18 mm long and 14 mm wide, with brown markings concentrated around the widest part of the blunt end (Figure 2a). Brown-headed

Table 1. Summary of egg and nestling morphology characteristics

Trait	Willow Flycatcher	Brown-headed Cowbird	Bronzed Cowbird
Egg Color	Buffy/light tan with brown markings at widest end	Bluish/grey with heavy brown spotting over entire egg	Light blue-green, somewhat glossy, with no spotting or streaking
Flanges/tomia Color	Yellow	White (*M. a. artemisiae*) Yellow (*M. a. obscurus*)	White
Mouth Lining Color	Yellow	Red/Orange	Red/Orange

cowbird eggs are slightly larger than willow flycatcher eggs. Cowbird eggs are bluish or greyish, average approximately 21.5 mm long and 16.5 mm wide, and are evenly dotted with brown, somewhat heavier at the large end (Figure 2b). Bronzed cowbird eggs are pale bluish-green, immaculate with no markings, and somewhat glossy. Each species' eggs are oval, but brown-headed cowbird eggs may vary considerably from this shape (Harrison 1979).

Nestlings of these species may be more difficult to differentiate, especially immediately after hatching. However, within several days differences become fairly obvious. Nestling weights for days 1 through 3 average 1.5 g, 2.5 g, and 4.0 g for willow flycatchers; brown-headed cowbirds average 2.5 g, 4.5 g, and 8.0 g. After the third day size differences are very pronounced. The color of the mouth lining is of particular value in determining species. The inside of the mouth of willow flycatchers is yellow (J. Sedgwick, pers. comm.; Figure 3a), while both cowbirds have red or orange mouth linings (Rothstein 1978; Figure 3b). Although the color of rictal flange/tomia is yellowish in both willow flycatchers (J. Sedgwick, pers. comm.) and *Molothrus ater obscurus* (which occurs throughout most of *E.t. extimus* range), it is pinkish or white/grey in other cowbirds (Rothstein 1978). Thus, a combination of flange and mouth color characteristics can be used to differentiate nestling willow flycatchers and cowbirds.

Cowbirds may also hatch several days before the flycatchers, and flycatchers will sometimes stop incubating before their own eggs hatch. Thus, any nestling much larger than the rest or a nestling that is several days old and alone in a nest that still contains some eggs is likely to be a cowbird and should be carefully examined (S. Rothstein in litt..)

SURVEY PROTOCOL

Preparation for Conducting Surveys

Surveyors must be trained in the survey technique, and should be experienced birders. Information on training techniques can be obtained through the USFWS or State Partners in Flight organization, or the agency contacts listed on page 15. Surveyors should study drawings and photographs of the species, and where possible, examine study skins or mounts. It is particularly important for surveyors to become familiar with willow flycatcher vocalizations before going in the field. This can be done by listening to willow flycatcher tapes, available as companions to the National Geographic and Peterson Field Guide series. Local recordings of southwestern willow flycatchers are now often available through the State Partners in Flight organizations. If at all possible, surveyors should visit known willow flycatcher breeding sites in order to become familiar with flycatcher appearance, behavior, vocalizations, and habitat. Such visits should be coordinated with USFWS and State wildlife agencies, and must avoid disturbance to resident flycatchers. Surveyors should also be familiar, by sight and vocalizations, with other species likely to be found in survey areas which may be confused with southwestern willow flycatchers. Surveyors should also be able to identify (by sight and sound) brown-headed cowbirds.

Timing

Conduct surveys during the early nesting season to maximize likelihood of detection, determine breeding status and success, and to verify subspecies status through nesting behavior (Unitt 1987; Brown 1988, 1991; Craig et al. 1992). Surveys conducted too early or too late in the breeding cycle can create confusion due to detection of migrant willow flycatchers.

Initial surveys should be conducted in late May/early June with follow-up surveys in the latter half of June, because: (a) southwestern willow flycatchers do not arrive in their breeding range until early- to mid-May (Unitt 1987); (b) the primary nesting season for southwestern willow flycatchers is June; and (c) other subspecies of willow flycatcher (primarily *E.t. brewsteri*) are migrating through the region before June and after July (Unitt 1987). There is limited value in earlier or later visits, unless following up on a known nesting site. If survey resources (funding, personnel) are limited, surveys should be done in early to mid-June (5th to 20th) to guarantee appropriate timing.

Number of Visits

Survey sites should be visited at least twice. The first visit (late May or early June) is timed to detect willow flycatchers and locate potential nesting sites, near the onset of egg laying. The second visit (mid-late June or early July) should be timed to re-survey sites in order to detect late settling or breeding males. This second trip can also confirm possible nesting sites, and assess nesting success, at all occupied locations identified on the first visit. When possible, an additional "follow-up" should be made to sites where willow flycatchers were detected, yet the breeding status may not have been determined. This "follow-up" visit would only examine sites at which willow flycatchers had been detected on previous trips. For example, if a singing male but no nest was found during the second visit, this site should be visited during the "follow-up" trip to determine if the male was still present, and if it was breeding.

Survey Protocol/Methods

Survey protocols and methods are described below, to fulfill all primary and secondary objectives. This protocol is primarily a tape-playback survey. At each site, surveyors should broadcast recorded vocalizations of willow flycatchers, a proven method for eliciting a vocal response from nearby resident flycatchers (Seutin 1987, Craig et al. 1992, Sogge and Tibbitts 1992). This method also allows positive identification of the responding bird's species by comparison to the "known" tape.

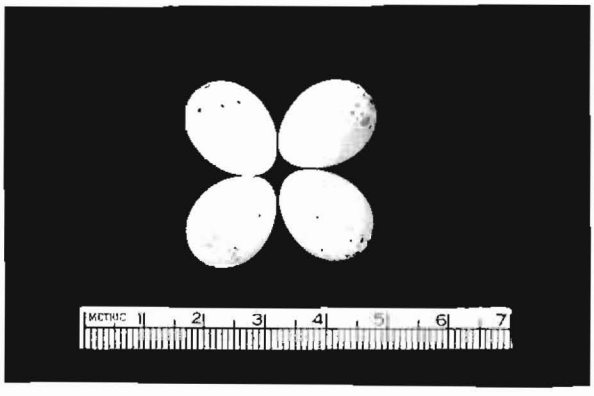
Objective #1: Determine presence/absence of male willow flycatchers.

Begin surveys as soon as there is enough light to safely walk (about one hour before sunrise) and end by about 0900 or 1000 hours, depending on temperature. If observers are camped in or near potential habitat, surveys can also be conducted from late afternoon to dusk, when willow flycatchers may again sing and/or respond to tape-playback calls (Sogge unpublished data, Sogge and Tibbitts 1992, Sogge et al. 1993). However, emphasis should be placed on morning surveys. Afternoons and evenings may be more advantageously spent in reconnaissance of areas to be surveyed the following morning.

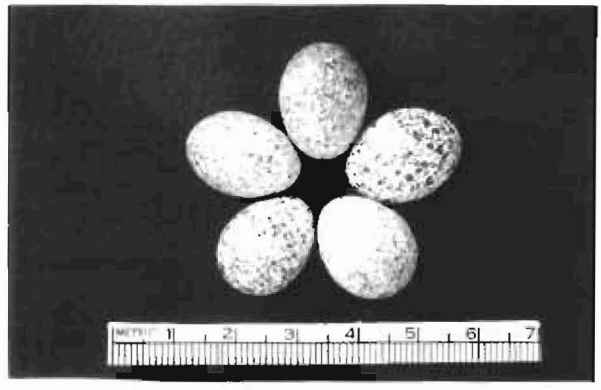
Surveyors should walk through, or adjacent to, surveyed habitats whenever possible. Where terrain or dense vegetation prohibits walking through the habitat, surveying can be done from the periphery. Initially approach each site and stand quietly for 1-3 minutes, listening for spontaneous singing by nearby males. If a detection is made, proceed to Objective #2, below. If not, continue as follows. Broadcast the willow flycatcher song tape for 15-30 seconds, then listen for approximately 1-3 minutes for a response. Repeat this procedure every 20-30 meters throughout each survey site, more often if background noise is loud. The tape should be played at about the volume of natural bird calls, not loud enough to cause distortion of song, and should include a series of 3-4 *fitz-bews*, interspersed with several *whitts*.

Response to the tape-broadcast call could take several forms. Usually, a willow flycatcher will approach the observer and: (a) sing (*fitz-bew*) from within or the top of vegetation; (b) give alarm (*whitt*) calls from within nearby vegetation; or (c) watch silently from nearby vegetation. The bird may not approach closely, but instead vocalize from a short distance away, depending upon your location in relation to their territory boundaries. Actively territorial breeding flycatchers almost always vocalize strongly when a tape is played from within their territory, particularly if surveys are conducted early in the breeding cycle and if neighboring territorial males are present.

Whenever a willow flycatcher is detected, carefully document the location on aerial photographs or sketches of the area, and complete a willow flycatcher detection form (Appendix 2). Sketches should be made on the back of the sighting form, and should include shape and proportions of the area surveyed, major habitat features, conspicuous landmarks, and compass directions. The site should also be marked on a USGS topographical map (with instructions for specific locations) so the site can be found again. If possible, movements of flycatchers should be shown on the sketch or photo. **Whenever a willow flycatcher breeding territory or nest site is confirmed, please notify the USFWS, State wildlife agency, and/or State Partners in Flight coordinator immediately, so that additional data may be collected (See "Contacts," page 15).** A willow flycatcher survey form (Appendix 1) should be filled out for each survey done, at each site visited, whether or not willow flycatchers are detected. "Negative data," a lack of detections, is important in order to document absence of willow flycatchers and to describe "vacant" habitat.



A



B

Figure 2. Eggs of (A) southwestern willow flycatcher and (B) brown-headed cowbird. Eggs and photo from the Western Foundation of Vertebrate Zoology collections.

A

B

Figure 3. Nestling (A) southwestern willow flycatcher and (B) brown-headed cowbird (*Molothrus ater artemisiae*). Note the differences in color of the mouth lining. Photos by Jim Sedgwick.

Objective #2: Determine breeding status.

If a singing or territorial willow flycatcher is detected, the site is considered a potential territory. To determine breeding status, observers should move a short distance away from where the bird was sighted, find a good vantage point, and watch closely to detect any nesting activity. Signs of possible nesting activity include:

(a) observation of another "unchallenged" willow flycatcher in the immediate vicinity;
(b) *whitt* calls between cohabiting flycatchers;
(c) *creeet* or *wheak-dee-dee* calls between cohabiting flycatchers;
(d) territorial defense (singing or physical aggression) against another flycatcher or bird species (e.g., cowbird);
(e) carrying of nest material or food (insects); or
(f) locating an active nest. [Ralph et al. (1993) presents useful tips for detecting nesting activity for most passerines, which are useful for willow flycatchers.]

Record the type(s) of breeding activity observed on the willow flycatcher detection form (Appendix 2). Note the locations of breeding activities on a map, sketch and/or photograph of area.

To locate a nest, observe flycatcher behavior long enough that the diagnostic activities described above are seen to focus on a small area within the habitat patch. Once the suspected nest area is narrowed down, approach it cautiously, slowly, and with minimum disturbance to all vegetation **(See "Special Considerations," above).** Nesting willow flycatchers will often *whitt* and approach you when you are close to a nest. Carefully examine the trees and shrubs in the suspected area for a nest matching the description given above, in "Breeding Biology".

Objective #3: Collect productivity and breeding biology information.

Determine nesting status by carefully observing the contents of any nest found. Information including clutch size, number and age of young, and presence of cowbird eggs or young should be noted. Nests that are located should be checked only once each survey trip, using a mirror mounted on a long/telescoping pole (See "Special Considerations," above). Record the breeding data on the willow flycatcher detection form (Appendix 2).

Objective #4: Describe habitat characteristics and habitat use patterns.

General habitat parameters can be estimated quickly during a visit to the site using the survey and/or detection forms (Appendices 1 and 2). Important data include dominant species composition, areal extent, and general structure. Include a map or sketch delineating layout of habitat types. Describe site moisture, e.g., surface water quantity, quality, proximity, etc.

Detailed nest site data are valuable to determine willow flycatcher breeding habitat needs. After fledging has taken place (or a nesting attempt fails), examine nests and make nesting location measurements. Important data include nesting substrate, placement within the vegetation, and distance to water. Contact State wildlife management agency, Fish and Wildlife Service, and/or National Biological Survey regarding possible research needs for collected nests. DO NOT COLLECT NESTS WITHOUT PROPER PERMITS AND COORDINATION WITH LAND MANAGERS/OWNERS.

Secondary Objectives-Additional Information Needs

Secondary Objective #1: Presence or absence of cowbirds.

To assess the threat of cowbird parasitism, regardless of willow flycatcher findings, note presence or absence of cowbirds in all areas surveyed. Note the number and behavior of cowbirds observed, and the response(s) of any willow flycatchers. As described above (Objective #3), note the presence or absence of cowbird eggs or young in the nest. Cowbird information should be reported on all willow flycatcher data forms.

Secondary Objective #2: Presence or absence of livestock.

Note presence or absence of livestock or signs of livestock in all areas surveyed, regardless of willow flycatcher findings. Note presence of animals, tracks, feces, corrals, feedlots, etc. Livestock information should be reported on all willow flycatcher data forms. Any qualifications that can be provided on livestock presence (e.g., stocking rates, seasonality) are also valuable.

Secondary Objective #3: Recording songs and calls.

Preliminary recordings (Sogge, unpublished data) suggest that the southwestern willow flycatcher may have a song dialect that is distinguishable from other willow flycatcher subspecies. To further investigate this possibility, high-quality recordings (made using a parabolic microphone) of southwestern willow flycatchers will be of considerable use. If surveyors are able to collect vocalization recordings, please inform the authors of this protocol so that they may coordinate with you regarding the recordings.

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Willow Flycatcher Survey Form

APPENDIX 1

SITE INFORMATION

Site Name: _____ County: _____

Site Ownership: _____ USGS Quad Name: _____

(Attach xerox of surveyed area.)

Site Location: T _____ R _____ Sec(s) _____ UTM _____ Elev. _____

T _____ R _____ Sec(s) _____

Survey Date: _____ Survey Time: Start _____ End _____

Tape-playback method used? (Circle one) Y N

Date site last surveyed: _____ WIFL present during previous surveys: Y N

Surveyor(s) [name/affiliation]: _____

Weather: Temp (min/max): _____ Wind (min/max): _____ Cloudcover % _____ Precip: _____

Background noise: (Describe wind, stream, etc.) _____

_____

_____

SPECIES OBSERVED

Willow Flycatcher (circle one): Absent Present

If present, fill out flycatcher detection form

Brown-headed Cowbird (circle one): Absent Present

Number observed: Male _____ Female _____ Unknown _____

Describe cowbird activity (e.g., singing, flying over, etc). _____

_____

HABITAT

Describe general habitat (include dominant vegetation, density, etc): _____

_____

_____

Describe patch morphology (include shape, height, terrain; describe understory, midstory, canopy)

_____

_____

Water present: Y N Describe: _____

Size of Area (ha): _____ Estimated or measured? _____

Were Livestock present? Y N Type _____ Number _____

Any sign of livestock? Y N Type of sign (e.g., dung, hoof prints, trails, etc.) _____

_____

COMMENTS: _____

_____

_____

Please attach a xerox of a topographical map of survey area, and mark survey area, patch shape and vegetation makeup, survey route in relation to patch, etc. If a xerox of a topographical map of survey area is not attached, please use this area to sketch survey area, patch shape and vegetation makeup, survey route in relation to patch, important landmarks, etc.

Willow Flycatcher Detection Form

APPENDIX 2

Site Name: _____ County: _____

Site Ownership: _____ USGS Quad Name: _____

(Attach xerox of surveyed area.)

Site Location: T _____ R _____ Sec _____ UTM _____ Elev. _____

Surveyor(s) [name/affiliation]: _____ Survey Date: _____

Bird Detected Before Playback? Y N Did Bird Respond to Playback? Y N

Describe Response: _____

Type of Initial Detection: Visual / Aural / Both

Number of Birds Detected in this Patch: _____ Male _____ Female _____ How Sex Determined? _____

Pair(s) confirmed? Y / N # of Pairs: _____ How Determined? _____

Any Young of Year? _____ HowDetermined? _____

Degree of Certainty of Species ID (circle one): 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Describe Quality of Detection (how far/long seen, lighting, vocalizations, etc.):

_____

_____

_____

Describe Flycatcher's Behavior (how using habitat):

_____

_____

Describe Any Signs of Breeding Behavior (e.g., territorial defense, paired birds, carrying nest material, etc.):

_____

_____

_____

Nest Found ? Y N (fill out nest data [on back] if possible)

Cowbirds present? Y N How Many: Male_____ Female _____ Unknown _____

Describe Willow Flycatcher Response to Cowbirds:

_____

_____

Comments:

_____

_____

_____

Make a sketch of the area (on the back of this form and/or xerox map or aerial photo) to show location of patch, key landmarks, general vegetative characteristics, willow flycatcher location and movements within the patch, nest site, etc. A photograph of the habitat patch or willow flycatcher observation area is also useful and should be attached if available.

Willow Flycatcher Nest Site Data
(DO NOT TOUCH ACTIVE NEST OR NEST TREE)

How Was Nest Found?: _____
Nest Fully Constructed? Y N
If not, describe state of construction and why you think it is a willow flycatcher nest: _____
_____
_____

Number of Eggs: WIFL _____ BHCO _____ Number of Young: WIFL _____ BHCO _____
Age of Young (describe): _____

Description of Nest Location (mark the location on the sketch below or on aerial photo):
_____
_____

General Description of Nest Habitat:
_____
_____

Nest Substrate (plant species in which nest is placed): _____

If the nest is still active, estimate the following from a distance, being careful to avoid disturbance to the nest. If the nest is no longer active, measure accurately using a meter tape or meter stick.

Height of nest: ____ Nest Substrate Height: _____ Nest Substrate dbh: _____ Patch Height:_____

Distance From Nest to:

Substrate Center: _____ Canopy Top: _____ Substrate Edge: _____
Nearest Edge of Vegetation Type: _____ Nearest Edge of Patch: _____
Distance to water _____ Type of Water: _____ Height above water: _____

Are the above measurements estimated _____ or measured _____?
Were photos taken of the nest or nesting habitat? Y N Are photos attached? Y N

Use this area to draw a sketch of the willow flycatcher site and/or nest site. Indicate vegetation patch borders, major landmarks, watercourses, etc. Please give some indication of scale and the direction "North". If possible, indicate flycatcher movements within the patch (e.g., where bird was located; song perches; nest site, etc.).