U.S. Fish & Wildlife Service

Expansion of QZM inspection stations in the Upper Colorado River Basin

Species Survey Guidelines (22 Species)

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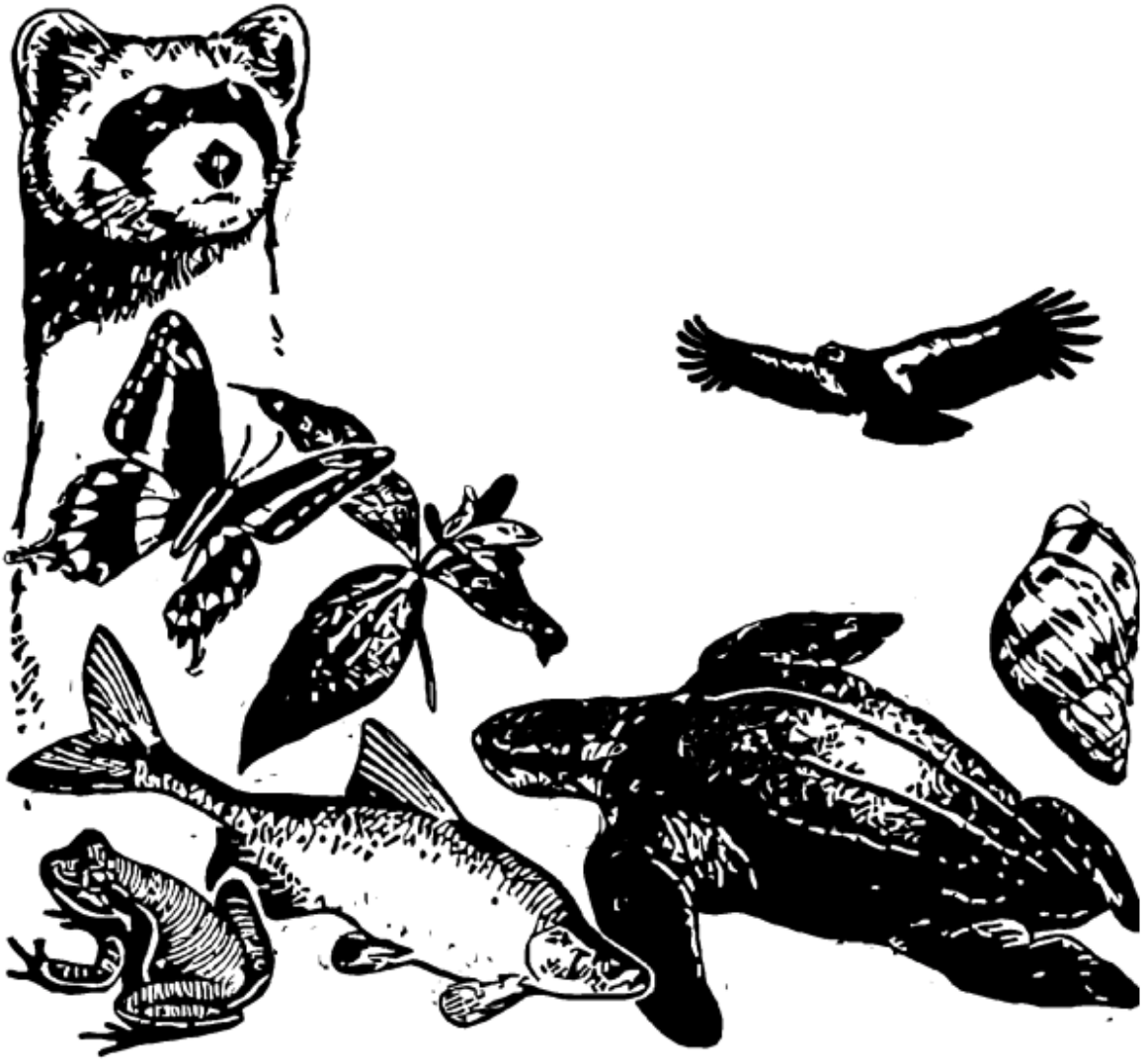

IPaC - Information for Planning and Consultation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish and Wildlife Service environmental review process.

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Species Document Availability

Species with survey guidelines

- Barneby Reed-mustard Schoenocrambe barnebyi
- Barneby Ridge-cress Lepidium barnebyanum
- Clay Phacelia Phacelia argillacea
- Clay Reed-mustard Schoenocrambe argillacea
- Heliotrope Milk-vetch Astragalus montii
- Jones Cycladenia Cycladenia humilis var. jonesii
- Kodachrome Bladderpod Lesquerella tumulosa
- Last Chance Townsendia Townsendia aprica
- Mexican Spotted Owl Strix occidentalis lucida
- Navajo Sedge Carex specuicola
- Pariette Cactus Sclerocactus brevispinus
- San Rafael Cactus Pediocactus despainii
- Shrubby Reed-mustard Schoenocrambe suffrutescens
- Siler Pincushion Cactus Pediocactus (=Echinocactus,=Utahia) sileri
- Southwestern Willow Flycatcher Empidonax traillii extimus
- Uinta Basin Hookless Cactus Sclerocactus wetlandicus
- Utah Prairie Dog Cynomys parvidens
- Ute Ladies'-tresses Spiranthes diluvialis
- Welsh's Milkweed Asclepias welshii
- Winkler Cactus Pediocactus winkleri
- Wright Fishhook Cactus Sclerocactus wrightiae
- Yellow-billed Cuckoo Coccyzus americanus

Species without survey guidelines available

- Black-footed Ferret Mustela nigripes
- Blowout Penstemon Penstemon haydenii
- Bonytail Gila elegans
- Brady Pincushion Cactus Pediocactus bradyi
- California Condor Gymnogyps californianus
- California Condor Gymnogyps californianus
- Canada Lynx Lynx canadensis
- Chapin Mesa Milkvetch Astragalus schmolliae
- Clay-loving Wild Buckwheat Eriogonum pelinophilum
- Colorado Hookless Cactus Sclerocactus glaucus
- Colorado Pikeminnow (=squawfish) Ptychocheilus lucius

Debeque Phacelia Phacelia submutica

Dudley Bluffs Bladderpod Lesquerella congesta

Dudley Bluffs Twinpod Physaria obcordata

Fickeisen Plains Cactus Pediocactus peeblesianus fickeiseniae

Gray Wolf Canis lupus

Greenback Cutthroat Trout Oncorhynchus clarkii stomias

Grizzly Bear Ursus arctos horribilis

Gunnison Sage-grouse Centrocercus minimus

Humpback Chub Gila cypha

Jemez Mountains Salamander Plethodon neomexicanus

June Sucker Chasmistes liorus

Kendall Warm Springs Dace Rhinichthys osculus thermalis

Knowlton's Cactus Pediocactus knowltonii

Least Tern Sterna antillarum

Mancos Milk-vetch Astragalus humillimus

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New Mexico Meadow Jumping Mouse Zapus hudsonius luteus

North American Wolverine Gulo gulo luscus

Northern Mexican Gartersnake Thamnophis eques megalops

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Pagosa Skyrocket Ipomopsis polyantha

Pallid Sturgeon Scaphirhynchus albus

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Penland Alpine Fen Mustard Eutrema penlandii

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Rio Grande Silvery Minnow Hybognathus amarus

Uncompahgre Fritillary Butterfly Boloria acrocnema

Virgin River Chub Gila seminuda (=robusta)

Western Prairie Fringed Orchid Platanthera praeclara

Whitebark Pine Pinus albicaulis

Whooping Crane Grus americana

Zuni Bluehead Sucker Catostomus discobolus yarrowi

Zuni Fleabane Erigeron rhizomatus

APPENDIX D - MEXICAN SPOTTED OWL SURVEY PROTOCOL

U.S. FISH AND WILDLIFE SERVICE, 2012

INTRODUCTION

The following field survey protocol is designed for detecting Mexican spotted owls (hereafter, "owl"; *Strix occidentalis lucida*) and for surveying areas where human activities might remove or modify owl habitat, or otherwise adversely affect the species. The owl was federally listed as threatened on March 16, 1993 (58 FR 14248). Federal agencies are not required to conduct surveys for listed species prior to preparing a biological assessment under the Endangered Species Act ["Act"; see 50 CFR 402.12(f)]. However, Federal agencies are required to provide the best scientific information available when assessing the effects of their actions to listed species and critical habitat [50 CFR 402.14(d)]. In the absence of necessary information, the U.S. Fish and Wildlife Service (FWS) gives the benefit of the doubt to the listed species [H.R. Conf. Rep. No. 697, 96th Cong., 2nd Sess. 12 (1979)].

This survey protocol expresses the FWS's scientific opinion on adequate owl survey methods and includes guidance and recommendations. It does not constitute law, rules, regulations, or absolute requirements. Our knowledge is continuously developing and changing; therefore, this protocol, which is based upon the best scientific data available, is a work in progress. This protocol will be modified as new information becomes available. The public will be notified of changes to the protocol and surveyor qualifications through postings to the FWS's Arizona Ecological Services Field Office (AESO) (http://www.fws.gov/southwest/es/arizona/MSO). We encourage submissions to us (email submissions to Shaula_Hedwall@fws.gov) at any time of any information that can add to our understanding of what is needed to provide for long-term conservation of this species and its ecosystem. Persons conducting owl surveys must be covered under a research and recovery permit under Section 10(a)(1)(A) of the Act in order to avoid unauthorized harassment of owls, which could violate the prohibitions of Section 9 of the Act. However, no other Federal permitting requirements are implied, though individual states might have their own permitting requirements. Circumstances dictate how owl surveys are implemented. If surveys cannot be accomplished pursuant to this protocol, we recommend contacting the nearest FWS Ecological Services Field Office (ESFO) for guidance on additional survey methods before proceeding.

The FWS endorses the use of this protocol for obtaining information on owl occupancy within and adjacent to proposed project areas. This protocol helps the public and agency personnel determine whether proposed activities will have an impact on owls and/or owl habitat. A properly conducted survey will help agencies determine whether or not further consultation with the FWS is necessary before proceeding with a project. Any information on owl presence within and/or adjacent to the proposed planning or activity areas is important, even if it does not meet the guidelines described below. However, if the only owl location information available for a proposed project was acquired through surveys not conducted in accordance with this protocol, the FWS may conservatively assess the impacts of the proposed management activity on owls, (e.g.) assume the species is present in or near the action area if the best available information

makes such an assumption reasonable. This survey protocol is not designed for monitoring owl population trends or for research applications.

The generally accepted protocol for inventorying Mexican spotted owls was developed by the Southwestern Region of the U.S. Forest Service (FS) in 1988. The protocol was revised in 1989 and in 1990 it was appended to the Forest Service Manual. The protocol, as an element of Interim Directive No. 2, had an official duration of 18 months but has served as the guidance accepted by most agencies and individuals conducting surveys for owls on public lands throughout Arizona, New Mexico, Utah, and Colorado through 2003. The FS reissued the inventory protocol in 1994, again in 1995, and then issued the latest version in February 1996. The FS incorporated recommendations from the draft and subsequent final Recovery Plan for the Mexican Spotted Owl (USDI FWS 1995) regarding the designation of protected activity centers (PACs) around owl locations but did not modify the overall survey design.

Through application of and the use of the data gathered by the existing protocol under informal and formal consultations under Section 7 of the Act, the FWS has found instances where the refinement of the protocol would benefit both the species and those working with it. On January 26, 1998, the FWS met with a group of experts to review the FS protocol and available literature and to improve and update the document. The following draft document is the result of those discussions and subsequent review by FWS biologists and Mexican Spotted Owl Recovery Team members.

This protocol provides a FWS-endorsed method to: 1) make inferences regarding the presence or absence of owls in a defined area; 2) assess occupancy and nesting status, and locate nests, in PACs or in areas where habitat alterations or disturbances to owls are likely to occur; and, 3) provide information to allow designation of PACs.

The primary objective of conducting surveys using this protocol should be to locate and observe the nest of a Mexican spotted owl or young. These observations provide the most reliable and efficient information for documenting presence and delineating potential nest core areas or roost sites (Ward and Salas 2000). Because spotted owls do not nest every year, the alternative, and often default outcome, is to observe adult or subadult spotted owls at daytime roosts. However, it can take up to four years of roost location data to effectively delineate owl core activity areas (Ward and Salas 2000). Locating a resident owl's nest or young may be accomplished most effectively using the mousing technique described in the protocol below (and see Forsman 1983). The mousing technique requires that personnel are trained in proper care and handling of live animals for research, and that, when conducting daytime follow-up surveys, they procure and carry "feeder" mice into the field (American Society of Mammalogists 1998, National Academy of Sciences 1996).

Individuals surveying for owls should meet certain training standards. Experience will be reviewed and approved during a surveyor's application for an FWS issued Section 10(a)(1)(a) recovery permit. These standards strongly encourage surveyors to have knowledge of this protocol and the ability to identify owls visually and vocally, determine sex and age of owls, imitate vocal calls of the owls if not utilizing a tape recording of the calls, and identify other local raptor species. Orienteering skills, including use of map, compass, and/or Global

Positioning System (GPS) units, are essential. Surveyor safety should be of primary importance. Those surveying for owls who do not meet these training standards could "take" owls by harming or harassing them, resulting in criminal or civil penalties.

MEXICAN SPOTTED OWL SURVEY PROTOCOL

The most efficient way to locate owls is to imitate their calls (Forsman 1983). The owl is territorial and responds to imitations of its common vocalizations. Night calling is used to elicit responses from owls and locate the general areas occupied by them. Daytime follow-up visits are used to locate roosting and/or nesting owls and to further pinpoint the activity centers of individual owls. If owls are located, mice are offered to them to locate mates, nests, and young. The information collected from nighttime calling surveys and daytime follow-up surveys assist biologists and land managers to determine whether areas are occupied or unoccupied by owls and to determine the owl's reproductive status.

Throughout this protocol, all bold-faced terms are included in the glossary. Only the first use of the term is bold-faced. An outline summarizing the primary steps for implementing the protocol appear below.

1. Survey Design

The survey design uses designated **calling routes** and **calling stations** to locate owls. The intent of establishing calling routes and calling stations is to obtain **complete coverage** of the survey area so that owls will be able to hear a surveyor calling and a surveyor will be able to hear the owl(s) responding.

A. The survey area should include all areas where owls or their habitat might be affected by management actions. If an area is relatively large, it can be subdivided into manageable subunits to achieve the best survey results. In general, the survey area should include the survey area and an 800-meter (0.5-mile) area from its exterior boundaries. Within the project area, all areas that contain forested **recovery habitat**, riparian forest, and canyon habitat, or might support owls, are surveyed as defined in this revised Recovery Plan. Descriptions of owl habitat for different areas and physiographic provinces should be available from various state and Federal wildlife agencies.

   Where known **protected activity centers (PACs)** exist within the survey area, calling routes can be adjusted to lessen disturbance to established PACs.

B. Owl surveyors should establish calling routes and calling stations to ensure complete coverage of the survey area. The number of calling routes and calling stations will depend upon the size of the area, topography, vegetation, and access. Calling stations should be spaced from approximately 400 meters (0.25 mile) to no more than 800 meters (0.5 mile) apart depending upon topography and background noise levels. Nighttime calling routes and calling stations should be delineated on a map, reviewed in the field, and then relocated, as necessary, to improve the survey effectiveness.

2. Survey Methods

Owls are usually located using nocturnal calling surveys where a surveyor imitates the territorial calls of an owl (Forsman 1983). Upon hearing a suspected intruder within their territories at night, most owls respond by calling to and/or approaching the intruder.

A. CALLING

1. Owls call during all hours of the night. However, optimal survey times include two hours following sunset and two hours prior to sunrise, and surveys should be concentrated around these periods.

2. Surveys should use nighttime surveys for all calling routes in the survey area unless safety concerns dictate that a daytime survey is necessary.

3. Calls can be imitated by the surveyor or by playing recordings of owl vocalizations. If a tape recorder is used, both the tape and tape deck used should be of high quality. Tape decks should have a minimum output of 5 watts (Forsman 1983).

4. The vocal repertoire of owls consists of a variety of hooting, barking, and whistling calls (Ganey 1990). Three call types accounted for 86 percent of calling bouts heard in Arizona: four-note location call, contact call, and bark series. The four-note call appears to be used the most frequently by owls defending a territory. It is suggested that surveyors use all three of these calls during surveys, with the four-note call as the primary call.

5. Surveyors should discontinue calling when a potential owl **predator** is detected, and should move on to another calling station out of earshot of the predator before resuming calling. Surveyors should return at a later time to the station(s) skipped to complete the calling route. If the predator is detected again, the surveyor may try active listening rather than calling at the station. Other solutions completing routes with high-densities of predators, such as great-horned owls, may include active listening at these stations in order to complete the route. Please contact the FWS Mexican spotted owl lead if there are concerns regarding spotted owl predator detections on survey routes.

6. Surveyors should avoid calling for owls during periods of rain or snow, unless there is only a light misting of rain or snow that would not affect the surveyor's ability to detect owls. Surveying during inclement weather could prevent a surveyor from hearing owl responses and reduce the quality of the overall survey effort. Negative results collected under inclement weather conditions are not adequate for evaluating owl presence/**absence**. There is also the added risk of inducing a female owl to leave the **nest** during inclement weather and potentially jeopardizing nesting success.

7. Calling should not be conducted when the wind is stronger than approximately 24 km (15 miles) per hour or when the surveyor feels that the wind is limiting their ability to hear an owl. Consider using the Beaufort Wind Strength Scale. Level 4 describes winds 21 to 29

km (13 to 18 miles) per hour as a moderate breeze capable of moving thin branches, raising dust, and raising paper.

B. SURVEYS

To ensure complete coverage of the survey area, surveyors should select the best survey method for the situation and/or terrain. An owl survey might require a combination of methods, which are defined below, including: 1) calling stations; 2) continuous calling routes to obtain complete coverage of an area; and, 3) leapfrog techniques. Each of these methods is designed for nighttime calling and involves calling for owls and listening for their responses. All surveys where occupancy status is unknown should include nighttime calling.

It is <u>imperative</u> that, whatever method is used, surveyors actively listen during owl surveys. Owls may respond only once; therefore, surveyors must concentrate on listening at all times during surveys. In addition to active listening, surveyors should watch for owls that might be drawn in but do not respond vocally.

1. CALLING STATIONS

a. **Spacing** - Calling stations should typically be spaced approximately 400 meters (0.25 mile) to no more than 800 meters (0.5 mile) apart depending on topography and background noise. In some situations (i.e., complex topography, etc.), establishing calling stations <400 meters apart and more calling stations increases the likelihood of detecting owls. In canyon habitat, if surveying from the canyon bottom, stations should be placed at canyon intersections. If surveying canyons from the rims, calling stations at points and canyon heads should be included.

b. **Timing** - Surveyors should spend at least 15 minutes at each calling station: 10 minutes calling and listening in an alternating fashion, and the last 5 minutes listening. Owl response time varies, most likely because of individual behavior. Some owls will respond immediately, some respond following a delay, and some do not respond. In canyon habitat, it is recommended that surveyors spend a minimum of 20 minutes (30 minutes, if possible) at each station.

c. **Visitation** - Vary the sequence of visitation to calling stations, if possible, during subsequent visits to the area. For example, the order of the calling stations can be reversed. Varying the order of calling stations avoids potential bias related to time of night or other factors.

d. **Intermediate calling stations** should be used when factors decrease the probability of achieving complete coverage using the originally designated stations, or as triangulation points for determining nighttime owl locations. Use of intermediate calling stations can increase the likelihood of detecting owls and, thus, allow for stronger inference regarding the absence of an owl within the area.

2. CONTINUOUS CALLING METHOD

In some cases, using continuous calling is appropriate. Continuous calling involves imitating owl calls at irregular intervals while walking slowly along a route and stopping regularly to listen for owl responses. Because of the sounds produced by walking (e.g., snapping twigs, pinecones, etc.), surveyors utilizing this calling method must concentrate on active listening. In canyon habitat, the continuous calling method is only recommended when combined with calling stations.

a. The surveyor should walk slowly (5 km per hour [3.3 miles per hour]) so as to minimize the possibility that an owl responds after surveyors are out of hearing range (i.e., allow time for owls to respond).

b. The surveyor must stop regularly (400 meters [0.25 mile]) along the route to listen for owl responses.

3. LEAPFROG METHOD

The leapfrog method is very useful when roads allow for coverage of all or a portion of the survey area. This method requires two people and a vehicle.

a. One surveyor is dropped off and begins calling while the other person drives the vehicle ahead at least 800 meters (0.5 mile). The second person then leaves the vehicle for the first person and proceeds ahead while calling.

b. Each surveyor should follow the continuous calling method. The first person continuously calls as he or she walks towards the vehicle, drives the truck at least 800 meters (0.5 mile) past the second person (i.e., "leapfrogs"), leaves the vehicle there and resumes calling along the survey route.

c. Surveyors should repeat this procedure until complete coverage of the survey area is accomplished.

3. Number and Timing of Surveys

Owl detection rates change with season, owl activity, and habitat. Ganey (1990) found that calling activity was highest during the nesting season (March-June). Information from past survey efforts indicate that owl response can also vary with habitat type and/or reproductive chronology (Fig. D.1). Generally, late March through late June is the optimal time period to detect owls. Surveys conducted during March-June will increase the likelihood of detecting owls. Additionally, if owls are not detected when surveys are conducted properly and at these peak times, then inferences about absence of owls in a given area will be stronger. It should be noted that responses in September can be used only to document presence. Surveys in September are not reliable for locating nests, delineating PACS, and/or inferring absence.

Specific criteria on number and timing of surveys are used to determine whether a **complete inventory** has been accomplished. A complete inventory requires that at least four properly scheduled complete surveys be accomplished annually for two years. Additional years of surveys strengthen any inferences made in cases where owls are not detected. If habitat-modifying or potentially disruptive activities are scheduled for a particular year, the second year of surveys should be conducted either the year before or the year of (but prior to) project implementation. In other words, projects should occur as soon as possible after completion of surveys to minimize the likelihood that owls will be present during project implementation. If more than five years have elapsed between the last survey year and the initiation of the proposed action, then one additional year of survey is recommended prior to project implementation.

A. In compliance with the guidelines in B through G below, surveyors should conduct four **complete surveys** during each breeding season. A complete survey can be a combination of a pre-call (daytime reconnaissance of habitat to be night called), a nighttime calling survey, and, if owls are detected, a **daytime follow-up survey**. If owls are not detected during daytime calling, night calling must be completed. However, if owls are located during a pre-call, night calling of the survey area is not required. Surveyors might want to conduct additional surveys if there is evidence that additional owls remain undetected in the area.

B. The four complete surveys must be spread out over the breeding season (1 March - 31 August) by following one of three recommended scheduling scenarios:

   1. Conducting two to four surveys during 1 March - 30 June, with no more than one survey in March. Owl calling activity tends to increase from March through May (Ganey 1990), so this time period is optimal for locating owls.

   2. Completing all surveys by 31 August, with no more than one of the four required surveys conducted in August. Owl response rates tend to decrease by July (Ganey 1990). By September, juveniles have usually dispersed and adults are not necessarily on their territories. If additional surveys are needed (e.g., more than the recommended four surveys), then more than one complete survey could be completed in August.

   3. Allowing at least five full days between surveys. For example, assume a visit ends on 30 April. Using a proper five-day spacing (1-5 May), the next possible survey date would be 6 May (see section 3.D below for an exception to this rule).

C. A complete survey of the area should be conducted within seven consecutive days. If the area is too large to be surveyed in seven consecutive days, it should be divided into smaller subunits based on available owl habitat, topography, and other important factors.

D. In **remote areas,** surveyors can conduct two complete surveys during one trip into the area, so long as surveyors allow a minimum of two days between complete surveys. Conduct all field outings required for a complete survey prior to repeating any route for the second survey. Wait a minimum of 10 days before starting the next two surveys. **Areas defined as remote should be cleared with the FWS prior to proceeding with this deviation from the survey protocol.**

E. The two- to three-hour periods following sunset and preceding sunrise are the peak owl calling periods and the best times to locate owls in or near day **roosts** or nests.

F. Surveys can be discontinued in a given area when data indicate that the entire survey area is designated as PACs.

G. Vocal or visual locations of owls outside the breeding season (1 September - 28 February) as extra information can be of assistance in locating nesting owls in the upcoming breeding season.

4. Methods After Detecting a Mexican Spotted Owl

Once an owl has been detected, the following should be done:

A. Record the time the owl(s) was first detected, the type(s) of call(s) heard (if any), the owl's sex, and whether **juveniles** were detected.

B. Record a compass bearing from the surveyor's location to the location where the owl was heard and/or visually observed. If possible, triangulate the owl's location, taking compass bearings from three or more locations and estimate the distance to the owl. Record both the location where the owl responded from and the surveyor's calling location and triangulation locations on a map or photo attached to the survey form. The surveyor should know her/his location at all times. Triangulating provides an accurate means to map the owl's location. Attempt to confirm the presence of the owl(s) with a daytime follow-up visit (see section 5 below). Daytime owl locations, particularly of nests and young of the year, are very important in determining activity centers.

C. If the owl is heard clearly, and the call type and direction are confirmed, there is no need to continue calling. If, however, there is some doubt as to whether a response was detected, or from which direction, the surveyor should listen carefully for a few minutes, as an owl may call again if given the opportunity. If the owl does not respond after two to five minutes, the surveyor should continue calling to confirm owl presence and better assess the direction of the call. Do not call any more than is necessary. By stimulating the owl(s) to move you may harass a female owl off a nest or increase an owl's risk of predation.

D. Owls may move before or after they begin calling. Every effort should be made to estimate the location of the owl when the first response was heard. After you have determined the owl's location (see section 4.B above), move approximately 800 to 1,200 meters (0.5 to 0.75 mile) away (depending upon topography) before continuing surveys to avoid response by the same owl. If the owl responds from the original detection area, then move farther away before continuing to call.

E. Record the approximate location (bearing and distance), sex, age, and species of all other raptors heard in the survey area.

F. Conduct a daytime follow-up survey as soon as possible (see section 5 below).

5. Conducting Daytime Follow-up Surveys

As with nighttime surveys, follow-up daytime searches ensure quality of results and standardization of effort. Calling to elicit territorial responses is also used during daytime follow-up visits. A daytime follow-up survey helps locate owl roosts, nest sites, and young of the year (during 1 Jun - 1 Aug) by conducting an intensive search within the general vicinity of the original night response location. Owls tend to be more active in the early morning and late evening. During the day, owls are sleepy and do not always readily respond to calling, especially on warm days. Therefore, it is critical that surveyors conduct a thorough daytime search of the response area. Surveyors should spend enough time within the response area to cover all habitats within at least an 800-meter (0.5 mile) radius of the response location. This involves walking throughout the area, calling, listening, and watching for owl sign (e.g., whitewash, pellets, etc.). The FWS recommends that a minimum of one hour be spent searching for owls (regardless of the number of people surveying).

A. Complete a daytime follow-up survey as soon as possible, but within a maximum of 48 hours after owls are detected during nighttime surveys. The optimum daytime follow-up time is the morning following the nighttime detection. In general, the longer the time delay between the nighttime response and daytime follow-up survey, the smaller the probability of locating the bird and finding its roost or nest location. This is especially true if the owl(s) are not nesting. If the daytime follow-up survey is performed longer than 48 hours after the nighttime detection and no owls are found, the survey is considered incomplete and the survey must be re-done.

B. Conduct daytime follow-up surveys in the early morning or late afternoon/early evening. The optimal dawn period is 0.5 hour before sunrise to two hours after sunrise and the optimal dusk period is two hours prior to sunset; each daytime follow-up visit should include one of these time periods. Investing time in searching for the owl during these times will provide a more reliable inference of absence in the case where the owl cannot be located. For areas where spotted owls have been observed during the daytime during previous years, an initial survey in late April through mid-May can often elicit a response. However, non-responses are not that meaningful in documenting absence without nighttime surveys because owls could have moved to another nesting or roosting grove. Initial daytime surveys can be an efficient way to start each survey season where owls have been found in the past. If the initial daytime survey is unsuccessful (i.e., no response is heard), then nighttime surveys should be used to locate owls before attempting additional daytime surveys.

C. The search area for a daytime follow-up survey is a specific, smaller area within the broader survey area in which an owl was detected.

1. Minimum search area is all recovery habitat within at least an 800-meter (0.5-mile) radius of a nighttime owl response.

2. The search area should center on the location of the owl or owls that were heard during the nighttime survey. If there is some uncertainty, focus the search on the best nesting and roosting habitats (e.g. see Ward and Salas 2000).

3. Aerial photos and maps of the area should be studied to identify habitat patches and topographic features, such as canyons or drainages, to prioritize daytime survey locations. In forested areas, spotted owls often roost in first- and second-order tributaries (Ward and Salas 2000).

D. To conduct a thorough search for owls, the surveyor should systematically walk and call all forested recovery, riparian forest, and canyon habitats within the search area. As with nighttime surveys, be aware that owls often fly into the area to investigate; thus, surveyors must also attentively watch for owls. Surveyors should also search for signs of owls such as pellets, white wash, or molted feathers. However, pellets and whitewash alone are not sufficient to document owls. Mobbing jays or other birds can also be a sign that an owl is present.

E. If a daytime follow-up visit is not completed for any reason, or the search effort was not thorough because of the presence of predators or weather, a second follow-up visit should be conducted as soon as possible.

F. If no owl(s) are located during complete daytime follow-up visits, the surveyor should return to conduct nighttime surveys. Four complete surveys to an area are recommended by the survey protocol, but surveyors should assess the confidence of the nighttime and daytime responses and determine if additional nighttime surveys are needed to more accurately determine the location of the responding owl(s). Field personnel conducting surveys need to be given the flexibility to return as many times as necessary to find the owl(s).

G. As with nighttime surveys, daytime follow-up surveys should not be conducted in inclement weather and surveyors should avoid calling when potential owl predators are present.

H. Surveyors should minimize the amount of incidental disturbance to owls. For example, surveyors must not linger in nest sites or over-call in an area.

6. Methods If Mexican Spotted Owls Are Located on a Daytime Follow-up Visit

Mousing is the primary tool to locate an owl's mate, young, and/or nest. Mousing entails feeding live mice to **adult/subadult** owl(s) and observing the owl's subsequent behavior. Surveyors should be prepared to offer four mice (one at a time) to at least one member of the pair or to a single owl located on the daytime follow-up visit. For surveyors to draw conclusions about reproductive status, the owl must take at least two mice before refusing them. A mouse is considered "refused" if, after 30 minutes, it has not been taken by an owl.

If an owl takes a mouse and flies away, the surveyor should follow it as closely as possible to determine where it takes the mouse. If the surveyor is unable to follow the owl, and doesn't know if it took the mouse to a mate, nest, or fledged young, then the fate of that mouse cannot be counted toward the four-mouse minimum described above. Surveyors should be ready to rapidly pursue owls that take mice, as owls sometimes fly several hundred meters with mice to reach their nests or young. It is not necessary to complete the four mice minimum after a mouse has unequivocally been taken to a nest.

Owl pairs are determined to be non-nesting if a single owl eats and/or caches all four mice or eats and/or caches two mice and refuses to take a third. A mouse is cached when the owl puts the mouse in a tree or on the ground and then leaves the mouse or the owl perches with the mouse for at least one hour and gives no sign of further activity. Do not feed any more mice than necessary to determine pair status, nest location, and/or reproductive status (i.e., if all observed juveniles have received a mouse then number of young produced is determined and there is no need to continue mousing). Dropped mice or mice whose fates are unknown do not count toward the total of four mice needed to complete the protocol.

Ancillary notes on an owl's behavior during the mousing attempts are also very important to record. These observations can help clarify situations in which incomplete information was collected. For example, if a male is given a mouse and begins to make single-note contact calls while looking in a specific direction in April-June, that is often a good clue that a mate, nest, and/or young may be present. Sometimes observers are too close to other owls or the nest for the "true" mouse fate to be observed. Such observations should trigger another daytime follow-up to secure the location of a mate, nest, or young of the year. For these types of additional follow-up surveys, nighttime calling is usually not necessary.

7. Determining Status from Nighttime Surveys and Daytime Follow-up Visits

A. "Pair status" is established by any of the following:

1. A male and female owl are heard and/or observed in proximity (500 meters or 0.31 mile apart) to each other on the same visit.
2. A male takes a mouse to a female (see section 6 mousing guidelines).
3. A female is observed or heard on a nest.
4. One or both adults are observed with young.
5. At least one young of the year is observed.

B. "Single status" is inferred from:

1. A daytime observation on a single occasion or nighttime responses of a single owl within the same general area (within 500 meters or 0.31 mile) on two or more occasions, with no response by an owl of the opposite sex after two complete inventories (two years of survey); or

2. Multiple responses over several years from a bird of the same sex (i.e., two responses in the first year of surveys and one response in the second year of surveys, from the same general area).

Determining if the responses occur within the same general area should be based on topography and the location of any other known owls in the surrounding area.

C. "Two birds, pair status unknown" is inferred from:

The presence or response of two owls of the opposite sex where pair status cannot be determined.

D. "Status unknown" is inferred by:

The response of a male and/or female spotted owl that does not meet any of the above criteria. We recommend additional years of survey if this is the site status following a complete inventory of the site.

E. "Absence" is inferred:

If a complete inventory has been conducted according to this protocol, or an alternative protocol approved by the FWS, and no owls are heard. However, absence does not necessarily indicate that owls never occupy the area.

F. Separate territories are inferred by:

When two responses are recorded from owls that are more than 800 meters (0.5 mile) apart. These responses should be considered from individuals in separate territories unless daytime follow-up visits indicate otherwise. Ideally, surveyors on two or more crews should coordinate efforts to begin calling simultaneously near each suspected activity area to rule out the existence of multiple territories. If more than one survey crew elicits responses from owls of the same sex at roughly the same time, then two or more territories probably exist. However, if responses vary from those above, the results are considered inconclusive and additional attempts to determine status should continue. Keep in mind that some spotted owls shift their use of an area after failing to nest in a given season. Hence, responses heard in July that are 800 meters (0.5 mile) from a pair that was nesting in April or early May could be from the same individuals.

8. Determining Nesting Status and Reproductive Success

Determining reproductive success is not required if breeding season restrictions that protect owl reproduction are applied to all management projects in any given year. However, reproduction surveys are always valuable as they can provide information on nest tree locations, which provide the best data for determining 100-acre **core areas** (Ward and Salas 2000) and delineating PAC boundaries as recommended in the revised Recovery Plan. If the exact location of the nest is not determined, but juveniles are seen prior to August, the area where the juveniles are seen

can be referenced as the **nest stand**. There are two stages of reproduction surveys: nesting status and reproductive success.

A. Determining Nesting Status:

1. Nesting-status surveys should be conducted between 1 April and 1 June. The start date is based on nesting initiation dates. Young identified after 1 June would still confirm that nesting occurred but would not allow identification of the exact location of the nest. However, young observed prior to August are usually within 400 meters (0.2 miles) of the nest of that year (Ward and Salas 2000) and this information can be useful in delineating a 100-acre nest buffer.

2. Mousing should be used to determine nesting status. The site is classified as nesting, non-nesting, or unknown nesting status based on the surveyor's observations.

3. Two observations at least one week apart are necessary to determine nesting status if the first observation occurs before 1 May. This is necessary because the owls may show signs of initiating nesting early in the season without actually laying eggs and their behavior could be mistaken for nesting behavior. After 1 May, a single observation of nesting behavior is sufficient.

4. The owls are classified as nesting if, on two visits prior to 1 May, or one visit after 1 May:

   a. The female is seen on the nest;

   b. Either the male or female member of a pair carries a mouse to a nest; or

   c. Young-of-the-year are detected.

5. The owls will be classified as non-nesting if any of the following behaviors are observed. Two observations, minimum three weeks apart, are required during the nest survey period (1 April - 1 June) in order to infer non-nesting status. Because nesting attempts might fail before surveys are conducted, the non-nesting status includes owls that did not attempt to nest as well as those that had a failed nesting attempt. Non-nesting status is inferred during a daytime follow-up visit if:

   a. The female is observed roosting for a full 60 minutes (1-30 April) during the time she should be on a nest. The female should not be in an agitated state and should be given every opportunity to return to the nest. Surveyors should attempt to mouse the female.
   b. The surveyor offers prey to one or both members of the pair and they cache the prey, sit with the prey for an extended period of time (30-60 minutes), or refuse to take additional prey beyond the minimum of two prey items. To be considered a valid nesting survey, one owl must take <u>at least</u> two prey items.

c. All pairs considered to be non-nesting should receive at least one daytime follow-up visit between 15 May and 15 July to confirm that no young were produced.

6. Nesting status is unknown if:

   a. Owls are found after 1 June without young-of-the-year; or

   b. No adult or young owls are found after 1 June at those sites where adult owls were present prior to 1 June.

B. Determining Reproductive Status:

1. Once a pair is classified as nesting, reproductive success surveys should be conducted after the time the young-of-the-year leave the nest (fledge), usually in early to mid-June. For pairs whose nesting status was not determined, reproductive success surveys should be conducted between 15 May and 15 July.

2. At least two visits to the site spaced at least one week apart should be conducted to locate and count fledged young, and the timing of the visits should be scheduled so that the fledged young are observed as soon after leaving the nest as possible.

3. Visual searches and/or mousing should be used to determine reproductive success. The mousing protocol is the same as for determining non-nesting. If young are present, the adults should take at least some of the prey to the young. The sight of an adult with prey can stimulate the young to beg, revealing their number and location.

4. If the owls take at least two prey items and eventually cache, sit with, or refuse further prey without ever taking prey to fledged young during the proper time period and no other indicative behaviors like contact calls or searching are observed, then zero young are recorded. If one individual adult or subadult owl takes and eats four mice on one visit during the proper time period, then zero young are recorded. If, however, other behaviors indicate young may be in the area, another follow-up survey is recommended to verify that zero young were produced, particularly if the pair had been observed nesting earlier that year.

9. Annual Reporting

An annual report of the activities conducted (including field data forms, if appropriate) should be submitted to the FWS Permits Office in Albuquerque, New Mexico, as well as the appropriate state FWS ESFO. If applicable, hard copies of any unpublished or published reports generated by the study and other data that would be useful for the conservation or recovery of the owl should be submitted to the appropriate FWS ESFO(s).

10. Disposition of Dead, Injured, or Sick Mexican Spotted Owls

Upon locating a dead, injured, or sick owl, initial notification should be made to the FWS's Law Enforcement Office in Arizona (telephone: 480-967-7900), Colorado (telephone: 303-274-3560), New Mexico (telephone: 505-346-7828), or Utah (telephone: 801-625-5570) within two working days (48 hours) of its finding. Written notification should be made within five calendar days and should include information on when (date, time) and where (exact location) the owl was found, photographs of the owl and/or area, if possible, and any other pertinent information. The notification should be sent to the Law Enforcement Office with a copy to the appropriate FWS ESFO. Sick and injured owls should be transported by an authorized biologist to a licensed and permitted wildlife rehabilitator or veterinarian, and care must be taken during handling to ensure effective treatment. Should the treated owl(s) survive, the FWS should be contacted regarding the final disposition of the animal. Salvaged specimens or owls that did not survive rehabilitation should be handled with care to preserve the biological material, and the remains of intact owl(s) should be provided to the appropriate FWS ESFO (as noted in the Section 10 permit). If the remains of the owl(s) are not intact or are not collected, the information noted above should be obtained.

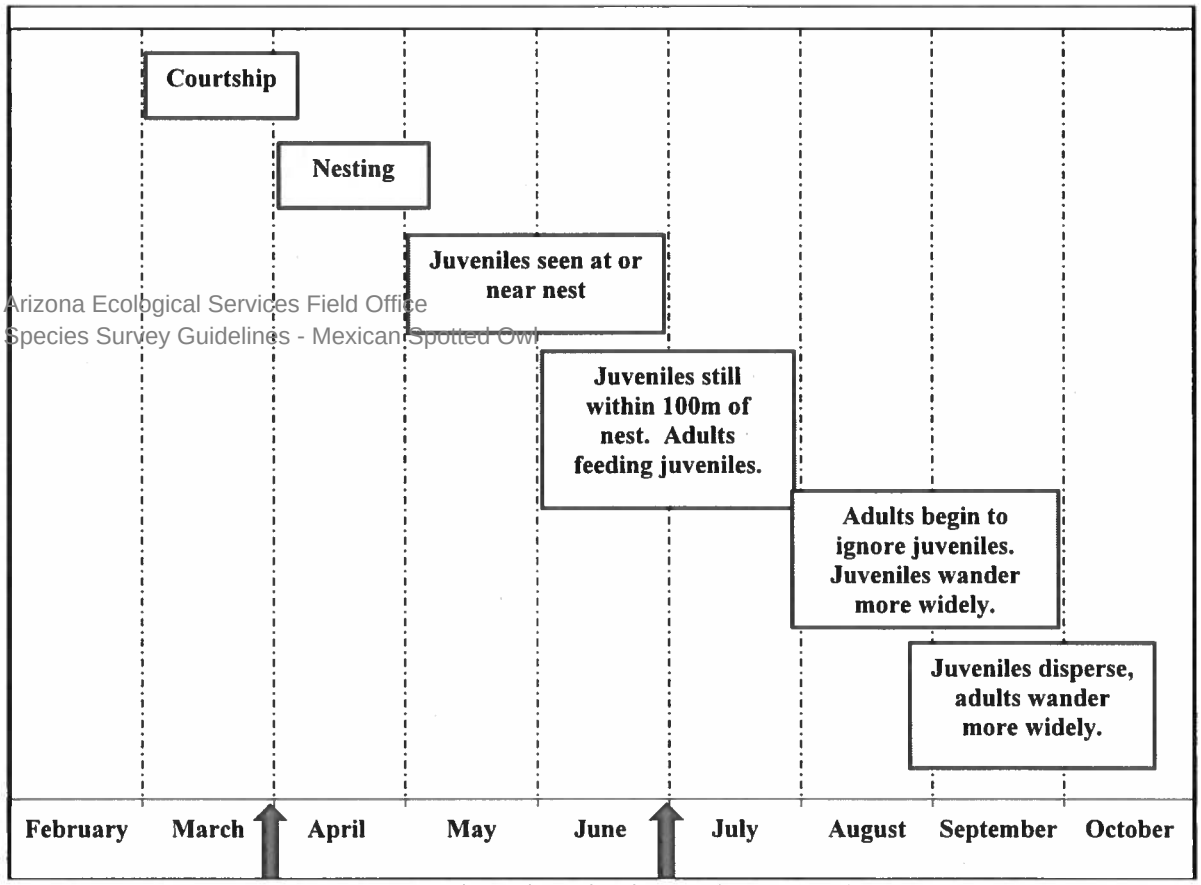

Figure D.1. Generalized reproductive chronology for the Mexican spotted owl. The area between the arrows at the bottom of the table indicates periods of high probability of detecting owls. Chronology may vary slightly with area, elevation, and/or in response to weather.

11. Glossary for Appendix D - Survey Protocol

Absence	Absence of Mexican spotted owls can be inferred when no response is recorded after a complete inventory has been completed in a defined area. Absence does not necessarily indicate that Mexican spotted owls do not or never occupy the area.
Adult	A Mexican spotted owl ≥27 months old. Tips of retrices (tail feathers) will be rounded with white and mottled color. Subadults will have triangular all white tips on tail feathers. For more information on identifying adult and first and second-year subadult Mexican spotted owls, see Moen et al. (1991).

Breeding Season	The time period from 1 March through 31 August that includes courtship, nesting, and nestling- and fledgling-dependency periods. **This is the period of time in which surveys should be conducted.** This time period will vary by geographic locale.
Calling Route	An established route within a survey area where vocal imitations or recorded calls of Mexican spotted owls are used to elicit a response.
Calling Stations	Point locations used to conduct surveys, distributed throughout an area so as to attain complete coverage of the survey area.
Complete Coverage	Complete coverage is obtained when the calling stations have been located within a survey area so that a Mexican spotted owl anywhere in the survey area would be able to hear surveyors and vice-versa.
Complete Inventory	When the following are met: 1) four complete surveys have been conducted in one year; 2) consecutive surveys have been conducted a minimum of five days apart; 3) no more than one survey has been conducted in March; 4) a minimum of two surveys have been conducted by 30 June; 5) all surveys were completed by 31 August, with no more than one survey conducted in the months of July and August; and, 6) two years of survey have been completed.
Complete Survey	A survey is complete when all calling stations or calling routes within a survey area are called within a seven-day period, including daytime follow-up visits for all Mexican spotted owl responses. If every reasonable effort has been made to cover the survey area in one outing but this is not accomplished, then additional outings will be scheduled to cover the remaining area. The entire survey area must be covered within seven consecutive days in order to be considered one complete survey. Although adverse weather conditions may present problems, an effort should be made to complete survey visits on consecutive days. If the survey area is too large to be completely surveyed in seven days, it may be

	divided into smaller areas based on available habitat, topography, drainages, etc.
Core Area	A 40-ha (100-acre) area within designated protected activity centers (PACs) circumscribed around the nest or roost site. The nest or roost area should include habitat that resembles the structural and floristic characteristics of the nest site. These 100-acre areas will be deferred from mechanical treatment. For additional details on delineation, see Ward and Salas (2000).
Daytime Follow-up Visit	A daytime follow-up visit is conducted around Mexican spotted owl responses. The objective of a daytime follow-up visit is to locate Mexican spotted owl(s), their nests and their young by conducting an intensive search within an 800-meter (0.5-mile) radius of the original nighttime or last known response location. The follow-up visit is conducted during daylight hours and should be completed as soon as possible following the initial detection, but no later than 48 hours after detection. If Mexican spotted owls are located during the daytime follow-up visit, the surveyors use the mousing technique to determine nesting and reproductive status.
Intermediate Calling Stations	Calling locations between identified calling stations or routes used to triangulate a Mexican spotted owl's location or used to improve calling coverage of an area when weather or other conditions require. These stations are not required to be established prior to the field outing in which they are used.
Juvenile	A Mexican spotted owl is considered a juvenile in its first five months after hatching. Juveniles one to three months old are very white and have downy plumage over all of the body or evident on breast and head; at four to five months old, juveniles begin losing downy plumage but retain white triangular tips on their tail feathers (Moen et al. 1991).
Mousing	Mousing is a term used to describe the act of offering prey items to owls or other birds of prey. The purpose of mousing Mexican spotted owls is to find mates and determine the reproductive status of the owl(s) (i.e., pair, nesting, non-nesting). In some instances, a male Mexican spotted owl will take a prey item to an unseen female or an adult owl will take prey items to unseen young.
Nest	Mexican spotted owls use broken-topped trees, old raptor nests, witches brooms, caves, cliff ledges, and tree cavities for nests. A Mexican spotted owl must be observed using the structure in order to designate a nest site.
Nest Stand	An area of vegetation that contains a Mexican spotted owl nest.

Nestling	A young owl that is still in the nest; may also be called a hatchling.
Predator	Potential predators of Mexican spotted owl eggs and young include the following: great-horned owl (*Bubo virginianus*), northern goshawk (*Accipiter gentilis*), red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), common ravens (*Corvus corax*) and procyonid mammals (e.g., coati [*Nasua nasua*] and ringtail [*Bassariscus astutus*]).
Protected Activity Center (PAC)	An area of at least 243 ha (600 acres) surrounding the "core area," which is the nest site, a roost grove commonly used during the breeding season in absence of a verified nest site, or the best roosting/nesting habitat if both nesting and roosting information are lacking. The 243 ha (600 acres) (minimum size) is delineated around the activity center using boundaries of known habitat polygons and/or topographic boundaries, such as ridgelines, as appropriate. The boundary should enclose the best possible Mexican spotted owl habitat, configured into as compact a unit as possible, with the nest or activity center located near the center. This should include as much roost/nest habitat as is reasonable, supplemented by foraging habitat where appropriate. For example, in a canyon containing mixed-conifer on north-facing slopes and ponderosa pine on south-facing slopes, it may be more desirable to include some of the south-facing slopes as foraging habitat than to attempt to include 600 acres of north-slope habitat. In many canyon situations, oval PACs may make more sense than, for example, circular PACs; but oval PACs could still include opposing canyon slopes as described above. All PACs should be retained until this subspecies is delisted, even if Mexican spotted owls are not located there in subsequent years.
Remote Area	Generally, any survey area that requires more than four hours of travel time by vehicle and/or foot during good road, trail, and weather conditions (good for the road or trail in question) to reach. All remote areas should be agreed upon by the FWS on a case-by-case basis prior to using the survey protocol to clear a project.
Recovery Habitat	Mixed-conifer and pine-oak forest types, and riparian forests as described in this revised Recovery Plan. Recovery nest/roost habitat either is currently or has the potential to develop into nest/roost habitat. Recovery foraging/non-breeding habitat currently does or could provide habitat for foraging, dispersing, or wintering life history needs. Specific guidelines for management activities and developing recovery nest/roost conditions are specified in this revised Recovery Plan.

Roost	Tree, cliff ledge, rock, or log used by a Mexican spotted owl for extended daytime rest periods. A roost site consists of the roost itself and the immediate vicinity. Roost areas are identified by observations of the Mexican spotted owls and/or the presence of pellets, whitewash, and other evidence.
Subadult	Mexican spotted owls in their second and third summers (5 to 26 months of age). Identified by characteristic tail feathers with white tips tapering to sharp points (i.e., triangular shaped). For more information on identifying subadult Mexican spotted owls, please see Moen et al. (1991).

12. Literature Cited for Appendix D - Survey Protocol

American Society of Mammalogists. 1998. Guidelines for the capture, handling, and care of mammals as approved by the American Society of Mammalogists. Journal of Mammalogy 79:1416–1431.

Forsman, E.D. 1983. Methods and materials for locating and studying spotted owls. USDA Forest Service, General Technical Report PNW-162, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, USA..

Franklin, A.B. 1992. Population regulation in northern spotted owls: theoretical implications for management Pgs. 815-827 in D.R. McCullough and R.H. Barrett, eds. Wildlife 2001: populations. El Sevier Applied Sciences, London, England.

Ganey, J.L. 1990. Calling behavior of spotted owls in northern Arizona. Condor 92:485-490.

Moen, C.A., A.B. Franklin, and R.J. Gutierrez. 1991. Age determination of subadult northern spotted owls in northwest California. Wildlife Society Bulletin 19:489-493.

National Academy of Sciences. 1996. Guide for the care and use of laboratory animals. Institute for Laboratory Animal Resources. Commission on Life Sciences, National Research Council, Washington, D.C, USA.

U.S. Department of the Interior, Fish and Wildlife Service [USDI FWS]. 1995. Recovery plan for the Mexican spotted owl. Albuquerque, New Mexico.

Ward, J. P., Jr., and D. Salas. 2000. Adequacy of roost locations for defining buffers around Mexican spotted owl nests. Wildlife Society Bulletin 28:688-698.

13. Suggested Reading for Appendix D – Survey Protocol

Ganey, J.L. and J. L. Dick, Jr. 1995. Chapter 4. Habitat relationships of the Mexican spotted owl: current knowledge. Pp. 1-42 *in* USDI Fish and Wildlife Service. Recovery plan for the Mexican spotted owl: volume II. Albuquerque, New Mexico, USA.

Gutiérrez, R. J., A. B. Franklin, and W. S. LaHaye. 1995. Spotted owl. The birds of North America 179:1-28.

Moen, C.A., A.B. Franklin, and R.J. Gutierrez. 1991. Age determination of subadult northern spotted owls in northwest California. Wildlife Society Bulletin 19:489-493.

Rinkevich, S.E., and R.J. Gutierrez. 1996. Mexican spotted owl habitat characteristics in Zion National Park. Journal of Raptor Research 30:74-78.

Seamans, M.E., and R.J. Gutierrez. 1997. Breeding habitat of the Mexican spotted owl in the Tularosa Mountains, New Mexico. Condor 97:944-951.

USDI Fish and Wildlife Service. 1993. Final rule to list the Mexican spotted owl as threatened. Federal Register 14248. Albuquerque, New Mexico, USA.

USDI Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl: volume I. Albuquerque, New Mexico, USA. 172 p.

Ward, J.P., and D. Salas. 2000. Adequacy of roost locations for defining buffers around Mexican spotted owl nests. Wildlife Society Bulletin 28(3):688-698.

White, G. C., A. B. Franklin, and J. P. Ward, Jr. 1995. Chapter 2. Population Biology Pp. 1-25 *in* USDI Fish and Wildlife Service. Recovery plan for the Mexican spotted owl: volume II. Albuquerque, New Mexico, USA.

Zwank, P.J., K.W. Kroel, D.M. Levin, G.M. Southward, and R.C. Romme. 1994. Habitat characteristics of Mexican spotted owls in southwestern New Mexico. Journal of Field Ornithology 65:324-334.

14. Mexican Spotted Owl Survey Protocol Outline

Complete Inventory Four complete surveys each year (minimum five days apart)
No more than one survey in March
Minimum of two surveys prior to June 30th
No more than one survey in each of July and August
All surveys completed by 31 August
Two years of complete surveys

1. Owl(s) Detected, go to 3

2. No Owls Detected, Absence inferred for survey area

3. PRESENCE - Conduct a daytime follow-up visit

   A. No owl(s) found on daytime follow-up visit:

      Status unknown, SINGLE STATUS inferred, return to night calling

   B. Single owl located on daytime follow-up visit:

      Feed maximum 4 mice to owl to determine status; if no other owl located, RESIDENT SINGLE CONFIRMED

   C. Pair of owls located on daytime follow-up visit:

      PAIR CONFIRMED for site, go to 4B

4. NESTING STATUS SURVEYS (1 April - 1 June)

   A. Pair not detected, non-nesting, non-reproduction inferred (for that survey)

   B. Pair located, mouse owls (1 of owl pair fed 4 mice)

      1. If one of the following occurs, nesting confirmed, reproduction unknown, go to 5B:

         a. Female on nest

         b. Owl takes prey to nest

         c. Young in nest with adult present

      2. If one of the following occurs, non-nesting inferred, non reproduction inferred (two visits to infer non-nesting, minimum three weeks apart):

a. One of owl pair fed four mice (know fate of all four mice)

b. Female refuses mouse and/or roosts for minimum one hour (1 April - 30 April)

3. Pair (but no young) located after 1 June:

a. NESTING STATUS UNKNOWN

b. Conduct reproductive visit, go to 5A

5. REPRODUCTIVE SUCCESS VISITS

A. NESTING STATUS UNKNOWN

1. Recommend two visits, one week apart, feed four mice to locate juveniles

B. NESTING STATUS KNOWN

1. One visit to look for juveniles (this may take more than one visit to locate all juveniles produced)

2. If surveyor does not find juveniles, mouse adults to locate juveniles

APPENDIX D - MEXICAN SPOTTED OWL SURVEY PROTOCOL

U.S. FISH AND WILDLIFE SERVICE, 2012

INTRODUCTION

The following field survey protocol is designed for detecting Mexican spotted owls (hereafter, "owl"; *Strix occidentalis lucida*) and for surveying areas where human activities might remove or modify owl habitat, or otherwise adversely affect the species. The owl was federally listed as threatened on March 16, 1993 (58 FR 14248). Federal agencies are not required to conduct surveys for listed species prior to preparing a biological assessment under the Endangered Species Act ["Act"; see 50 CFR 402.12(f)]. However, Federal agencies are required to provide the best scientific information available when assessing the effects of their actions to listed species and critical habitat [50 CFR 402.14(d)]. In the absence of necessary information, the U.S. Fish and Wildlife Service (FWS) gives the benefit of the doubt to the listed species [H.R. Conf. Rep. No. 697, 96th Cong., 2nd Sess. 12 (1979)].

This survey protocol expresses the FWS's scientific opinion on adequate owl survey methods and includes guidance and recommendations. It does not constitute law, rules, regulations, or absolute requirements. Our knowledge is continuously developing and changing; therefore, this protocol, which is based upon the best scientific data available, is a work in progress. This protocol will be modified as new information becomes available. The public will be notified of changes to the protocol and surveyor qualifications through postings to the FWS's Arizona Ecological Services Field Office (AESO) (http://www.fws.gov/southwest/es/arizona/MSO). We encourage submissions to us (email submissions to Shaula_Hedwall@fws.gov) at any time of any information that can add to our understanding of what is needed to provide for long-term conservation of this species and its ecosystem. Persons conducting owl surveys must be covered under a research and recovery permit under Section 10(a)(1)(A) of the Act in order to avoid unauthorized harassment of owls, which could violate the prohibitions of Section 9 of the Act. However, no other Federal permitting requirements are implied, though individual states might have their own permitting requirements. Circumstances dictate how owl surveys are implemented. If surveys cannot be accomplished pursuant to this protocol, we recommend contacting the nearest FWS Ecological Services Field Office (ESFO) for guidance on additional survey methods before proceeding.

The FWS endorses the use of this protocol for obtaining information on owl occupancy within and adjacent to proposed project areas. This protocol helps the public and agency personnel determine whether proposed activities will have an impact on owls and/or owl habitat. A properly conducted survey will help agencies determine whether or not further consultation with the FWS is necessary before proceeding with a project. Any information on owl presence within and/or adjacent to the proposed planning or activity areas is important, even if it does not meet the guidelines described below. However, if the only owl location information available for a proposed project was acquired through surveys not conducted in accordance with this protocol, the FWS may conservatively assess the impacts of the proposed management activity on owls, (e.g.) assume the species is present in or near the action area if the best available information

makes such an assumption reasonable. This survey protocol is not designed for monitoring owl population trends or for research applications.

The generally accepted protocol for inventorying Mexican spotted owls was developed by the Southwestern Region of the U.S. Forest Service (FS) in 1988. The protocol was revised in 1989 and in 1990 it was appended to the Forest Service Manual. The protocol, as an element of Interim Directive No. 2, had an official duration of 18 months but has served as the guidance accepted by most agencies and individuals conducting surveys for owls on public lands throughout Arizona, New Mexico, Utah, and Colorado through 2003. The FS reissued the inventory protocol in 1994, again in 1995, and then issued the latest version in February 1996. The FS incorporated recommendations from the draft and subsequent final Recovery Plan for the Mexican Spotted Owl (USDI FWS 1995) regarding the designation of protected activity centers (PACs) around owl locations but did not modify the overall survey design.

Through application of and the use of the data gathered by the existing protocol under informal and formal consultations under Section 7 of the Act, the FWS has found instances where the refinement of the protocol would benefit both the species and those working with it. On January 26, 1998, the FWS met with a group of experts to review the FS protocol and available literature and to improve and update the document. The following draft document is the result of those discussions and subsequent review by FWS biologists and Mexican Spotted Owl Recovery Team members.

This protocol provides a FWS-endorsed method to: 1) make inferences regarding the presence or absence of owls in a defined area; 2) assess occupancy and nesting status, and locate nests, in PACs or in areas where habitat alterations or disturbances to owls are likely to occur; and, 3) provide information to allow designation of PACs.

The primary objective of conducting surveys using this protocol should be to locate and observe the nest of a Mexican spotted owl or young. These observations provide the most reliable and efficient information for documenting presence and delineating potential nest core areas or roost sites (Ward and Salas 2000). Because spotted owls do not nest every year, the alternative, and often default outcome, is to observe adult or subadult spotted owls at daytime roosts. However, it can take up to four years of roost location data to effectively delineate owl core activity areas (Ward and Salas 2000). Locating a resident owl's nest or young may be accomplished most effectively using the mousing technique described in the protocol below (and see Forsman 1983). The mousing technique requires that personnel are trained in proper care and handling of live animals for research, and that, when conducting daytime follow-up surveys, they procure and carry "feeder" mice into the field (American Society of Mammalogists 1998, National Academy of Sciences 1996).

Individuals surveying for owls should meet certain training standards. Experience will be reviewed and approved during a surveyor's application for an FWS issued Section 10(a)(1)(a) recovery permit. These standards strongly encourage surveyors to have knowledge of this protocol and the ability to identify owls visually and vocally, determine sex and age of owls, imitate vocal calls of the owls if not utilizing a tape recording of the calls, and identify other local raptor species. Orienteering skills, including use of map, compass, and/or Global

Positioning System (GPS) units, are essential. Surveyor safety should be of primary importance. Those surveying for owls who do not meet these training standards could "take" owls by harming or harassing them, resulting in criminal or civil penalties.

MEXICAN SPOTTED OWL SURVEY PROTOCOL

The most efficient way to locate owls is to imitate their calls (Forsman 1983). The owl is territorial and responds to imitations of its common vocalizations. Night calling is used to elicit responses from owls and locate the general areas occupied by them. Daytime follow-up visits are used to locate roosting and/or nesting owls and to further pinpoint the activity centers of individual owls. If owls are located, mice are offered to them to locate mates, nests, and young. The information collected from nighttime calling surveys and daytime follow-up surveys assist biologists and land managers to determine whether areas are occupied or unoccupied by owls and to determine the owl's reproductive status.

Throughout this protocol, all bold-faced terms are included in the glossary. Only the first use of the term is bold-faced. An outline summarizing the primary steps for implementing the protocol appear below.

1. Survey Design

The survey design uses designated **calling routes** and **calling stations** to locate owls. The intent of establishing calling routes and calling stations is to obtain **complete coverage** of the survey area so that owls will be able to hear a surveyor calling and a surveyor will be able to hear the owl(s) responding.

A. The survey area should include all areas where owls or their habitat might be affected by management actions. If an area is relatively large, it can be subdivided into manageable subunits to achieve the best survey results. In general, the survey area should include the survey area and an 800-meter (0.5-mile) area from its exterior boundaries. Within the project area, all areas that contain forested **recovery habitat**, riparian forest, and canyon habitat, or might support owls, are surveyed as defined in this revised Recovery Plan. Descriptions of owl habitat for different areas and physiographic provinces should be available from various state and Federal wildlife agencies.

   Where known **protected activity centers (PACs)** exist within the survey area, calling routes can be adjusted to lessen disturbance to established PACs.

B. Owl surveyors should establish calling routes and calling stations to ensure complete coverage of the survey area. The number of calling routes and calling stations will depend upon the size of the area, topography, vegetation, and access. Calling stations should be spaced from approximately 400 meters (0.25 mile) to no more than 800 meters (0.5 mile) apart depending upon topography and background noise levels. Nighttime calling routes and calling stations should be delineated on a map, reviewed in the field, and then relocated, as necessary, to improve the survey effectiveness.

2. Survey Methods

Owls are usually located using nocturnal calling surveys where a surveyor imitates the territorial calls of an owl (Forsman 1983). Upon hearing a suspected intruder within their territories at night, most owls respond by calling to and/or approaching the intruder.

A. CALLING

1. Owls call during all hours of the night. However, optimal survey times include two hours following sunset and two hours prior to sunrise, and surveys should be concentrated around these periods.

2. Surveys should use nighttime surveys for all calling routes in the survey area unless safety concerns dictate that a daytime survey is necessary.

3. Calls can be imitated by the surveyor or by playing recordings of owl vocalizations. If a tape recorder is used, both the tape and tape deck used should be of high quality. Tape decks should have a minimum output of 5 watts (Forsman 1983).

4. The vocal repertoire of owls consists of a variety of hooting, barking, and whistling calls (Ganey 1990). Three call types accounted for 86 percent of calling bouts heard in Arizona: four-note location call, contact call, and bark series. The four-note call appears to be used the most frequently by owls defending a territory. It is suggested that surveyors use all three of these calls during surveys, with the four-note call as the primary call.

5. Surveyors should discontinue calling when a potential owl **predator** is detected, and should move on to another calling station out of earshot of the predator before resuming calling. Surveyors should return at a later time to the station(s) skipped to complete the calling route. If the predator is detected again, the surveyor may try active listening rather than calling at the station. Other solutions completing routes with high-densities of predators, such as great-horned owls, may include active listening at these stations in order to complete the route. Please contact the FWS Mexican spotted owl lead if there are concerns regarding spotted owl predator detections on survey routes.

6. Surveyors should avoid calling for owls during periods of rain or snow, unless there is only a light misting of rain or snow that would not affect the surveyor's ability to detect owls. Surveying during inclement weather could prevent a surveyor from hearing owl responses and reduce the quality of the overall survey effort. Negative results collected under inclement weather conditions are not adequate for evaluating owl presence/**absence**. There is also the added risk of inducing a female owl to leave the **nest** during inclement weather and potentially jeopardizing nesting success.

7. Calling should not be conducted when the wind is stronger than approximately 24 km (15 miles) per hour or when the surveyor feels that the wind is limiting their ability to hear an owl. Consider using the Beaufort Wind Strength Scale. Level 4 describes winds 21 to 29

km (13 to 18 miles) per hour as a moderate breeze capable of moving thin branches, raising dust, and raising paper.

B. SURVEYS

To ensure complete coverage of the survey area, surveyors should select the best survey method for the situation and/or terrain. An owl survey might require a combination of methods, which are defined below, including: 1) calling stations; 2) continuous calling routes to obtain complete coverage of an area; and, 3) leapfrog techniques. Each of these methods is designed for nighttime calling and involves calling for owls and listening for their responses. All surveys where occupancy status is unknown should include nighttime calling.

It is imperative that, whatever method is used, surveyors actively listen during owl surveys. Owls may respond only once; therefore, surveyors must concentrate on listening at all times during surveys. In addition to active listening, surveyors should watch for owls that might be drawn in but do not respond vocally.

1. CALLING STATIONS

a. **Spacing** - Calling stations should typically be spaced approximately 400 meters (0.25 mile) to no more than 800 meters (0.5 mile) apart depending on topography and background noise. In some situations (i.e., complex topography, etc.), establishing calling stations <400 meters apart and more calling stations increases the likelihood of detecting owls. In canyon habitat, if surveying from the canyon bottom, stations should be placed at canyon intersections. If surveying canyons from the rims, calling stations at points and canyon heads should be included.

b. **Timing** - Surveyors should spend at least 15 minutes at each calling station: 10 minutes calling and listening in an alternating fashion, and the last 5 minutes listening. Owl response time varies, most likely because of individual behavior. Some owls will respond immediately, some respond following a delay, and some do not respond. In canyon habitat, it is recommended that surveyors spend a minimum of 20 minutes (30 minutes, if possible) at each station.

c. **Visitation** - Vary the sequence of visitation to calling stations, if possible, during subsequent visits to the area. For example, the order of the calling stations can be reversed. Varying the order of calling stations avoids potential bias related to time of night or other factors.

d. **Intermediate calling stations** should be used when factors decrease the probability of achieving complete coverage using the originally designated stations, or as triangulation points for determining nighttime owl locations. Use of intermediate calling stations can increase the likelihood of detecting owls and, thus, allow for stronger inference regarding the absence of an owl within the area.

2. CONTINUOUS CALLING METHOD

In some cases, using continuous calling is appropriate. Continuous calling involves imitating owl calls at irregular intervals while walking slowly along a route and stopping regularly to listen for owl responses. Because of the sounds produced by walking (e.g., snapping twigs, pinecones, etc.), surveyors utilizing this calling method must concentrate on active listening. In canyon habitat, the continuous calling method is only recommended when combined with calling stations.

a. The surveyor should walk slowly (5 km per hour [3.3 miles per hour]) so as to minimize the possibility that an owl responds after surveyors are out of hearing range (i.e., allow time for owls to respond).

b. The surveyor must stop regularly (400 meters [0.25 mile]) along the route to listen for owl responses.

3. LEAPFROG METHOD

The leapfrog method is very useful when roads allow for coverage of all or a portion of the survey area. This method requires two people and a vehicle.

a. One surveyor is dropped off and begins calling while the other person drives the vehicle ahead at least 800 meters (0.5 mile). The second person then leaves the vehicle for the first person and proceeds ahead while calling.

b. Each surveyor should follow the continuous calling method. The first person continuously calls as he or she walks towards the vehicle, drives the truck at least 800 meters (0.5 mile) past the second person (i.e., "leapfrogs"), leaves the vehicle there and resumes calling along the survey route.

c. Surveyors should repeat this procedure until complete coverage of the survey area is accomplished.

3. Number and Timing of Surveys

Owl detection rates change with season, owl activity, and habitat. Ganey (1990) found that calling activity was highest during the nesting season (March-June). Information from past survey efforts indicate that owl response can also vary with habitat type and/or reproductive chronology (Fig. D.1). Generally, late March through late June is the optimal time period to detect owls. Surveys conducted during March-June will increase the likelihood of detecting owls. Additionally, if owls are <u>not</u> detected when surveys are conducted properly and at these peak times, then inferences about absence of owls in a given area will be stronger. It should be noted that responses in September can be used only to document presence. Surveys in September are not reliable for locating nests, delineating PACS, and/or inferring absence.

Specific criteria on number and timing of surveys are used to determine whether a **complete inventory** has been accomplished. A complete inventory requires that at least four properly scheduled complete surveys be accomplished annually for two years. Additional years of surveys strengthen any inferences made in cases where owls are not detected. If habitat-modifying or potentially disruptive activities are scheduled for a particular year, the second year of surveys should be conducted either the year before or the year of (but prior to) project implementation. In other words, projects should occur as soon as possible after completion of surveys to minimize the likelihood that owls will be present during project implementation. If more than five years have elapsed between the last survey year and the initiation of the proposed action, then one additional year of survey is recommended prior to project implementation.

A. In compliance with the guidelines in B through G below, surveyors should conduct four **complete surveys** during each breeding season. A complete survey can be a combination of a pre-call (daytime reconnaissance of habitat to be night called), a nighttime calling survey, and, if owls are detected, a **daytime follow-up survey**. If owls are not detected during daytime calling, night calling must be completed. However, if owls are located during a pre-call, night calling of the survey area is not required. Surveyors might want to conduct additional surveys if there is evidence that additional owls remain undetected in the area.

B. The four complete surveys must be spread out over the breeding season (1 March - 31 August) by following one of three recommended scheduling scenarios:

    1. Conducting two to four surveys during 1 March - 30 June, with no more than one survey in March. Owl calling activity tends to increase from March through May (Ganey 1990), so this time period is optimal for locating owls.

    2. Completing all surveys by 31 August, with no more than one of the four required surveys conducted in August. Owl response rates tend to decrease by July (Ganey 1990). By September, juveniles have usually dispersed and adults are not necessarily on their territories. If additional surveys are needed (e.g., more than the recommended four surveys), then more than one complete survey could be completed in August.

    3. Allowing at least five full days between surveys. For example, assume a visit ends on 30 April. Using a proper five-day spacing (1-5 May), the next possible survey date would be 6 May (see section 3.D below for an exception to this rule).

C. A complete survey of the area should be conducted within seven consecutive days. If the area is too large to be surveyed in seven consecutive days, it should be divided into smaller subunits based on available owl habitat, topography, and other important factors.

D. In **remote areas,** surveyors can conduct two complete surveys during one trip into the area, so long as surveyors allow a minimum of two days between complete surveys. Conduct all field outings required for a complete survey prior to repeating any route for the second survey. Wait a minimum of 10 days before starting the next two surveys. **Areas defined as remote should be cleared with the FWS prior to proceeding with this deviation from the survey protocol.**

E. The two- to three-hour periods following sunset and preceding sunrise are the peak owl calling periods and the best times to locate owls in or near day **roosts** or nests.

F. Surveys can be discontinued in a given area when data indicate that the entire survey area is designated as PACs.

G. Vocal or visual locations of owls outside the breeding season (1 September - 28 February) as extra information can be of assistance in locating nesting owls in the upcoming breeding season.

4. Methods After Detecting a Mexican Spotted Owl

Once an owl has been detected, the following should be done:

A. Record the time the owl(s) was first detected, the type(s) of call(s) heard (if any), the owl's sex, and whether **juveniles** were detected.

B. Record a compass bearing from the surveyor's location to the location where the owl was heard and/or visually observed. If possible, triangulate the owl's location, taking compass bearings from three or more locations and estimate the distance to the owl. Record both the location where the owl responded from and the surveyor's calling location and triangulation locations on a map or photo attached to the survey form. The surveyor should know her/his location at all times. Triangulating provides an accurate means to map the owl's location. Attempt to confirm the presence of the owl(s) with a daytime follow-up visit (see section 5 below). Daytime owl locations, particularly of nests and young of the year, are very important in determining activity centers.

C. If the owl is heard clearly, and the call type and direction are confirmed, there is no need to continue calling. If, however, there is some doubt as to whether a response was detected, or from which direction, the surveyor should listen carefully for a few minutes, as an owl may call again if given the opportunity. If the owl does not respond after two to five minutes, the surveyor should continue calling to confirm owl presence and better assess the direction of the call. Do not call any more than is necessary. By stimulating the owl(s) to move you may harass a female owl off a nest or increase an owl's risk of predation.

D. Owls may move before or after they begin calling. Every effort should be made to estimate the location of the owl when the first response was heard. After you have determined the owl's location (see section 4.B above), move approximately 800 to 1,200 meters (0.5 to 0.75 mile) away (depending upon topography) before continuing surveys to avoid response by the same owl. If the owl responds from the original detection area, then move farther away before continuing to call.

E. Record the approximate location (bearing and distance), sex, age, and species of all other raptors heard in the survey area.

F. Conduct a daytime follow-up survey as soon as possible (see section 5 below).

5. Conducting Daytime Follow-up Surveys

As with nighttime surveys, follow-up daytime searches ensure quality of results and standardization of effort. Calling to elicit territorial responses is also used during daytime follow-up visits. A daytime follow-up survey helps locate owl roosts, nest sites, and young of the year (during 1 Jun - 1 Aug) by conducting an intensive search within the general vicinity of the original night response location. Owls tend to be more active in the early morning and late evening. During the day, owls are sleepy and do not always readily respond to calling, especially on warm days. Therefore, it is critical that surveyors conduct a thorough daytime search of the response area. Surveyors should spend enough time within the response area to cover all habitats within at least an 800-meter (0.5 mile) radius of the response location. This involves walking throughout the area, calling, listening, and watching for owl sign (e.g., whitewash, pellets, etc.). The FWS recommends that a minimum of one hour be spent searching for owls (regardless of the number of people surveying).

A. Complete a daytime follow-up survey as soon as possible, but within a maximum of 48 hours after owls are detected during nighttime surveys. The optimum daytime follow-up time is the morning following the nighttime detection. In general, the longer the time delay between the nighttime response and daytime follow-up survey, the smaller the probability of locating the bird and finding its roost or nest location. This is especially true if the owl(s) are not nesting. If the daytime follow-up survey is performed longer than 48 hours after the nighttime detection and no owls are found, the survey is considered incomplete and the survey must be re-done.

B. Conduct daytime follow-up surveys in the early morning or late afternoon/early evening. The optimal dawn period is 0.5 hour before sunrise to two hours after sunrise and the optimal dusk period is two hours prior to sunset; each daytime follow-up visit should include one of these time periods. Investing time in searching for the owl during these times will provide a more reliable inference of absence in the case where the owl cannot be located. For areas where spotted owls have been observed during the daytime during previous years, an initial survey in late April through mid-May can often elicit a response. However, non-responses are not that meaningful in documenting absence without nighttime surveys because owls could have moved to another nesting or roosting grove. Initial daytime surveys can be an efficient way to start each survey season where owls have been found in the past. If the initial daytime survey is unsuccessful (i.e., no response is heard), then nighttime surveys should be used to locate owls before attempting additional daytime surveys.

C. The search area for a daytime follow-up survey is a specific, smaller area within the broader survey area in which an owl was detected.

1. Minimum search area is all recovery habitat within at least an 800-meter (0.5-mile) radius of a nighttime owl response.

2. The search area should center on the location of the owl or owls that were heard during the nighttime survey. If there is some uncertainty, focus the search on the best nesting and roosting habitats (e.g. see Ward and Salas 2000).

3. Aerial photos and maps of the area should be studied to identify habitat patches and topographic features, such as canyons or drainages, to prioritize daytime survey locations. In forested areas, spotted owls often roost in first- and second-order tributaries (Ward and Salas 2000).

D. To conduct a thorough search for owls, the surveyor should systematically walk and call all forested recovery, riparian forest, and canyon habitats within the search area. As with nighttime surveys, be aware that owls often fly into the area to investigate; thus, surveyors must also attentively watch for owls. Surveyors should also search for signs of owls such as pellets, white wash, or molted feathers. However, pellets and whitewash alone are not sufficient to document owls. Mobbing jays or other birds can also be a sign that an owl is present.

E. If a daytime follow-up visit is not completed for any reason, or the search effort was not thorough because of the presence of predators or weather, a second follow-up visit should be conducted as soon as possible.

F. If no owl(s) are located during complete daytime follow-up visits, the surveyor should return to conduct nighttime surveys. Four complete surveys to an area are recommended by the survey protocol, but surveyors should assess the confidence of the nighttime and daytime responses and determine if additional nighttime surveys are needed to more accurately determine the location of the responding owl(s). Field personnel conducting surveys need to be given the flexibility to return as many times as necessary to find the owl(s).

G. As with nighttime surveys, daytime follow-up surveys should not be conducted in inclement weather and surveyors should avoid calling when potential owl predators are present.

H. Surveyors should minimize the amount of incidental disturbance to owls. For example, surveyors must not linger in nest sites or over-call in an area.

6. Methods If Mexican Spotted Owls Are Located on a Daytime Follow-up Visit

Mousing is the primary tool to locate an owl's mate, young, and/or nest. Mousing entails feeding live mice to **adult**/**subadult** owl(s) and observing the owl's subsequent behavior. Surveyors should be prepared to offer four mice (one at a time) to at least one member of the pair or to a single owl located on the daytime follow-up visit. For surveyors to draw conclusions about reproductive status, the owl must take at least two mice before refusing them. A mouse is considered "refused" if, after 30 minutes, it has not been taken by an owl.

If an owl takes a mouse and flies away, the surveyor should follow it as closely as possible to determine where it takes the mouse. If the surveyor is unable to follow the owl, and doesn't know if it took the mouse to a mate, nest, or fledged young, then the fate of that mouse cannot be counted toward the four-mouse minimum described above. Surveyors should be ready to rapidly pursue owls that take mice, as owls sometimes fly several hundred meters with mice to reach their nests or young. It is not necessary to complete the four mice minimum after a mouse has unequivocally been taken to a nest.

Owl pairs are determined to be non-nesting if a single owl eats and/or caches all four mice or eats and/or caches two mice and refuses to take a third. A mouse is cached when the owl puts the mouse in a tree or on the ground and then leaves the mouse or the owl perches with the mouse for at least one hour and gives no sign of further activity. Do not feed any more mice than necessary to determine pair status, nest location, and/or reproductive status (i.e., if all observed juveniles have received a mouse then number of young produced is determined and there is no need to continue mousing). Dropped mice or mice whose fates are unknown do not count toward the total of four mice needed to complete the protocol.

Ancillary notes on an owl's behavior during the mousing attempts are also very important to record. These observations can help clarify situations in which incomplete information was collected. For example, if a male is given a mouse and begins to make single-note contact calls while looking in a specific direction in April-June, that is often a good clue that a mate, nest, and/or young may be present. Sometimes observers are too close to other owls or the nest for the "true" mouse fate to be observed. Such observations should trigger another daytime follow-up to secure the location of a mate, nest, or young of the year. For these types of additional follow-up surveys, nighttime calling is usually not necessary.

7. Determining Status from Nighttime Surveys and Daytime Follow-up Visits

A. "Pair status" is established by any of the following:

1. A male and female owl are heard and/or observed in proximity (500 meters or 0.31 mile apart) to each other on the same visit.
2. A male takes a mouse to a female (see section 6 mousing guidelines).
3. A female is observed or heard on a nest.
4. One or both adults are observed with young.
5. At least one young of the year is observed.

B. "Single status" is inferred from:

1. A daytime observation on a single occasion or nighttime responses of a single owl within the same general area (within 500 meters or 0.31 mile) on two or more occasions, with no response by an owl of the opposite sex after two complete inventories (two years of survey); or

2. Multiple responses over several years from a bird of the same sex (i.e., two responses in the first year of surveys and one response in the second year of surveys, from the same general area).

Determining if the responses occur within the same general area should be based on topography and the location of any other known owls in the surrounding area.

C. "Two birds, pair status unknown" is inferred from:

The presence or response of two owls of the opposite sex where pair status cannot be determined.

D. "Status unknown" is inferred by:

The response of a male and/or female spotted owl that does not meet any of the above criteria. We recommend additional years of survey if this is the site status following a complete inventory of the site.

E. "Absence" is inferred:

If a complete inventory has been conducted according to this protocol, or an alternative protocol approved by the FWS, and no owls are heard. However, absence does not necessarily indicate that owls never occupy the area.

F. Separate territories are inferred by:

When two responses are recorded from owls that are more than 800 meters (0.5 mile) apart. These responses should be considered from individuals in separate territories unless daytime follow-up visits indicate otherwise. Ideally, surveyors on two or more crews should coordinate efforts to begin calling simultaneously near each suspected activity area to rule out the existence of multiple territories. If more than one survey crew elicits responses from owls of the same sex at roughly the same time, then two or more territories probably exist. However, if responses vary from those above, the results are considered inconclusive and additional attempts to determine status should continue. Keep in mind that some spotted owls shift their use of an area after failing to nest in a given season. Hence, responses heard in July that are 800 meters (0.5 mile) from a pair that was nesting in April or early May could be from the same individuals.

8. Determining Nesting Status and Reproductive Success

Determining reproductive success is not required if breeding season restrictions that protect owl reproduction are applied to all management projects in any given year. However, reproduction surveys are always valuable as they can provide information on nest tree locations, which provide the best data for determining 100-acre **core areas** (Ward and Salas 2000) and delineating PAC boundaries as recommended in the revised Recovery Plan. If the exact location of the nest is not determined, but juveniles are seen prior to August, the area where the juveniles are seen

can be referenced as the **nest stand**. There are two stages of reproduction surveys: nesting status and reproductive success.

A. Determining Nesting Status:

1. Nesting-status surveys should be conducted between 1 April and 1 June. The start date is based on nesting initiation dates. Young identified after 1 June would still confirm that nesting occurred but would not allow identification of the exact location of the nest. However, young observed prior to August are usually within 400 meters (0.2 miles) of the nest of that year (Ward and Salas 2000) and this information can be useful in delineating a 100-acre nest buffer.

2. Mousing should be used to determine nesting status. The site is classified as nesting, non-nesting, or unknown nesting status based on the surveyor's observations.

3. Two observations at least one week apart are necessary to determine nesting status if the first observation occurs before 1 May. This is necessary because the owls may show signs of initiating nesting early in the season without actually laying eggs and their behavior could be mistaken for nesting behavior. After 1 May, a single observation of nesting behavior is sufficient.

4. The owls are classified as nesting if, on two visits prior to 1 May, or one visit after 1 May:

    a. The female is seen on the nest;

    b. Either the male or female member of a pair carries a mouse to a nest; or

    c. Young-of-the-year are detected.

5. The owls will be classified as non-nesting if any of the following behaviors are observed. Two observations, minimum three weeks apart, are required during the nest survey period (1 April - 1 June) in order to infer non-nesting status. Because nesting attempts might fail before surveys are conducted, the non-nesting status includes owls that did not attempt to nest as well as those that had a failed nesting attempt. Non-nesting status is inferred during a daytime follow-up visit if:

    a. The female is observed roosting for a full 60 minutes (1-30 April) during the time she should be on a nest. The female should not be in an agitated state and should be given every opportunity to return to the nest. Surveyors should attempt to mouse the female.
    b. The surveyor offers prey to one or both members of the pair and they cache the prey, sit with the prey for an extended period of time (30-60 minutes), or refuse to take additional prey beyond the minimum of two prey items. To be considered a valid nesting survey, one owl must take <u>at least</u> two prey items.

c. All pairs considered to be non-nesting should receive at least one daytime follow-up visit between 15 May and 15 July to confirm that no young were produced.

6. Nesting status is unknown if:

a. Owls are found after 1 June without young-of-the-year; or

b. No adult or young owls are found after 1 June at those sites where adult owls were present prior to 1 June.

B. Determining Reproductive Status:

1. Once a pair is classified as nesting, reproductive success surveys should be conducted after the time the young-of-the-year leave the nest (fledge), usually in early to mid-June. For pairs whose nesting status was not determined, reproductive success surveys should be conducted between 15 May and 15 July.

2. At least two visits to the site spaced at least one week apart should be conducted to locate and count fledged young, and the timing of the visits should be scheduled so that the fledged young are observed as soon after leaving the nest as possible.

3. Visual searches and/or mousing should be used to determine reproductive success. The mousing protocol is the same as for determining non-nesting. If young are present, the adults should take at least some of the prey to the young. The sight of an adult with prey can stimulate the young to beg, revealing their number and location.

4. If the owls take at least two prey items and eventually cache, sit with, or refuse further prey without ever taking prey to fledged young during the proper time period and no other indicative behaviors like contact calls or searching are observed, then zero young are recorded. If one individual adult or subadult owl takes and eats four mice on one visit during the proper time period, then zero young are recorded. If, however, other behaviors indicate young may be in the area, another follow-up survey is recommended to verify that zero young were produced, particularly if the pair had been observed nesting earlier that year.

9. Annual Reporting

An annual report of the activities conducted (including field data forms, if appropriate) should be submitted to the FWS Permits Office in Albuquerque, New Mexico, as well as the appropriate state FWS ESFO. If applicable, hard copies of any unpublished or published reports generated by the study and other data that would be useful for the conservation or recovery of the owl should be submitted to the appropriate FWS ESFO(s).

10. Disposition of Dead, Injured, or Sick Mexican Spotted Owls

Upon locating a dead, injured, or sick owl, initial notification should be made to the FWS's Law Enforcement Office in Arizona (telephone: 480-967-7900), Colorado (telephone: 303-274-3560), New Mexico (telephone: 505-346-7828), or Utah (telephone: 801-625-5570) within two working days (48 hours) of its finding. Written notification should be made within five calendar days and should include information on when (date, time) and where (exact location) the owl was found, photographs of the owl and/or area, if possible, and any other pertinent information. The notification should be sent to the Law Enforcement Office with a copy to the appropriate FWS ESFO. Sick and injured owls should be transported by an authorized biologist to a licensed and permitted wildlife rehabilitator or veterinarian, and care must be taken during handling to ensure effective treatment. Should the treated owl(s) survive, the FWS should be contacted regarding the final disposition of the animal. Salvaged specimens or owls that did not survive rehabilitation should be handled with care to preserve the biological material, and the remains of intact owl(s) should be provided to the appropriate FWS ESFO (as noted in the Section 10 permit). If the remains of the owl(s) are not intact or are not collected, the information noted above should be obtained.

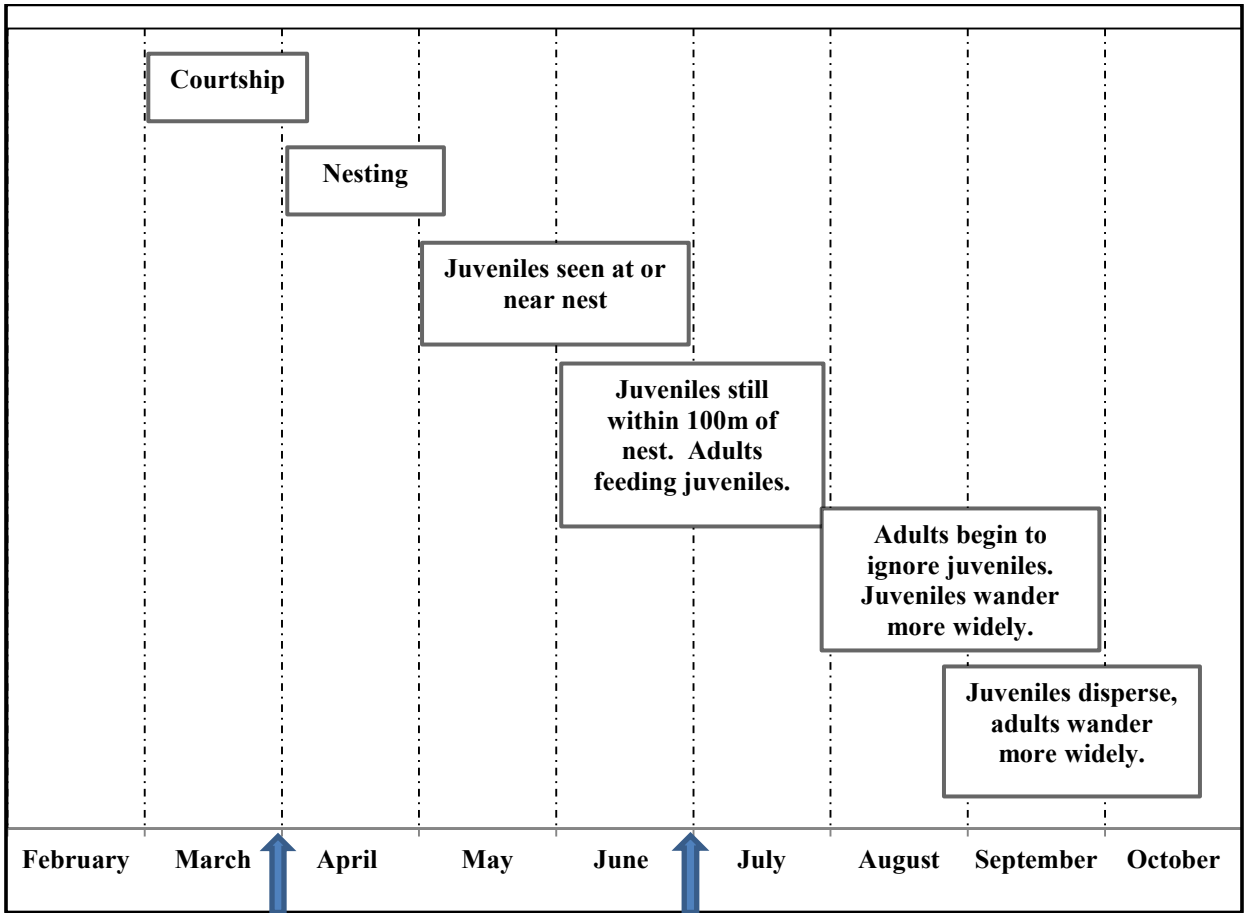

Figure D.1. Generalized reproductive chronology for the Mexican spotted owl. The area between the arrows at the bottom of the table indicates periods of high probability of detecting owls. Chronology may vary slightly with area, elevation, and/or in response to weather.

11. Glossary for Appendix D - Survey Protocol

Absence	Absence of Mexican spotted owls can be inferred when no response is recorded after a complete inventory has been completed in a defined area. Absence does not necessarily indicate that Mexican spotted owls do not or never occupy the area.
Adult	A Mexican spotted owl ≥27 months old. Tips of retrices (tail feathers) will be rounded with white and mottled color. Subadults will have triangular all white tips on tail feathers. For more information on identifying adult and first and second-year subadult Mexican spotted owls, see Moen et al. (1991).
Breeding Season	The time period from 1 March through 31 August that includes courtship, nesting, and nestling- and fledgling-dependency periods. **This is the period of time in which surveys should be conducted.** This time period will vary by geographic locale.
Calling Route	An established route within a survey area where vocal imitations or recorded calls of Mexican spotted owls are used to elicit a response.
Calling Stations	Point locations used to conduct surveys, distributed throughout an area so as to attain complete coverage of the survey area.
Complete Coverage	Complete coverage is obtained when the calling stations have been located within a survey area so that a Mexican spotted owl anywhere in the survey area would be able to hear surveyors and vice-versa.
Complete Inventory	When the following are met: 1) four complete surveys have been conducted in one year; 2) consecutive surveys have been conducted a minimum of five days apart; 3) no more than one survey has been conducted in March; 4) a minimum of two surveys have been conducted by 30 June; 5) all surveys were completed by 31 August, with no more than one survey conducted in the months of July and August; and, 6) two years of survey have been completed.
Complete Survey	A survey is complete when all calling stations or calling routes within a survey area are called within a seven-day period, including daytime follow-up visits for all Mexican spotted owl responses. If every reasonable effort has been made to cover the survey area in one outing but this is not accomplished, then additional outings will be scheduled to cover the remaining area. The entire survey area must be covered within seven consecutive days in order to be considered one complete survey. Although adverse weather conditions may present problems, an effort should be made to complete survey visits on consecutive days. If the survey area is too large to be completely surveyed in seven days, it may be

	divided into smaller areas based on available habitat, topography, drainages, etc.
Core Area	A 40-ha (100-acre) area within designated protected activity centers (PACs) circumscribed around the nest or roost site. The nest or roost area should include habitat that resembles the structural and floristic characteristics of the nest site. These 100-acre areas will be deferred from mechanical treatment. For additional details on delineation, see Ward and Salas (2000).
Daytime Follow-up Visit	A daytime follow-up visit is conducted around Mexican spotted owl responses. The objective of a daytime follow-up visit is to locate Mexican spotted owl(s), their nests and their young by conducting an intensive search within an 800-meter (0.5-mile) radius of the original nighttime or last known response location. The follow-up visit is conducted during daylight hours and should be completed as soon as possible following the initial detection, but no later than 48 hours after detection. If Mexican spotted owls are located during the daytime follow-up visit, the surveyors use the mousing technique to determine nesting and reproductive status.
Intermediate Calling Stations	Calling locations between identified calling stations or routes used to triangulate a Mexican spotted owl's location or used to improve calling coverage of an area when weather or other conditions require. These stations are not required to be established prior to the field outing in which they are used.
Juvenile	A Mexican spotted owl is considered a juvenile in its first five months after hatching. Juveniles one to three months old are very white and have downy plumage over all of the body or evident on breast and head; at four to five months old, juveniles begin losing downy plumage but retain white triangular tips on their tail feathers (Moen et al. 1991).
Mousing	Mousing is a term used to describe the act of offering prey items to owls or other birds of prey. The purpose of mousing Mexican spotted owls is to find mates and determine the reproductive status of the owl(s) (i.e., pair, nesting, non-nesting). In some instances, a male Mexican spotted owl will take a prey item to an unseen female or an adult owl will take prey items to unseen young.
Nest	Mexican spotted owls use broken-topped trees, old raptor nests, witches brooms, caves, cliff ledges, and tree cavities for nests. A Mexican spotted owl must be observed using the structure in order to designate a nest site.
Nest Stand	An area of vegetation that contains a Mexican spotted owl nest.

Nestling	A young owl that is still in the nest; may also be called a hatchling.
Predator	Potential predators of Mexican spotted owl eggs and young include the following: great-horned owl (*Bubo virginianus*), northern goshawk (*Accipiter gentilis*), red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), common ravens (*Corvus corax*) and procyonid mammals (e.g., coati [*Nasua nasua*] and ringtail [*Bassariscus astutus*]).
Protected Activity Center (PAC)	An area of at least 243 ha (600 acres) surrounding the "core area," which is the nest site, a roost grove commonly used during the breeding season in absence of a verified nest site, or the best roosting/nesting habitat if both nesting and roosting information are lacking. The 243 ha (600 acres) (minimum size) is delineated around the activity center using boundaries of known habitat polygons and/or topographic boundaries, such as ridgelines, as appropriate. The boundary should enclose the best possible Mexican spotted owl habitat, configured into as compact a unit as possible, with the nest or activity center located near the center. This should include as much roost/nest habitat as is reasonable, supplemented by foraging habitat where appropriate. For example, in a canyon containing mixed-conifer on north-facing slopes and ponderosa pine on south-facing slopes, it may be more desirable to include some of the south-facing slopes as foraging habitat than to attempt to include 600 acres of north-slope habitat. In many canyon situations, oval PACs may make more sense than, for example, circular PACs; but oval PACs could still include opposing canyon slopes as described above. All PACs should be retained until this subspecies is delisted, even if Mexican spotted owls are not located there in subsequent years.
Remote Area	Generally, any survey area that requires more than four hours of travel time by vehicle and/or foot during good road, trail, and weather conditions (good for the road or trail in question) to reach. All remote areas should be agreed upon by the FWS on a case-by-case basis prior to using the survey protocol to clear a project.
Recovery Habitat	Mixed-conifer and pine-oak forest types, and riparian forests as described in this revised Recovery Plan. Recovery nest/roost habitat either is currently or has the potential to develop into nest/roost habitat. Recovery foraging/non-breeding habitat currently does or could provide habitat for foraging, dispersing, or wintering life history needs. Specific guidelines for management activities and developing recovery nest/roost conditions are specified in this revised Recovery Plan.

Roost	Tree, cliff ledge, rock, or log used by a Mexican spotted owl for extended daytime rest periods. A roost site consists of the roost itself and the immediate vicinity. Roost areas are identified by observations of the Mexican spotted owls and/or the presence of pellets, whitewash, and other evidence.
Subadult	Mexican spotted owls in their second and third summers (5 to 26 months of age). Identified by characteristic tail feathers with white tips tapering to sharp points (i.e., triangular shaped). For more information on identifying subadult Mexican spotted owls, please see Moen et al. (1991).

12. Literature Cited for Appendix D - Survey Protocol

American Society of Mammalogists. 1998. Guidelines for the capture, handling, and care of mammals as approved by the American Society of Mammalogists. Journal of Mammalogy 79:1416–1431.

Forsman, E.D. 1983. Methods and materials for locating and studying spotted owls. USDA Forest Service, General Technical Report PNW-162, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, USA..

Franklin, A.B. 1992. Population regulation in northern spotted owls: theoretical implications for management Pgs. 815-827 in D.R. McCullough and R.H. Barrett, eds. Wildlife 2001: populations. El Sevier Applied Sciences, London, England.

Ganey, J.L. 1990. Calling behavior of spotted owls in northern Arizona. Condor 92:485-490.

Moen, C.A., A.B. Franklin, and R.J. Gutierrez. 1991. Age determination of subadult northern spotted owls in northwest California. Wildlife Society Bulletin 19:489-493.

National Academy of Sciences. 1996. Guide for the care and use of laboratory animals. Institute for Laboratory Animal Resources. Commission on Life Sciences, National Research Council, Washington, D.C, USA.

U.S. Department of the Interior, Fish and Wildlife Service [USDI FWS]. 1995. Recovery plan for the Mexican spotted owl. Albuquerque, New Mexico.

Ward, J. P., Jr., and D. Salas. 2000. Adequacy of roost locations for defining buffers around Mexican spotted owl nests. Wildlife Society Bulletin 28:688-698.

13. Suggested Reading for Appendix D – Survey Protocol

Ganey, J.L. and J. L. Dick, Jr. 1995. Chapter 4. Habitat relationships of the Mexican spotted owl: current knowledge. Pp. 1-42 *in* USDI Fish and Wildlife Service. Recovery plan for the Mexican spotted owl: volume II. Albuquerque, New Mexico, USA.

Gutiérrez, R. J., A. B. Franklin, and W. S. LaHaye. 1995. Spotted owl. The birds of North America 179:1-28.

Moen, C.A., A.B. Franklin, and R.J. Gutierrez. 1991. Age determination of subadult northern spotted owls in northwest California. Wildlife Society Bulletin 19:489-493.

Rinkevich, S.E., and R.J. Gutierrez. 1996. Mexican spotted owl habitat characteristics in Zion National Park. Journal of Raptor Research 30:74-78.

Seamans, M.E., and R.J. Gutierrez. 1997. Breeding habitat of the Mexican spotted owl in the Tularosa Mountains, New Mexico. Condor 97:944-951.

USDI Fish and Wildlife Service. 1993. Final rule to list the Mexican spotted owl as threatened. Federal Register 14248. Albuquerque, New Mexico, USA.

USDI Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl: volume I. Albuquerque, New Mexico, USA. 172 p.

Ward, J.P., and D. Salas. 2000. Adequacy of roost locations for defining buffers around Mexican spotted owl nests. Wildlife Society Bulletin 28(3):688-698.

White, G. C., A. B. Franklin, and J. P. Ward, Jr. 1995. Chapter 2. Population Biology Pp. 1-25 *in* USDI Fish and Wildlife Service. Recovery plan for the Mexican spotted owl: volume II. Albuquerque, New Mexico, USA.

Zwank, P.J., K.W. Kroel, D.M. Levin, G.M. Southward, and R.C. Romme. 1994. Habitat characteristics of Mexican spotted owls in southwestern New Mexico. Journal of Field Ornithology 65:324-334.

14. Mexican Spotted Owl Survey Protocol Outline

Complete Inventory Four complete surveys each year (minimum five days apart)
No more than one survey in March
Minimum of two surveys prior to June 30th
No more than one survey in each of July and August
All surveys completed by 31 August
Two years of complete surveys

1. Owl(s) Detected, go to 3

2. No Owls Detected, Absence inferred for survey area

3. PRESENCE - Conduct a daytime follow-up visit

   A. No owl(s) found on daytime follow-up visit:

      Status unknown, SINGLE STATUS inferred, return to night calling

   B. Single owl located on daytime follow-up visit:

      Feed maximum 4 mice to owl to determine status; if no other owl located, RESIDENT SINGLE CONFIRMED

   C. Pair of owls located on daytime follow-up visit:

      PAIR CONFIRMED for site, go to 4B

4. NESTING STATUS SURVEYS (1 April - 1 June)

   A. Pair not detected, non-nesting, non-reproduction inferred (for that survey)

   B. Pair located, mouse owls (1 of owl pair fed 4 mice)

      1. If one of the following occurs, nesting confirmed, reproduction unknown, go to 5B:

         a. Female on nest

         b. Owl takes prey to nest

         c. Young in nest with adult present

      2. If one of the following occurs, non-nesting inferred, non reproduction inferred (two visits to infer non-nesting, minimum three weeks apart):

a. One of owl pair fed four mice (know fate of all four mice)

b. Female refuses mouse and/or roosts for minimum one hour (1 April - 30 April)

3. Pair (but no young) located after 1 June:

a. NESTING STATUS UNKNOWN

b. Conduct reproductive visit, go to 5A

5. REPRODUCTIVE SUCCESS VISITS

A. NESTING STATUS UNKNOWN

1. Recommend two visits, one week apart, feed four mice to locate juveniles

B. NESTING STATUS KNOWN

1. One visit to look for juveniles (this may take more than one visit to locate all juveniles produced)

2. If surveyor does not find juveniles, mouse adults to locate juveniles

Species Survey Guidelines - Barneby Reed-mustard and 17 more species

Published by Utah Ecological Services Field Office - Publication Date 8/31/2011 for the following species included in your project

- Barneby Reed-mustard *Schoenocrambe barnebyi*
- Barneby Ridge-cress *Lepidium barnebyanum*
- Clay Phacelia *Phacelia argillacea*
- Clay Reed-mustard *Schoenocrambe argillacea*
- Heliotrope Milk-vetch *Astragalus montii*
- Jones Cycladenia *Cycladenia humilis var. jonesii*
- Kodachrome Bladderpod *Lesquerella tumulosa*
- Last Chance Townsendia *Townsendia aprica*
- Navajo Sedge *Carex specuicola*
- Pariette Cactus *Sclerocactus brevispinus*
- San Rafael Cactus *Pediocactus despainii*
- Shrubby Reed-mustard *Schoenocrambe suffrutescens*
- Siler Pincushion Cactus *Pediocactus (=Echinocactus,=Utahia) sileri*
- Uinta Basin Hookless Cactus *Sclerocactus wetlandicus*
- Ute Ladies'-tresses *Spiranthes diluvialis*
- Welsh's Milkweed *Asclepias welshii*
- Winkler Cactus *Pediocactus winkleri*
- Wright Fishhook Cactus *Sclerocactus wrightiae*

U.S. Fish and Wildlife Service (USFWS) Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed and Candidate Plants

August 31, 2011

Barneby ridge-cress
Jessi Brunson, USFWS

Jones cycladenia
Daniela Roth, USFWS

Holmgren milk-vetch
Daniela Roth, USFWS

Uinta Basin hookless cactus
Bekee Hotze, USFWS

Dwarf bear-poppy
Daniela Roth, USFWS

Last chance townsendia
Daniela Roth, USFWS

INTRODUCTION AND PURPOSE

These guidelines were developed by the USFWS Utah Field Office to clarify our office's minimum standards for botanical surveys for sensitive (federally listed, proposed and candidate) plant species (collectively referred to throughout this document as "target species"). Although developed with considerable input from various partners (agency and non-governmental personnel), these guidelines are solely intended to represent the recommendations of the USFWS Utah Field Office and should not be assumed to satisfy the expectations of any other entity.

These guidelines are intended to strengthen the quality of information used by the USFWS in assessing the status, trends, and vulnerability of target species to a wide array of factors and known threats. We also intend that these guidelines will be helpful to those who conduct and fund surveys by providing up-front guidance regarding our expectations for survey protocols and data reporting. These are intended as general guidelines establishing minimum criteria; the USFWS Utah Field Office reserves the right to establish additional standards on a case-by-case basis.

Note: The Vernal Field Office of the BLM requires specific qualifications for conducing botanical field work in their jurisdiction; nothing in this document should be interpreted as replacing requirements in place by that (or any other) agency. Contact the BLM for additional information when working in areas under that agency's jurisdiction.

I. PERSONNEL QUALIFICATIONS

If the work is performed under contract, resumes should be included for every surveyor who will be working on a botanical survey or monitoring project. Resumes should include educational background (colleges and universities attended, and any diplomas and degrees received), botanical survey work history, and any related work experience. The following minimum qualifications are recommended:

A. <u>Field Crew Leaders</u>

Field crew leaders must meet the same qualifications as a botanist working for the Federal government (Botanist series 0430), namely:

- Degree: botany; or basic plant science that included at least 24 semester hours in botany. Two field seasons of surveying experience for special status species in the geographic area are highly recommended.

OR

- Combination of education and experience -- courses equivalent to a major in botany or basic plant science that included at least 24 semester hours in botany, as shown in A above, plus appropriate experience or additional education. Two field seasons of surveying experience for special status species in the geographic area are highly recommended.

Field crew leaders must be present with their crew during surveys and must have the ability to identify vascular plant species using whatever means necessary (e.g., dissecting microscopes, technical keys, and monographs, etc.). A crew leader should supervise no more than 5 technicians/field assistants. Crew leaders should possess a wide array of skills necessary to plan, oversee and conduct vascular plant surveys, particularly: training and experience with vascular plant survey methods; familiarity with the flora and geological formations of Utah; and the knowledge and ability to locate and identify target plant species.

Section III (GPS Data) establishes minimum standards for documenting and reporting survey efforts using GPS/GIS technology. Field crew leaders must either possess the skills to document the work of their entire crew in accordance with these standards, or ensure that at least one member of their crew is capable of doing this on behalf of the entire field crew.

B. Technicians/Field Assistants

Field assistants must possess at least one year of biological coursework at the college level, to include:

- At least 6 semester hours in any combination of scientific or technical courses (biology, entomology, geology, or botany); and

- At least 1 course in plant taxonomy

Field assistants must have the ability to recognize special status plant species in Utah and use technical botanical keys appropriate to the area. While it is not necessary for every field assistant to possess GPS skills, every assistant should be capable of supporting the field crew's efforts to document surveys using field notes, paper maps, GPS, or other means necessary (see Section III for more information on how location data should be documented and reported).

II. SURVEY GUIDELINES

In this section, we first describe general survey guidelines applicable to most botanical surveys. These are followed by recommendations specific to three types of survey efforts frequently conducted for special status plant species: clearance surveys, status surveys, and monitoring efforts.

The recommendations in this section specifically address information that should be gathered while in the field. Sections III and IV addresses how this information should be summarized for purposes of reporting.

A. General guidelines

1. Botanical surveys must be conducted in a manner that will maximize the likelihood of finding target species. For example, one of the most common reasons that we consider surveys inadequate is because they were conducted during portions of the year when

target species were not visible. Refer to Appendix A for appropriate species-specific survey dates based upon flowering and/or fruiting periods.

2. Multiple site visits may be necessary during a single field season to ensure that surveys are conducted during the appropriate life stage (usually flowering or fruiting) of all target species in the area.
3. Reference populations (i.e., other known occurrences of the target species) must be visited to confirm that target species are flowering, fruiting, or otherwise identifiable prior to initiating surveys. Reference populations should be documented with digital photos of the target species and habitat. For assistance in locating a reference population, contact the land management agency or the USFWS species lead (http://www.fws.gov/utahfieldoffice/EndSppLeads.html).
4. Document the overall biological setting, plant communities, topography, and soils, and any other environmental conditions (e.g., local precipitation patterns) that could influence the emergence of (and therefore the ability to detect) target species. To the maximum extent practical, include a comprehensive list of other vascular plant species associated with the areas where focused surveys were conducted for target species.
5. Document the level of survey effort, including the number of persons involved and the amount of time spent conducting surveys for target species.
6. At the outset, define whether the target species will be counted by clumps, rosettes, vegetative stems, flowering stems, and/or some other unit. Clearly indicate the unit used for all counts in all field notes and data collection forms.
7. Obtain separate counts of alive/dead, vegetative/reproductive, and adult/juvenile plants. Identify the life stage of all individuals of the target species that are located on the surveys. If actual seedlings (evidenced by cotyledons) are observed, make specific note of this important piece of evidence that recruitment is occurring.
8. Document the presence of target species using GPS. Refer to Section III (GPS Data).
9. Document the presence of target species with at least one high quality photograph of the plant and one of occupied habitat. If a large area is covered during the survey, take photographs at a representative number of locations, and make note of the unique identifier(s) of photos taken at specific GPS coordinates.
10. Photographs used in place of actual voucher specimens should be of sufficient scale and resolution to show the identifying characteristics of the given target species. Physical collection of plants (actual voucher specimens) may be necessary in cases of taxonomic ambiguities, habitat or range extensions. However, the collection of federally listed species on Federal lands requires a permit from the USFWS and typically also requires a permit from the Federal land management agency. Ensure that you have all necessary permits before collecting voucher specimens.
11. If species that could be confused with the target species are observed within the areas surveyed, identify them (by scientific name), and describe how these species were distinguished from the target species.
12. Specifically note the presence of existing or potential threats to the target species or its habitat (e.g., invasive exotic species, grazing, unmanaged or excessive recreational use). Assess the relative severity of these threats across all sites surveyed. If multiple threats are present at a given location, assess the relative importance of each threat at that site.

13. Use standard field forms for field observations, with clear and standardized means of assessing presence/absence and abundance of target species at a given location. Refer to Appendix C for some examples of commonly used field data collection forms.

B. Clearance surveys

The objective of clearance surveys is to cover 100% of a given project area to determine presence of target species, and their distribution and abundance prior to ground-disturbing activities. These surveys are particularly used to document compliance with the provisions of Section 7 of the Endangered Species Act. Therefore, clearance surveys represent the primary means of assessing a proposed action's direct, indirect and cumulative effects to target species.

"Project area" refers to the specific area in which impacts may occur to target species in association with a proposed activity. As such, project areas may be linear features (e.g., rights-of-way) or polygons (e.g., well pads).

1. Clearance surveys must include an assessment of all potential habitat within the project area, including a buffer. The standard buffer for clearance surveys is 300 feet from the project area, however the necessary buffer may vary depending on the scope of the project and target species. For additional guidance and to define an appropriate buffer, contact USFWS species lead in our office prior to conducting surveys (http://www.fws.gov/utahfieldoffice/EndSppLeads.html).
2. Clearance surveys are typically conducted by walking belt transects (of a fixed width) throughout all areas of potential habitat. Refer to Appendix A for species-specific transect widths to be used in clearance surveys. Use of other survey techniques may be appropriate in limited instances, however these exceptions must be discussed ahead of time with our office and the lead action agency.
3. Unless otherwise specified by our office, clearance surveys are valid for a period of one year.
4. If the target species is not found, clearly indicate whether or not the surveyed habitat appeared suitable for the target species, and provide photographic documentation:
    a. If habitat appeared suitable but the target species was not observed, indicate whether or not the species may have gone undetected, and why. Asses the likelihood that the target species was present but undetected.
    b. If surveyed habitat is deemed unsuitable for the target species, provide an explanation of the criteria used for making this determination.
5. Recognize that adverse conditions may prevent field crews from determining presence or identifying some target species in areas of potential habitat. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any year. We may require botanical inventory(-ies) in subsequent year(s) if adverse conditions likely reduced the ability to observe the target species in areas of potential habitat(s). Discuss such conditions with our office's species lead and the lead action agency.
6. If the target species is present and is associated with wetlands, make note of the direction and integrity of flow of surface hydrology. If the target species is (are) affected by off-site hydrological influences, make note of these factors.

C. Status surveys

Status surveys document the distribution and abundance of one or more target species over a specific geographic area at a specific point in time. Status surveys typically consist of visits to previously known locations and areas not previously known to be occupied. These surveys usually encompass a substantial portion of the total known range of the species, and frequently the entire range. Relative to clearance surveys and most monitoring efforts, status surveys tend to involve less intensive survey effort at any given site, in exchange for surveying across a wider geographic area (i.e., larger number of potential sites). Status surveys are similar to monitoring efforts (see the section on monitoring, below) in that they can involve repeated observations at the same location(s) over time, but are typically less quantitative. Although every effort should be made to conduct status surveys in a manner that enables some degree of assessment as to whether conditions have changed relative to previous surveys, these types of surveys primarily characterize only coarse spatial patterns as opposed to the fine-scale, quantitative trends in populations that monitoring efforts seek to detect.

1. Status report surveys must include visits to all known populations/sites within the geographic scope of the survey effort; usually this means visits to all known (current and historical) populations of the species.
2. To the maximum extent possible, these surveys should also include visits to areas with the potential to contain the target species (potential habitat). Criteria used to identify potential habitat (prior to field surveys) should be explicitly stated.
3. While in the field, all areas identified as potential habitat should be assessed for the presence of the target species (e.g., occupied habitat). Areas found not to contain the target species should be assessed for the presence of conditions suitable for the target species (e.g., suitable habitat that is apparently unoccupied).
4. While in the field, make note of existing and former patterns of land use within the surrounding landscape.

In addition to documenting the presence of target species, characterize the density and abundance of the target species in absolute numbers (e.g., via direct and precise counts) or in relative terms (e.g., by estimates using standardized categorical ranges). Structure field observations to provide meaningful comparisons of abundance and density among all locations visited during the course of the survey.

D. Monitoring surveys

In contrast to clearance or status surveys, "monitoring" typically involves structured, repeated assessments of a target species in a manner that investigates the species response to one or more environmental or human-caused factors. Monitoring programs can take many different approaches depending upon the target species, the number of monitoring locations, site conditions, and the objectives of the effort. The nature of the questions being addressed and the level of certainty expected from the data will largely dictate the methods used. Refer to Appendix B for some resources that may assist in the design of

monitoring objectives and sampling regimes; a review of the principles and contents of these sources is beyond the scope of these guidelines.

There are fundamental components of any successful monitoring program. At a minimum, monitoring efforts must consist of the following:

1. Monitoring plans must be developed prior to initiating the effort. Section IV contains specific recommendations for the basic components of a monitoring plan.
2. Monitoring reports must be produced for each discrete period of data collection (typically annually), in accordance with the frequency specified in the monitoring plan. Section IV provides general reporting guidelines, as well as reporting recommendations specific to monitoring efforts.
3. Electronic files (spreadsheet format) must be developed to track and evaluate the raw data.
4. Adaptive management mechanisms must be in place for key parties (agencies and their contractors) to review and comment on the monitoring program, and to revise the program as necessary. In most instances, this should consist of regular face-to-face meetings among appropriate personnel, with site visits as needed.

III. GPS DATA: DATA COLLECTION AND REPORTING

While in the field, the location information of target species must be documented according to the standards set by Utah's Geospatial Technical Committee. This committee, which is made up of Federal, State, and County officials, has standardized data collection for our state to be in UTM Zone 12, NAD 83. The location, expressed in x (or easting) and y (or northing) coordinates, and additional site/attribute data should be provided in electronic file format. Electronic data must be provided in a manner that allows them to be directly imported into a GIS without the additional time and error associated with transcription. At a minimum, location data must be reported as follows:

1. A statement indicating the make, model, precision capabilities (e.g., recreational, mapping, or survey grade) and the datum and coordinate system of the GPS used to collect the data.
2. The electronic file containing location coordinates must be provided in one of the following *electronic* file formats:
    i. any one of the many commonly used file formats for vector data (e.g., shapefile, coverage, feature class, geodatabase, digital line graph, computer-aided design (CAD, or AutoCAD)),
    ii. a spreadsheet, or
    iii. a delimited text file.
3. Each unique location (whether a point, line or polygon) must be accompanied by the following information in separate fields:
    i. unique location identifier (e.g., waypoint number, ID field, etc.)

ii. target species present
iii. date of observation
iv. waypoint accuracy, in meters
v. unique photo identifier (e.g., filename of any photographs associated with that specific location)
vi. the number of plants at that location (if data is collected separately by seedling/juvenile/vegetative/flowering/fruiting, these data should be presented in separate fields with field names clearly identifying the nature of the data in that field)
vii. comments on threats to the target species (as appropriate, if specific to a given location)
viii. comments on the vigor of the target species (as appropriate, if specific to a given location)
ix. additional fields, as necessary

GPS data should be differentially corrected while in the field (using real-time methods) or postprocessed later in the office before being submitted to our office. Refer to the following URLs for background information for, and methods of, differential correction:

http://www.esri.com/news/arcuser/0103/differential1of2.html

http://www.spatial-ed.com/gps/gps-basics/135-differential-correction-methods.html

If the GPS data contains a combination of positive and negative survey data (with respect to the presence of target species), it should be possible to quickly identify negative survey data by querying or sorting on a single field – this should not require manual review and sorting of records based upon narrative data found in one or more comment fields (or the accompanying report).

IV. REPORTING

A. General Guidelines

Regardless of the type of survey (or monitoring) effort being conducted, botanical field reports must include:

1. A description of the biological setting, including plant community, topography, soils, potential habitat of target species, and an evaluation of environmental conditions, such as timing or quantity of rainfall, which may influence the performance and expression of target species.
2. An overview map showing the location(s) surveyed, with sufficient scale and resolution for someone unfamiliar with these areas to locate them.
3. Survey methodologies and dates.

4. A description of the level of survey effort, specifically including the number of people conducting surveys and amount of time spent surveying each project area.
5. If the survey encompasses current or historical locations for the target species that were previously mapped by the Utah Natural Heritage Program (UNHP), provide a map depicting the specific locations where UNHP mapped the species, accompanied by a unique UNHP identifier (typically the Element Occurrence number) for each location. In the map and accompanying report, clearly indicate whether the survey results include new locations, or updated information for previously mapped locations.
6. A summary of abundance (count) data for the target species, with separate tallies for alive/dead, vegetative/reproductive, adult/juvenile. The unit of measurement (clumps, rosettes, stems, or other) should be clearly specified.
7. Assessments of the vigor of the target species (e.g., disease, predation, and/or mortality), regardless of whether the causes are known. If certain factors are suspected as contributing to these patterns, identify them and assess the likelihood that they are actually contributing to reduced vigor in the target species.
8. Assessments of threats to the target species (e.g., invasive exotic species, unmanaged and excessive recreational use, over-grazing, etc.). To the extent possible, distinguish between threats that are clearly affecting the status (vegetative vigor and/or reproduction) of the target species, and those that are present but do not yet appear to be affecting the target species.
9. Copies of field data sheets.
10. Electronic copies of all photographs. Photographs captured using film (as opposed to digital) cameras should be scanned at high resolution, and saved in a universally recognized file format for images (e.g., JPEG, TIFF, etc.).

Copies of the full report (including appendices) should be sent to:

- Utah Natural Heritage Program (with copies of NHP field survey forms)
- Applicable/affected land owners and/or management agencies
- USFWS Utah Field Office (mailing address: 2369 West Orton Circle, West Valley City, Utah 84119).

B. Clearance Surveys

In addition to the general guidelines above, reports for clearance surveys should also include:

1. Map(s) depicting the specific properties surveyed, with the following information clearly indicated:
    i. Scale bar and map orientation (e.g., North arrow)
    ii. Project/parcel boundaries
    iii. Map quadrangle name
    iv. Specific areas where target species was found to be present, with clear relationships to areas to be affected by project activities.
2. Descriptions of the spatial extent (in acres or river/stream miles, as appropriate) of habitats occupied by the target species;

3. Descriptions of the spatial extent of apparently suitable but unoccupied habitat;
4. Comprehensive list of vascular plant species occurring on the project site, by habitat (plant community) type;
5. Assessments of the overall biological significance or ecological quality of the project site, in a local and regional context;
6. Assessments of the significance of the project site to the target species, in a local and regional (range-wide) context; and
7. Descriptions of the direction and integrity of flow of surface hydrology, particularly if the target species are associated with wetlands. If target species is (are) affected by adjacent off-site hydrological influences, describe these factors.

C. Status Surveys

In addition to the general guidelines above, status survey reports should also include:

1. Assessments of the ecological condition and integrity of the landscape(s) in which surveyed locations occur, with specific emphasis on patterns of disturbance or fragmentation, or other threats to the ecosystem (e.g., invasive exotic species, unmanaged and excessive recreational use, over-grazing, etc.).
2. Assessments of land use(s) within the larger landscape as well as the specific areas of occupied and potentially suitable habitat.
3. Assessments of the relative density of target species among all areas surveyed.
4. Separate calculations of the acres of occupied habitat of the target species at each discrete survey location and cumulatively over all areas surveyed. The appropriate geographic scales at which to summarize this information will require professional judgment as well as coordination with our office and the entity funding the survey.
5. Assessments of how each of the above factors has changed relative to any prior status surveys conducted for the target species (this is the historical reference point against which all assessments of current conditions should be gauged). However, these discussions should appropriately state any known limitations in comparisons to prior surveys (e.g., different survey methods, different personnel, climate conditions such as drought). Refer to the discussion under Section II.C regarding these and other cautions, and do not overstate the ability to detect changes in abundance or density of the target species (or other factors).

Draft copies of status reports should be circulated to our office's species lead for preliminary review and comment. Failure to satisfactorily address our comments in final versions may result in these reports not being accepted by our office.

D. Monitoring Reports

Because monitoring activities usually involve repeated assessments of a target species over a period of time that usually spans several years, clear and consistent reporting of monitoring activities is particularly challenging. Although monitoring programs will vary significantly depending upon a variety of factors (as discussed above), nearly every monitoring effort must be accompanied by the following documents:

1. Monitoring plan describing:
    i. objective(s) of the effort;
    ii. methods of data collection, a rationale for the methods chosen and a brief discussion of any alternative methods considered but rejected;
    iii. questions to be addressed during data analysis;
    iv. anticipated frequency of data collection and reporting;
    v. format for monitoring reports; and
    vi. entity(-ies) responsible for conducting monitoring, analyzing and reporting on the monitoring data, and distributing the monitoring reports.

2. Monitoring reports that include:
    i. A format modeled after peer-reviewed scientific papers, with an Introduction, Materials/Methods, Results, and Discussion sections;
    ii. References to applicable monitoring plans, and explain any deviations from those plans;
    iii. References to prior years of monitoring reports, as applicable;
    iv. Map(s) of monitoring locations at a sufficient spatial scale that someone unfamiliar with these areas could locate them;
    v. Summaries of data for the most recent period of data collection (in tabular, graphical and narrative format, as appropriate);
    vi. Analysis of apparent trends over the entire period of time for which data are available;
    vii. Assessments of apparent threats to the target species, and the relative severity of these threats;
    viii. Specific, focused assessments of
        1) management recommendations, and
        2) whether revisions are needed to the monitoring plan;
    ix. Copies of field data collection forms (examples provided in Appendix C).

Draft copies of monitoring plans and reports should be submitted to our office's species lead for preliminary review and comment. Failure to satisfactorily address our comments in final version(s) of these documents may result in these reports not being accepted by our office.

APPENDIX A: SPECIES SPECIFIC SURVEY PERIOD AND TRANSECT WIDTH

SPECIES	*SURVEY PERIOD*	*TRANSECT WIDTH* [a]
Arctomecon humilis	Mid April – May	10 – 20 ft
Asclepias welshii	June – September	25 – 50 ft
Astragalus anserinus	May – June	10 – 20 ft
Astragalus ampullarioides	April – May	10 – 20 ft
Astragalus desereticus	May – June	10 – 20 ft
Astragalus holmgreniorum	April – May	10 – 20 ft
Astragalus montii	July – August	10 ft
Carex specuicola	May – September	N/A, habitat not suitable for transects
Cycladenia humilis var. jonesii	April – June	10 – 20 ft
Eriogonum corymbosum var. nilesii	September - October	10 – 20 ft
Eriogonum soredium	Mid June - July	10 – 20 ft
Lepidium barnebyanum	May – June	10 – 20 ft
Lepidium ostleri	Mid June - July	5 ft
Lesquerella tumulosa	May – June	5 – 10 ft
Pediocactus despainii	April – May	3 ft
Pediocactus sileri	April – June	3 – 6 ft
Pediocactus winkleri	March – April	3 ft
Penstemon scariosus var. albifluvis	May – June	10 – 20 ft
Penstemon grahamii	May – June	10 ft
Phacelia argillacea	June	10 ft
Primula maguirei	May	N/A, habitat not suitable for transects
Ranunculus aestivalis	July	5 ft
Schoenocrambe argillacea	May to early June	3 – 5 ft unless habitat too steep for transects and then habitat is assumed occupied
Schoenocrambe barnebyi	May to early June	5 – 10 ft

[a] *Transect widths represent the average distance (width) that can be adequately surveyed per person in each pass through potentially occupied habitat, for purposes of clearance surveys. Some transect widths are expressed as a range (minimum – maximum). The actual transect width used may depend upon site conditions and other factors (timing and purpose of survey); work with the USFWS species lead and the lead action agency (e.g., the permitting or land management agency) as appropriate to determine the widths to be used for any specific survey effort.*

SPECIES	***SURVEY PERIOD***	***TRANSECT WIDTH*** [a]
Schoenocrambe suffrutescens	Mid April – early August	10 ft
Sclerocactus brevispinus	Mid March – June 30	3 – 6 ft
Sclerocactus wrightiae	Mid April – early June	3 – 6 ft
Sclerocactus wetlandicus	Anytime without snow cover	3 – 6 ft
Sphaeralcea gierischii	April to Early June	10 – 20 ft
Spiranthes diluvialis	August	In some areas, habitat restricted to narrow band along water edge, not wide enough for multiple transects; in other habitats (wet meadows) transects up to 6 feet apart may be walked
Townsendia aprica	April – May	3ft
Trifolium friscanum	May - June	10 – 20 ft

[a] *Transect widths represent the average distance (width) that can be adequately surveyed per person in each pass through potentially occupied habitat, for purposes of clearance surveys. Some transect widths are expressed as a range (minimum – maximum). The actual transect width used may depend upon site conditions and other factors (timing and purpose of survey); work with the USFWS species lead and the lead action agency (e.g., the permitting or land management agency) as appropriate to determine the widths to be used for any specific survey effort.*

APPENDIX B.

Resources for developing and implementing monitoring programs

The following resources address the many considerations of developing and implementing monitoring programs addressing many issues within the broad arena of natural resource management. As evidenced by their titles, some of these documents specifically address the issue of monitoring target (rare) species, and plant species in particular.

Bureau of Land Management, Measuring and Monitoring Plant Populations. Available at http://www.blm.gov/nstc/library/pdf/MeasAndMon.pdf.

Elzinga, C.L. et al. 2001. Measuring and Monitoring Plant and Animal Populations. Blackwell Science, Inc. ISBN 0-632-04442-X. 360 pp. Includes appendices.

USFS. Photo point monitoring handbook: part A – field procedures. Gen. Tech. Rep. PNW-GTR-526. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p. 2 parts.

APPENDIX C.

EXAMPLE FIELD DATA COLLECTION FORMS

The following examples should help to encourage consistency in observation and reporting among field crews and among survey sites. Deciding which form to use will depend upon the objectives of the survey effort – e.g., clearance surveys or status surveys. Due to the complex and species- or site-specific nature of most monitoring efforts, it is unlikely that any single example will adequately suit the needs of any given monitoring program. Refer to Appendix B for resources to help in the design of monitoring programs, including field data collection forms.

Example 1. The Utah Natural Heritage Program's Plant Sruvey Form is available at: http://dwrcdc.nr.utah.gov/ucdc/viewreports/Plant_Field_Form.pdf.

Example 2. The Bureau of Land Management (BLM; Ritchfield and Price Field Offices), National Park Service (NPS, Capitol Reef National Park) and the USFWS (Utah Field Office) have formed an Interagency Rare Plant Team to focus on rare plant conservation in central Utah. This team has drafted a form to standardize repeat inventories of rare plants (last version dated March, 2011). This form is not yet available online, but is provided on the following pages.

REPEAT INVENTORY MONITORING FORM (SITE VISIT ACCOUNT (SVA))

DB#_____ entered into database on _____by _____

Verified DB on _____ by _____

Entered into GIS on _____ by _____

Verified GIS on _____ by _____

Photo files renamed on _____ by _____

New Site? yes no

Revisit? yes no

If revisit, plants found again? yes no

Site Name: _____Date: _____ Time: _____

Source of lead: _____

Species Found: _____Species Code: _____

Surveyor(s):_____

Quad Name(s):____ _____State: ____ County(ies): _____

Township(s): _____ Range(s): _____ Section(s): _____

UTM North: _____UTM East: _____UTM Zone: ____Datum: _____

UTM Precision (Circle one)**:** Corrected GPS Field Recorded GPS Determined from map

GPS unit(s) used: _____GPS File Name(s): _____

Site Location/Directions to site: Start directions from a specific known location and describe in detail the roads, trails, and routes taken to get to general area, then refer to nearby landmarks to concisely describe the site's location. Also describe the location of plants within the site, especially if plants would be difficult for someone not familiar with the site to relocate using only attached maps.

_____
_____
_____
_____
_____

Written Description (Describe the site, including such things as vegetation, significant species, aquatic features, notable landforms, natural disturbances, natural hazards, etc)**:**

_____
_____
_____
_____
_____

Transect Width:_____

Landowner (Circle one)**:** BLM USFS NPS State of Utah Private Other:

Owner unit (Circle one)**:** CARE Dixie NF Fishlake NF Richfield BLM Price BLM Other:

USFS subunit (Circle one)**:** Beaver RD Escalante RD FillmoreRD Fremont River RD Richfield RD

Current use of site:

_____

Surrounding land use (Describe physical structures and land use practices in the surrounding area, such as housing, agricultural, recreational, etc.)**:**

_____
_____

HABITAT

(Circle appropriate categories)

ASPECT	**SLOPE (degrees)**	**LIGHT**	**TOPOGRAPHIC POSITION**	**MOISTURE**
W NW	flat	Open	Crest	Inundated (hydric)
E NE	0-10	Partial	Upper slope	Intermittently flooded
S SW	10-35	Filtered	Mid-slope	Saturated (wet-mesic)
N SE	35+	Shade	Lower slope	Moist (mesic)
none	vertical		Bottom	Dry-mesic
multiple			All	Dry (xeric)

Elevation Range: _____ ft /m **to** _____ ft /m **Elevation at GPS Point:** _____ ft /m

Associated plant community:

_____

Associated plant species (list in order of dominance):

_____
_____
_____
_____

Soil/Geologic Formation:

_____

Full extent of occurrence mapped? (Circle one)**:** yes no

Estimated # of acres of potential habitat in the immediate area: **(**check only one category)

< 1 acre	6 – 20 acres	41 – 80 acres	121-160 acres
1 - 5 acres	21- 40 acres	81 – 120 acres	> 160 acres

BIOLOGY

PHENOLOGY *(must sum to 100%)*	***POPULATION ESTIMATE*** *(check one)*	***ACTUAL PLANT COUNT***	
%in leaf	1-10	**At Site:**	
%in bud	11-50		
%in flower	51-100	**In Polygon:**	
%immature fruit	101-1000		
%mature fruit	1001-10,000	Note: The count within the survey polygon **includes** the site count.	
%seed dispersing	10,000-50,000		
%dormant	> 50,000		

AGE STRUCTURE (must sum to 100%)	**VIGOR** (check one)
%seedlings	very feeble
%immature	feeble
%mature	normal
%senescent	vigorous
%unknown	exceptionally vigorous

Comments on biology:

_____
_____
_____
_____

Evidence of reproduction: yes no **Explain:**_____

Evidence of disease, predation, etc: yes no **Explain:** _____

IDENTIFICATION

Do other members of the same genus occur at this site? If yes, list species, any hybridization, etc.?

_____

Identification problems? If yes, explain:

_____
_____

Specimen(s) collected? (Circle one)**:** yes no

PHOTOGRAPHS

Photograph(s) taken? (Circle one)**:** yes no **Camera(s) used:** _____

Describe photographs (Use photo #'s. State if it's a close-up or habitat view, direction or bearing faced, etc.)**:**

_____
_____
_____
_____

CONSERVATION

Site Risk Category	Yes
High Risk	
Moderate Risk	
Low Risk	

(see definitions below)

Check the box or boxes that apply as justification for selection of risk category. Write comment in notes section below if further explanation is needed.

High Risk:		Moderate Risk:	Low Risk:
Adjacent to an actively used OHV play area or trail (designated or undesignated)	**Within ¼ mile of livestock concentration area:** (circle which) *Stockpond or other water source *Corral * Mineral supplements * Livestock trail * High value forage area * Shaded area	More than ¼ mile from livestock concentration area.	Area inaccessible to livestock and OHV's due to topography or geology.
Within ¼ mile of maintained primary road (collection issues)	Currently or recently occupied by livestock	Evidence of past livestock use in the area	Area within protective fencing
Visitor use; Hikers (trampling or collection issues)	Evidence of recent ATV use in the area	Evidence of past ATV use in the area	Lack of vegetation to attract livestock

Evidence of disturbances (describe any unnatural on-site disturbances**):**

_____
_____
_____

NUMBER OF SURVEYORS: _____ **SURVEY TIME FOR SITE:** _____hours

SURVEY TIME FOR ENTIRE SURVEY AREA (including time at site)**:** _____ hours

You **MUST** attach a map showing the site location, the area occupied by the plants (if able to determine this), and the area surveyed. Use some facsimile (copy machine or GIS-generated) of the appropriate portion of the standard USGS topographic quadrangle as your base. The site name, date, species name, and number of plants found should be indicated on the map. You may also draw a sketch of the site on the back of this sheet to show finer detail.

A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo

DRAFT May 2016

Cover: Western Yellow-billed Cuckoo. Photograph taken by Murrelet Halterman

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A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo.

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A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo

By Murrelet D. Halterman, Independent Researcher; Matthew J. Johnson and Jennifer A. Holmes, Colorado Plateau Research Station, Northern Arizona university; and Stephen A. Laymon, US Fish and Wildlife Service

Purpose

Our intent is to detail the current standard survey protocol and survey data interpretation for the western Distinct Population Segment (DPS) of Yellow-billed Cuckoos (*Coccyzus americanus*). It is intended to determine if a habitat patch contains one or more Yellow-billed Cuckoos, and is not designed to establish the exact distribution and abundance of cuckoos at a site. This protocol is intended to maximize detectability and efficiency; determining precise Yellow-billed Cuckoo numbers, locations, and breeding status requires many more visits and additional observation. This survey protocol also does not address issues and techniques associated with nest monitoring or other cuckoo research activities, but we discuss basic natural history and nest searching information in order to enhance surveyor understanding. This document is not intended to provide comprehensive coverage of that information. For more information on Yellow-billed Cuckoo biology see Hughes (1999), the final listing rule (79 FR 59992) and proposed critical habitat rule (79 FR 48547) for the species, and reports cited in this document.

Background

As early as 1944 the species was noted to be declining in California due to habitat loss and alteration (Grinnell and Miller 1944). The western population of the Yellow-billed Cuckoo was petitioned for listing as a federally endangered species in 1999 (USFWS 2001). In 2002 the western DPS was determined to be warranted but precluded for listing by higher priority species. On October 3, 2013 the proposed rule to list the western DPS of the Yellow-billed Cuckoo as a Threatened species was published in the Federal Register (78 FR 61621) and on October 3, 2014 the final listing rule was published (79 FR 59992) and the listing went into effect November 3, 2014.

At the time of the initial petition in 1999, little was known of the extent of the western population outside of California. Since then there has been additional research on distribution, ecology, and habitat use of the Yellow-billed Cuckoo in the western United States. We now have information on the population distribution in most of the western states, although there are still many areas that have not been thoroughly surveyed.

Breeding populations exist in California in the Sacramento Valley along the Sacramento River and some tributaries (although recent surveys found no evidence of breeding (Dettling and Howell 2011)), the South Fork Kern River, and restoration sites near Blythe on the lower Colorado River (Figure 1; Halterman et al 2001, McNeil et al 2013, Stanek and Stanek 2012). In Arizona, cuckoos are known to breed primarily within the Bill Williams, Big Sandy , Agua Fria,

Verde River, Gila River, Santa Cruz and San Pedro river watersheds, as well as multiple restoration sites along the lower Colorado River (Corman and Magill 2002, Halterman 2009, Johnson et al. 2010, McNeil et al. 2013). In New Mexico they breed on the Gila River and the middle Rio Grande (Stoleson and Finch 1998, Woodward et al. 2002, Ahlers and Moore 2012). In Colorado there are small numbers along the Colorado River and upper Rio Grande (Beason 2010). There are no known breeding populations in Oregon (Marshall et al. 2003). In Idaho there is reported breeding on the Snake River (Cavallaro 2011). In Nevada they may occasionally breed on the Carson, Virgin and Muddy Rivers (Halterman 2001, McKernan and Braden 2002, Tomlinson 2010, McNeil et al. 2013).

Figure 1. Range of the western Distinct Population Segment of the Yellow-billed Cuckoo.

In order to advance our understanding of the distribution of Yellow-billed Cuckoos, we need an effective and standardized survey protocol and uniform reporting of survey results. Cuckoos seldom call on their own and have a relatively low level of responsiveness to playback (Halterman 2009), and thus can be difficult to detect, making it difficult to accurately track populations. This document is intended to provide clear guidelines to agencies, consultants, volunteers, and researchers, to monitor Yellow-billed Cuckoo populations and determine habitat

occupancy. Because of the similarity of habitat use and survey techniques, some information was borrowed with permission from the SWFL protocol (Sogge et al. 2010).

Section 1. Natural History

Breeding Range and Taxonomy

Western Yellow-billed Cuckoos historically bred throughout riparian systems of western North America from southern British Columbia to northwestern Mexico (Hughes 1999). They inhabited the deciduous riparian woodlands once lining most rivers and streams. Since at least the 1850s, Yellow-billed Cuckoo populations have declined dramatically (Roberson 1980, Gaines and Laymon 1984, Laymon and Halterman 1987) and breeding cuckoos have been extirpated over much of the western range, including British Columbia, Oregon, and Washington (Hughes 1999). Although the western Yellow-billed Cuckoo has been described as a subspecies called the California Cuckoo (*Coccyzus americanus occidentalis*) (Ridgeway 1887, AOU 1956), there has been debate about its taxonomic status. There is research that both supports (Franzreb and Laymon 1993, Pruett et al. 2001), and refutes subspecies status (Banks 1988 and 1990, Fleischer 2001). The range of the Distinct Population Segment of the Yellow-billed Cuckoo is essentially the same as the range of the subspecies.

Migration and Winter Range

The Yellow-billed Cuckoo is a Neotropical migrant bird that winters in South America east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (78 FR 61621). The winter range and migration routes of the western Yellow-billed Cuckoo are poorly known. Eastern and western cuckoos may intermingle on the wintering grounds and in migration, or they may have separate wintering grounds and migration routes. Geolocator data is available from one single cuckoo captured during the breeding season on the middle Rio Grande River in New Mexico (Sechrist et al. 2012). This data indicates that the bird spent five months, from late November through April, in eastern Bolivia, southwestern Brazil, Paraguay, and northeastern Argentina. This cuckoo traveled south to southern Sonora, Mexico, in late July, then back to the Rio Grande before migrating southeast through Texas and eastern Mexico in August and September, and Honduras, Panama, and Columbia in October, and the upper Amazon basin in November. In the Spring it followed a different migration route through Brazil, Columbia, Venezuela, the Caribbean, the Yucatan Peninsula in Mexico, to the lower Rio Grande, then to the Conchas River in Chihuahua, Mexico, then back to the Rio Grande near its original capture point in early July (Sechrist et al. 2012, 78 FR 61621). There's little additional information on the western Yellow-billed Cuckoo's migration routes. Research indicates that the San Pedro River, and the lower Colorado River and its tributaries are migratory corridors (Halterman 2009) and a migrating flock was recorded by Miller (1950) in the Cape region of Baja California Sur in late May or early June (78 FR 61621).

Breeding Habitat

Breeding western Yellow-billed Cuckoos are riparian obligates and currently nest almost exclusively in low to moderate elevation riparian woodlands with native broadleaf trees and shrubs that are 20 hectares (ha) (50 acres (ac)) or more in extent within arid to semiarid

landscapes (Hughes 1999, 79 FR 59992). They are most commonly associated with cottonwood–willow–dominated vegetation cover, but the composition of dominant riparian vegetation can vary across its range. In California, habitat often consists of willows (*Salix* spp) mixed with Fremont cottonwoods (*Populus fremontii*) and, in other portions of its range, narrow-leaf cottonwood (*Populus augustifolia*) and mesquite (*Prosopis* spp.) are important habitat components. In Arizona, habitat may also contain box elder (*Acer negundo*), Arizona alder (*Alnus oblongifolia*), Arizona walnut (*Juglans major*), Arizona sycamore (*Platanus wrightii*), oak (*Quercus* spp.), netleaf hackberry (*Celtis reticulata*), velvet ash (*Fraxinus velutina*), Mexican elderberry (*Sambuccus mexicanus*), tamarisk (*Tamarix* spp.), and *Baccharis* ssp.; (Corman and Magill 2000, Corman 2005, Johnson et al. 2010). Occupancy rates (the percent of patches surveyed with at least one cuckoo detection) in Arizona were highest in cottonwood/willow/ash/ mesquite habitat (70.7% occupancy), cottonwood/willow/ash/mesquite/with less than 75% tamarisk habitat (60.7% occupancy), and mesquite bosque/hackberry habitat (60.0% occupancy). Yellow-billed Cuckoos were much less common in sycamore/cottonwood habitat (46.2% occupancy), sycamore/alder/willow/ash/walnut habitat (33.3% occupancy), and habitat comprised of greater than 75% tamarisk cover (33.3% occupancy; Johnson et al. 2010).

At the landscape level, the amount of cottonwood–willow-dominated vegetation cover and the width of riparian habitat influence western Yellow-billed Cuckoo breeding distribution (Gaines and Laymon 1984, Halterman 1991, Holmes et al. 2008, Givertz and Greco 2009, Johnson et al. 2012, 79 FR 59992). Riparian patches used by breeding cuckoos vary in size and shape, ranging from a relatively contiguous stand of mixed native/exotic vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Yellow-billed Cuckoos mainly nest in patches that are as large as 80 ha (several hundred ac); for example, San Pedro River, Arizona or Elephant Butte Reservoir, New Mexico, but they will nest in areas as small as 20 ha (Beal Lake Conservation Area at Havasu National Wildlife Refuge in Arizona (McNeil et. al. 2013). They have not been found nesting in isolated patches 0.4–0.8 ha (1-2 ac) or narrow, linear riparian habitats that are less than 10-20 meters (m) (33-66 ft) wide, although single birds have been detected in such isolated patches or linear habitats during migration or the early breeding season (mid-late June). In California, Yellow-billed Cuckoos are most likely to be found in patches of willow–cottonwood riparian habitat greater than 80 ha (200 ac) in size. Yellow-billed Cuckoos rarely used smaller patches of habitat (under 20 ha in size), particularly when patches were distant from other patches of riparian habitat (Laymon and Halterman 1989). In Arizona, on the lower Colorado River, Yellow-billed Cuckoos used large patches of habitat (> 20 ha) and areas with dense canopy closure for nesting (McNeil et al. 2013), and habitat modeling identified several important features associated with cuckoo breeding habitat: (1) a 4.5 ha (11.1 ac) core area of dense cottonwood-willow vegetation and (2) a large (72 ha/178 ac) native forest surrounding the core (Johnson et al 2012). The odds of cuckoo occurrence decreased rapidly as the amount of tamarisk cover increased or when cottonwood-willow vegetation was scarce (Johnson et al. 2012). On the Verde River in Arizona, sites occupied by cuckoos were at least 100 m (330 feet) wide; 79% of occupied sites were over 200 m (650 ft) wide, and 92% had at least 5 ha (12 ac) of mesquite in the uplands bordering the riparian patch. On average, occupied sites were larger than unoccupied sites (mean riparian patch width of occupied sites was 253 m (830 ft), and 134 m (440 ft) for unoccupied sites (Holmes et al. 2008).

At large spatial scales, cuckoos have been observed using newly formed sapling stands of riparian vegetation, first documented on the Sacramento River (Halterman 1991). Since then, cuckoos have been recorded using flood irrigated, fast-growing, restoration habitat that was less than a year old for foraging, and less than two years old for nesting (McNeil et al. 2013). Ahlers et al. (2014) found increasing numbers of cuckoos on the middle Rio Grande River in NM, likely in response to an increase of young riparian habitat through natural regeneration. The same was found on the Kern River where the majority of detections and all of the nests were found within the relatively younger habitat (Stanek and Stanek 2012). Johnson et al. (2008) found cuckoos nesting at a newly formed site, with three years old willows, on the Lake Mead/ Colorado River Delta, over 100 km from the nearest known breeding population. Although the mechanisms driving these fluctuations are unknown, it seems likely that availability of suitable breeding habitat and prey abundance are driving factors behind these changes (Greco 2012, Koenig and Leibhold 2005, Barber at al. 2008, Johnson et al. 2008, McNeil et al. 2013).

Yellow-billed Cuckoo habitat can be characterized and quantified in a number of ways, depending on the objectives of the observers. For the purposes of this protocol, we use a relatively simple approach, similar to that used in the Southwestern Willow Flycatcher (*Empidonax traillii extimus*) protocol (Sogge et al. 2010), that can be used to broadly describe and classify survey sites based on woody plant species composition and habitat structure. As described above, these, along with patch size and connectivity, have been documented as important components of cuckoo habitat, but they are likely not the only ones. Measuring other potentially important aspects of cuckoo habitat such as food availability, predators, hydrology, and environmental factors such as temperature and humidity, are beyond the scope of this protocol.

The general categories used to characterize cuckoo habitat in this protocol are based on the composition of the tree/shrub vegetation at the site: native broadleaf (>75% of cover from native trees/shrubs); exotic/introduced (>75% of cover from exotic trees/shrubs); mixed native/exotic-mostly native (51% - 75% cover from native trees/shrubs); and mixed native/exotic-mostly exotic (51% - 75% cover from exotic trees/shrubs). Each site's canopy and understory canopy height, canopy and understory canopy cover, and the cover of particular dominant plant species in the canopy and understory canopy are also recorded.

The native broadleaf tree/shrub category for breeding sites within the Western Yellow-billed Cuckoo range are described above, and often have a distinct overstory of willow, cottonwood, or other broadleaf trees, with recognizable sub-canopy layers and an understory of mixed species trees and shrubs, including tamarisk. Sites are classified as native broadleaf if greater than 75% of the cover is contributed by native broadleaf species. Exotic/introduced are sites where exotic/introduced trees/shrubs contribute 75% or greater of the vegetation cover. These sites are typically dominated by tamarisk or Russian olive (*Elaeagnus angustifolia*). Mixed native/exotic sites ("mixed exotic native-mostly native" and "mixed exotic native-mostly exotic) include mixtures of native broadleaf trees and shrubs mixed with exotic/introduced species such as tamarisk and Russian olive. The exotics are primarily in the understory canopy, but may be a component of the canopy, and the native/exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat. If a particular site is dominated primarily by natives (i.e. 51% - 75% native) it is classified as mixed exotic native-

mostly native. If it is dominated primarily by exotics/introduced species (i.e. 51% - 75% exotic) it is classified as mixed exotic native-mostly exotic.

The ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high too poor to unsuitable; the best habitats are those in which cuckoo reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding cuckoos. Small habitat patches may also provide critical stopover sites for refueling and resting during migration. There also may not be enough cuckoos in a given area, particularly at the periphery of its current range, to fill all available habitat.

Breeding Chronology and Biology

Western Yellow-billed Cuckoos are late spring migrants. In Arizona and California, a few individuals occasionally arrive in mid- to late May, but the majority do not arrive until mid-June, with late migrants straggling into early July (Corman 2005; Laymon 1998a). Nesting typically occurs between late June and late July, but may occasionally begin as early as late May, and continue into September. Cuckoos have been observed in California as late as mid-September (M. Halterman, pers. obs., McNeil and Tracy 2013, Parametrix and SSRS 2015) and mid-October in southeastern Arizona (Corman 2005). In southeastern Arizona (and possibly in other parts of the southwest), nesting may regularly continue into September, with some birds occasionally noted feeding older fledglings into early October (Corman and Magill 2000, Halterman 2002).

Nests and Eggs

Both adults build the nest, incubate the eggs, and brood and feed the young. Nest building may take as little as half a day, with additional material added to the nest as incubation proceeds (Halterman 2009). Nests are typically well-concealed in dense vegetation (Halterman 2002; Laymon et al. 1997; McNeil et al 2013). Typical clutch size varies from two to four eggs, but exceptionally one and five egg clutches have been observed. Larger clutches are likely the result of conspecific parasitism (Hughes 1999; Laymon et al 1997; Laymon 1998a; McNeil et al. 2013). Eggs, which are a pale bluish-green, are usually laid every second day, but the interval may be variable (Hughes 1999). Eggs are incubated from 9-11 days (Hughes 1999) and young cuckoos fledge five to eight days after hatching, with six days being typical (Laymon and Halterman 1985, Halterman 2009). Males incubate the eggs at night, and both sexes alternate incubation and nestling care during the day (Halterman 2009, Payne 2005). Males appear to be the primary caregiver of the young post-fledging (Halterman 2009).

Typically Western Yellow-billed Cuckoos have one brood per year (Ehrlich et al 1988). In California at the South Fork Kern River, in years of abundant food resources, two and even three broods have successfully fledged. Double brooding was observed in less than half of the 12 years of study there and triple brooding was observed only once (Laymon 1998a). Double broods have been regularly observed on the upper San Pedro River (Halterman 2009) and on the lower

Colorado and Bill Williams rivers (McNeil et al. 2013). Triple broods have occasionally been observed at these sites.

Fledglings continue to be dependent on the adults for approximately 14-21 days, seeking food from adults by giving short "cuk-cuk-cuk" calls. At approximately 14 days, fledglings give louder calls, but appear to lack the full range of adult vocalizations. The fledglings may continue to be dependent on the adults until they are 28-32 days old (Halterman 2009, McNeil et al. 2013). Young birds can be distinguished for several weeks post-fledging by the paler yellow coloration on the bill, and a shorter tail with slightly paler coloration (dark gray instead of black; Pyle 1997). It is very difficult to see these subtleties in the field, however, and aging fully-grown juveniles can be problematic for all but the most experienced observers (Halterman 2008).

Vocalizations

Cuckoos call infrequently, with an unsolicited vocalization rate of one call/hour (Halterman 2009). Their vocalizations are described by Hughes (1999) and others (Bent 1940, Hamilton and Hamilton 1965, Potter 1980). Common calls include variations of the contact call. This is a series of "kuk" notes with or without "kowlp" notes, given by both sexes (Halterman 2009; Hughes 1999). Also commonly heard is the "coo" call, apparently given primarily by females (Halterman 2009). A very soft "coo" call seems to be given by adults to nestlings. Adults also give an alarm consisting of a low "wooden knocking" call, continued until the threat leaves the area. This call is typically given in the vicinity of a nest or fledgling. Calls are described in detail in the Survey Protocol Section, Yellow-billed Cuckoo Identification, below.

Food and Foraging

Cuckoos eat a wide variety of prey items. These are primarily large arthropods such as cicadas, katydids, grasshoppers, and caterpillars, but may also include small lizards, frogs, spiders, tent caterpillars, and a variety of other insects. There is evidence to suggest that population levels and breeding may be closely tied to abundance of certain food items (Clay 1929, Bent 1940, Preble 1957, Hamilton and Hamilton 1965, Nolan and Thompson 1975, Laymon 1980, Koenig and Liebhold 2005, Halterman 2009, McNeil et al. 2013). Cuckoos typically perch inconspicuously while visually searching nearby vegetation for prey (Hamilton and Hamilton 1965, Stiles and Skutch 1989). This foraging method contributes to the difficulty of detection. They may venture out into surrounding low vegetation (flooded fields, younger habitat, sacaton (*Sporobolus* sp.) grassland) after observing prey items while perched in the riparian (Halterman 2002; McNeil et al. 2013).

Site Fidelity and Local Population Fluctuations

Little is known about population substructure, dispersal of young and post-breeding adults, juvenile and adult site fidelity, or the factors influencing breeding site detection and selection. Research indicates that the San Pedro River, lower Colorado River and tributaries are migratory corridors, in addition to being breeding areas (Halterman 2009). Cuckoos were captured and equipped with transmitters in suitable nesting habitat on these rivers; and many of these birds left the area before breeding. A small number of birds that left their banding location were detected

in the same season at other riparian sites. These within-season movements varied from 1 km to nearly 500 km (Halterman 2002, McNeil et al. 2013). Additional research is needed at other sites, particularly with more northern populations, to determine if these movements occur range wide.

Between-year fluctuations in estimated populations have been observed at multiple locations throughout the range. From 1997 to 2004, the estimated population on the Bill Williams River fluctuated between 6 and 28 pairs (20 to 78 survey detections/year; Halterman 2008). The estimated population of the South Fork Kern River fluctuated from less than 5 pairs to more than 20 pairs over a 12 year period (Laymon et al. 1997). The population on the San Pedro River fluctuated greatly from 2001 to 2007, with numbers halving from 2003 to 2006, then apparently doubling from 2006 to 2007 (Halterman 2008). Populations on the Sacramento River have shown year-to-year fluctuations (Halterman 1991) and decade-to-decade fluctuations (Laymon and Halterman 1987, Halterman et al. 2001, Dettling and Howell 2011).

The methods used to estimate population size varied between studies, but it is clear that Yellow-billed Cuckoo populations increase or decrease locally well beyond the expected fluctuations of a closed population. These studies indicate a species that is not only capable of, but likely adapted to, locating and utilizing resources that are highly variable in time and space. Multiple years of surveying are therefore required to obtain a reasonable estimation of occupancy, habitat use, and distribution.

Little is known about survivorship of Yellow-billed Cuckoos, though the Institute for Bird Populations reports an estimated annual survival probability of 50% (NBII/MAPS Avian Demographics Query Interface). Limited data from the San Pedro River, Arizona, with color-banded birds, indicates that a small percentage of the population (about 5%) returns to the breeding sites each year (Halterman 2009). On the lower Colorado River, primarily in LCR-MSCP habitat creation sites, about 10% of the banded birds were recaptured in the area one or more years after initial capture (McNeil et al. 2013). Returning birds on the San Pedro were re-sighted approximately 25 m (80 ft) and over 2 km (1.2 miles) from their banding location (Halterman 2009). Returning birds banded as adults on the lower Colorado River were re-sighted between approximately 25 m (80 ft) and 40 km (25 miles) from their banding location (McNeil et al. 2013). Returning birds banded as nestlings/fledglings on the Lower Colorado River were re-sighted between ~30 m (100 ft) to ~80 km (50 miles) from their banding location (McNeil et al. 2013). Breeding pairs of banded cuckoos at this site were found using the same territory for up to three years (Laymon 1998a).

Threats to the Cuckoo and Habitat

The decline of the western Yellow-billed Cuckoo is primarily the result of riparian habitat loss and degradation. Within the three states with the highest historical number of Yellow-billed Cuckoos, past riparian habitat losses are estimated to be about 90 to 95 percent in Arizona, 90 percent in New Mexico, and 90 to 99 percent in California (Ohmart 1994, USDOI 1994, Noss et al. 1995) Many of these habitat losses occurred historically, and although habitat destruction continues, many past impacts have ramifications that are ongoing and affect the size, extent, and quality of riparian vegetation within the range of the western Yellow-billed Cuckoo. Principal causes of riparian habitat destruction, modification, and degradation in the range have occurred

from alteration of hydrology due to dams, water diversions, management of river flow that differs from natural hydrological patterns, channelization, and levees and other forms of bank stabilization that encroach into the floodplain (79 FR 48547). These losses are further exacerbated by conversion of floodplains for agricultural uses, such as crops and livestock grazing. In combination with altered hydrology, these threats promote the conversion of existing primarily native habitats to monotypic stands of non-native vegetation, reducing the suitability of riparian habitats for the cuckoo.

Because of the absence or near absence of nesting by Yellow-billed Cuckoos in monotypic stands of tamarisk and other nonnative vegetation, the available literature suggests that conversion of native or mixed (native and non-native) riparian woodlands to nearly monotypic stands of tamarisk and other non-native vegetation, coupled with the inability of native vegetation to regenerate under altered hydrological conditions, is a significant threat to the western Yellow-billed Cuckoo now and in the future (79 FR 48547). Non-native vegetation occurs across most of the range; its establishment can be caused by altered hydrology or other disturbances, which are widespread throughout the range. Non-native vegetation is expected to increasingly modify and decrease habitat for the western Yellow-billed Cuckoo within a majority of its range in the United States and northern Mexico. Other threats to riparian habitat include long-term drought and climate change.

Section 2. Survey Protocol

This basic protocol has changed little since it was first written in 1998 (Laymon 1998) and expanded in 1999 (Halterman 1999). There have been a number of refinements as research has increased our knowledge of this elusive species. The greatest change is in interpretation of results. Previous versions of this protocol have been used effectively to survey hundreds of sites in the western United States.

Yellow-billed Cuckoos are challenging to survey for a number of reasons. They have a low unsolicited calling rate, averaging about one call/hour making standard point count surveys particularly ineffective (Halterman 2009). They have large home ranges, with average 95% kernel home ranges varying from 19.5 ha (48.2 ac) to 42.3 ha (104.5 ac), depending on location, breeding status, and gender of the individual (Halterman 2009, McNeil et al. 2013, Sechrist et al. 2009). This brevity of peak of activity, along with the potential for double and triple brooding, further complicates complete survey coverage. The peak of cuckoo nesting activity lasts only about one month, with breeding activity of the western DPS of the Yellow-billed Cuckoo peaking in July (Laymon et al. 1997, Halterman 1991, 2009; McNeil et al. 2013), but in some years breeding can start in May and end in September. Detection rates also peak during July and drop off dramatically after mid-August regardless of breeding status (Laymon et al 1997, Halterman 2008, Ahlers 2012, McNeil et al. 2013). Males and females are sexually monomorphic in appearance and in many behaviors (Halterman 2009). Breeding can only be confirmed by finding an active nest, seeing fledglings, distraction or alarm displays, or copulation. These render interpretation of survey results problematic. Given these challenges, no methodology can assure 100% detection rates. This protocol does provide an effective tool for detecting cuckoos when surveys are conducted by trained surveyors.

The secretive and sometimes subtle life history characteristics of this species influence how Yellow-billed Cuckoo surveys should be conducted and form the basis upon which this protocol was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding cuckoo absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for this and other rare and secretive species (Johnson et al 1981, Sogge et al. 1997, Conway and Simon 2003).

The primary objective of this protocol is to provide a standardized survey technique to detect Yellow-billed Cuckoos, estimate breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the experience, preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with Yellow-billed Cuckoos or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to visually distinguish Yellow-billed Cuckoos from similar species, and be able to distinguish Yellow-billed Cuckoo calls from similar vocalizations of other species. Visual sightings of cuckoos are relatively rare and often fleeting, and surveyors experienced with bird identification and behavioral observations of nesting birds will be best able to understand these brief observations. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and ability to remain alert and aware of cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and among sites, and among years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on cuckoo status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

Like previous versions, this revised protocol is based on call-playback techniques. However, it includes changes in the timing of surveys to increase the probability of detecting cuckoos and to help determine if detected cuckoos are breeders or migrants. A detailed description of surveys and timing is discussed in the section "Timing and Number of Visits." The current survey data sheets are easier to use and submit than previous versions, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that they are comparable to the current and widely used Southwestern Willow Flycatcher (SWFL) survey forms.

This protocol is intended to determine if a habitat patch contains Yellow-billed Cuckoos, and is not designed to establish the location of nests or the exact distribution and abundance of cuckoos at a site. Determining precise cuckoo numbers and locations requires many more visits and additional time observing behavior. This survey protocol also does not address issues and techniques associated with nest monitoring or other cuckoo research activities. Those efforts are beyond the scope needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to cuckoos. If nest monitoring is a required component of your study, personnel experienced with and permitted for nest searching and monitoring must be included in the project. We provide general information on nest searching so surveyors will recognize the behavior of cuckoos near a nest, and thus avoid unnecessary disturbance around a nest that might cause nest abandonment or predation.

Biologists who are not expert birders or specialists with Yellow-billed Cuckoos can effectively use this protocol. However, please note that prior to conducting any surveys, all surveyors are required to attend or have attended a U.S. Fish and Wildlife Service (USFWS)-approved Yellow-billed Cuckoo survey training workshop, and have knowledge and experience with bird identification, survey techniques, avian breeding behavior, and ecology sufficient to effectively apply this protocol.

Non-Protocol (Exploratory) Surveys

Under special circumstances, it may be permissible to use call-playback in a way that does not follow the protocol. They are intended to assess whether an area merits full protocol surveys, and to increase general distribution knowledge. These exploratory surveys will allow agency personnel (or others working with their approval) to survey 1-3 times at sites that are not scheduled for regular surveys. These exploratory surveys are not intended to be conducted in project areas. These surveys are not intended to estimate the distribution and abundance of cuckoos at the site, and can only be conducted by individuals with all appropriate State and Federal permits and permissions.

Permits

Federal endangered species 10(a) 1(A) recovery permits are required to conduct surveys for Yellow-billed Cuckoos in all USFWS regions where the western Yellow-billed Cuckoo DPS breeds. State permits may also be required, and both federal and state permits may take several months to obtain so please plan ahead. Permits or permission are often required to access potential survey locations. The level of permitting will depend on the applicant's expertise in observing and handling cuckoos and attending a USFWS-approved Yellow-billed Cuckoo survey protocol workshop.

Permits will cover a range of activities, and will depend on the applicants experience level and needs. Permits are required for the following activities: surveys, nest searching and monitoring, banding adults and nestlings, attaching transmitters to cuckoos, radio telemetry, and blood and feather sample collection.

Pre-Survey Preparation

Pre-survey preparation is essential to conducting efficient, quality surveys. It is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results. All surveyors are required to attend a USFWS-approved, survey protocol workshop prior to conducting surveys and should carefully study the Yellow-billed Cuckoo Identification section, below. It is especially critical for surveyors to be familiar with Yellow-billed Cuckoo vocalizations before going in the field. Surveyors should study calls, songs, drawings, photographs, and videos (if available) of Yellow-billed Cuckoos. An excellent source of vocalizations is the xeno-canto website (www.xeno-canto.org). This site is a community shared bird-sound database.

Surveyors should also become familiar with cuckoo habitat. If possible, visit as many known Yellow-billed Cuckoo breeding sites as possible and study photos of cuckoo habitat. Such visits are usually part of the Yellow-billed Cuckoo survey protocol workshops. All visits should be coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to cuckoos. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective cuckoo coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if cuckoos have been previously detected at the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where cuckoos have previously been detected. However, please realize if it has been several years since a location has been surveyed, some habitat sections may have changed, for better or worse. As an example, newer riparian sections may have developed in size and density to become appropriate nesting/foraging areas.

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. It is the individual surveyor's responsibility to survey all suitable habitat within the respective site. It's best to layout and walk transects in advance of the surveys. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and transect start and stop points (if previously surveyed), where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant water, muddy or swampy conditions, and quicksand, crawling through dense thickets, and exposure to rattlesnakes, skunks, and biting insects.

The day before conducting the survey, set a time for departure to the site. Surveying generally occurs in the early morning, beginning just before sunrise and continuing, depending on environmental factors (including noise levels), until 1100 or until temperatures reach 40C/104F whichever comes first. Know the directions to the survey site and estimate the time it will take to

get to the first point by driving and walking, possibly in the dark. If possible, preload you're GPS (or other navigation device) with survey transects and survey points. Your departure time for the following morning should ensure arrival at the starting point approximately one hour before sunrise. If the survey takes more than two hours, make an effort to start at the opposite end of the transect for each survey round, so that all points are surveyed in the earlier hours. This may not always be logistically possible.

It is imperative that all surveyors exercise safety first. Be aware of hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

Table 1. List of items for conducting Yellow-billed Cuckoo surveys.

Required Items	**Details**
USGS Map and/or aerial photo (orthorectified; color photocopies) of survey area	A marked copy is required to be attached to survey datasheets submitted at the end of the season. The survey site needs to be delineated and detections clearly marked. If the survey area differed between visits, individual surveys should be delineated.
Broadcast equipment (e.g., Audio device, and speakers) and batteries	Must be capable of broadcasting recorded calls 100 m without distortion (recommended speaker volume of 70 db). Having a fully charged device and extra batteries as well as back-up/extra broadcast equipment is highly recommended to avoid abandoning a survey due to equipment failure. Use only the provided contact call for broadcast.
Standardized survey form	Multiple copies for each survey.
Recorded contact/kowlp calls	Acquired by attending Yellow-billed Cuckoo protocol workshop.
Binoculars	A pair with 7-10 power that can provide crisp images in poor lighting conditions.
GPS device with extra batteries	With start and stop UTMs for previously surveyed areas. All surveyor locations at time of detection should be recorded as waypoints. The compass direction and distance to individual detections are recorded from the waypoint.
Compass	The compass bearing is taken, and distance to the detected cuckoo(s) is estimated, from the surveyor's waypoint. The compass feature on the GPS unit is often much more difficult to use in the field than a compass. A compass may also help surveyors navigate through the patch more easily than using the GPS.
Clipboard or electronic device	Survey results and observations should be recorded directly onto the survey data form to ensure that all required data is collected and recorded.
Pens, Pencils, and Sharpies	Take multiples of each.
Device to record time	Use the GPS unit, watch, or phone
Optional Items	**Details**
Cell phone/portable radio	For communication between surveyors and for safety.

Camera	Helpful for habitat photos of survey sites, especially where cuckoos are found.
Laser Rangefinder	For measuring distance to detections (if possible) and height of trees.
Hard copy of start/stop UTMs	Use as a back-up for the GPS unit.

Yellow-billed Cuckoo Identification

Yellow-billed Cuckoos are a slender, medium-sized bird, about 30 cm in length, and weighing about 60 grams. The upperparts are grey-brown, the underside is clean white, and the tail is long with white spots at the end of the central rectrices. A flash of bright rufous in the wings is usually visible in flight, and occasionally while perched. The legs are blue-gray, but are seldom visible since cuckoos typically perch so that the legs are hidden under the belly. The bill is long and slightly down-curved, with a mostly black upper mandible and lower mandible ranging from yellow to orange with a black tip. Flight is generally direct and agile. Sexes are similar, and although females average larger than males, this difference is seldom visible in the field (Pyle 1997, Halterman 2009). In general, look for a slender bird with a bright white chest, long tail, and grey-brown head contrasting with a white throat.

When seen clearly, this species is unmistakable. Often you will only have a fleeting glimpse of a bird, so you need to quickly assess what you've seen. Be sure to study all available photos and video of cuckoos. Familiarization with images of both cuckoos and similar species will aid in rapid and correct identification in the field. There are a number of species that can be mistaken for cuckoos when seen briefly. These include:

1. Ash-throated Flycatchers (*Myiarchus cinerascens*) are the most similar to cuckoos, with a slender build, rufous in the wings, a relatively long tail, and agile flight pattern. They often fly closer during cuckoo call playback. The breast typically appears gray, the head is "puffy", and there is no strong contrast between brown upperparts and white underparts. Look for the shorter bill and tail when this species is perched.
2. Mourning Doves (*Zenaida macroura*) are heavier, the breast appears tan/gray, the tail is pointed, and the flight is relatively heavy and direct.
3. White-winged Doves (*Zenaida asiatica*) are much larger, with tan/gray breast, and show a bold flash of white in the wings in flight.
4. Northern Mockingbirds (*Mimus polyglottos*) are slender with a relatively long tail tipped with white. Look for the large white wing patches and lack of strong contrast between the chest and back.
5. The rusty flash of a Northern Flicker's (*Colaptes auratus*) wings are reminiscent of the rufous flash in a cuckoo's wings, but either calls or subsequent views will aid in correct identification.
6. Brown-crested Flycatchers (*Myiarchus tyrannulus*) are also similar, but the bright yellow belly and the larger head facilitate correct identification.
7. Loggerhead Shrikes (*Lanius ludovicianus*) and both California (*Toxostoma redivivum*) and Crissal thrashers (*Toxostoma crissale*) may also look like cuckoos when seen fleetingly.

The majority of Yellow-billed Cuckoo detections are from birds that are heard but never seen (Halterman et al 2001; Halterman 2009, McNeil et al. 2013), so it is critically important to know

the calls of this species as well as similar species. There are two commonly heard calls, which can be given by males or females. Each call can be confused with calls of a number of other birds, especially when heard at a distance. We will discuss each in detail:

1. Contact call - also referred to as the "kowlp" call. This is a series of a variable number of "kuk" notes followed by a variable number of "kowlp" notes. This can be given at any time during the breeding season. Individuals may give calls with variable combinations of kuks and kowlps, and may omit one or the other of the notes altogether. Although distinctive when heard clearly, there are several species with similar calls, particularly when heard from a distance. The most similar species is the Yellow-breasted Chat (*Icteria virens*), which sometimes appears to give calls mimicking the cadence of cuckoo calls following playback. Chats also typically give a single diagnostic sharp "chuck". Familiarization with the calls of this species is critical to correct identification where the two co-occur. Pied-billed Grebe (*Podilymbus podiceps*) calls can also sound very similar to cuckoo calls; the fact that the call emanates from a wetland will usually help distinguish this species, though this call is loud, carries well, and the presence of a wetland may not be known. Less similar, but still worth learning, are most woodpecker and accipiter calls.

2. Coo call. This is given with greatest frequency in the early and middle part of the breeding season. It typically consists of a 5-8 evenly-pitched and evenly-spaced "coo" notes, ending with 1-3 notes on a lower pitch. The number of coo notes may vary from one or two notes to several minutes of continuous calling. Although diagnostic when heard clearly, there are a number of species with similar calls. The most similar is Greater Roadrunner (*Geococcyx californianus*); its call is a series of "coos" which drop in pitch with each note. Distant notes of both Mourning and White-winged dove calls can sound almost identical to cuckoo coos, but the pattern is very different, with only 1-3 coo notes heard. Both dove species typically repeat their calls, so the initially questionable coo can usually be identified with careful attention. Other sounds which, when heard from a distance and at the edge of hearing, could be (and have been) confused with the cuckoo coo call include noisy cows, barking dogs, and machinery.

Less commonly heard, but important to know, is the cuckoo alarm call, sometimes called the knocker call. This is a short series of soft wooden "kuk-kuk-kuk-kuk" notes. This is typically given near a nest or fledglings, but can be heard anytime a cuckoo is disturbed. The call typically is given multiple times, and at relatively close range. It is best to assume that the alarmed bird is near a nest or young, particularly in July and August, and leave the area to avoid further disturbance.

An excellent source of vocalizations of all these species is the xeno-canto website (www.xeno-canto.org). This site is a community shared bird-sound database.

Timing and Number of Visits

The timing of this protocol is intended to assess Yellow-billed Cuckoo presence, and potentially estimate abundance and distribution. Accurate population determination is beyond the scope of

this protocol, but conducting surveys during the peak of breeding activity will increase the probability of detecting any cuckoos that are present. This call-playback technique detects cuckoos that may otherwise be overlooked. Multiple surveys at each site are important, and with appropriate effort, avian biologists without extensive experience with cuckoos can find and verify Yellow-billed Cuckoo presence.

There are three survey periods. Surveys are conducted for the sole purpose of assessing whether Yellow-billed Cuckoos are present at a site. A minimum of four survey visits are required (Figure 2). Four surveys conducted during the three survey periods listed in Figure 2 will have an 80% probability of detecting an individual cuckoo (Carstensen et al. 2015, Halterman 2009) and a 95% probability of detecting cuckoos, when they are present at a site during the breeding season (McNeil et al. 2013, Carstensen et al. 2015).

Prior to the field season, we suggest developing a sampling schedule, based on the survey periods (Figure 2) and the number and extent of sites to be surveyed. Yellow-billed Cuckoo surveys should be scheduled to begin after a thorough training session (including attending a survey protocol workshop). Initiation of sampling is tailored to the phenology of the Yellow-billed Cuckoo in the study region, and is generally timed to begin after resident individuals have arrived, presumably to breed, within the region. Due to differences in breeding seasons across the western US, a survey window of ± 3 days is acceptable for the start and end of each survey period. Each survey site is visited a minimum of four times within the breeding season, with a minimum of 12 days and a maximum of 15 days between surveys at a particular site.

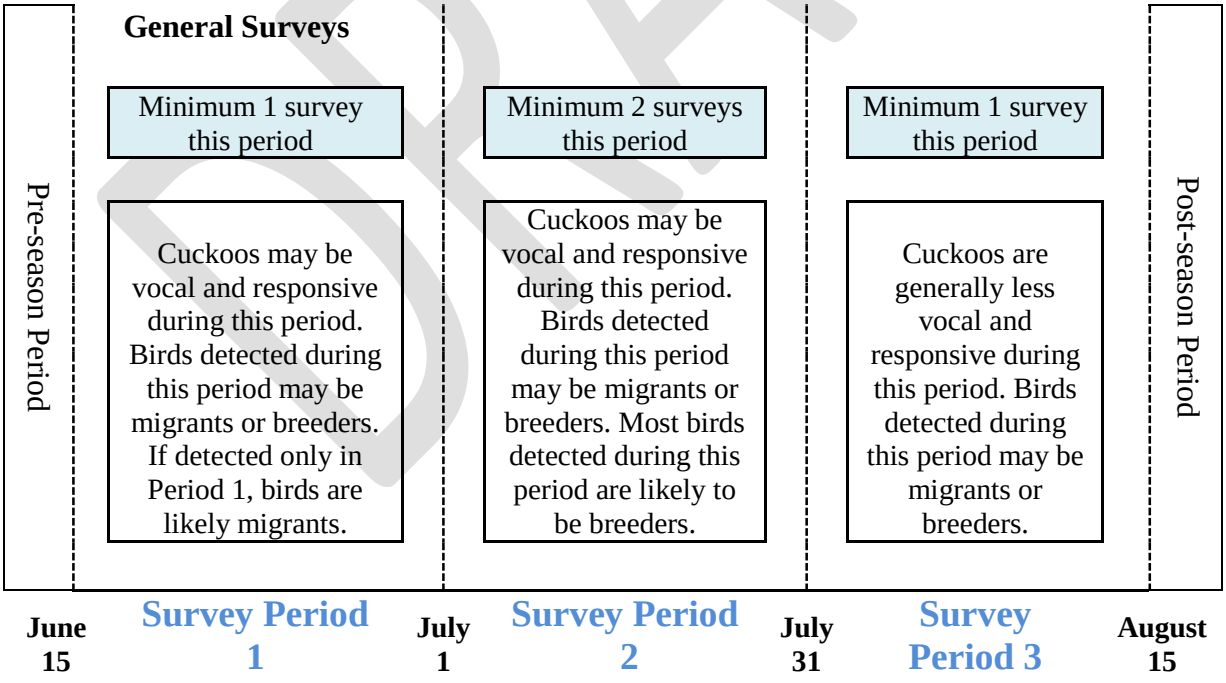

Figure 2. Recommended number and timing of visits during each survey period for Yellow-billed Cuckoo surveys.

If breeding confirmation is required, more visits will be needed and they must be conducted by surveyors permitted to search for nests. Even with additional effort, it may not be possible to verify breeding activity during a season. When developing a survey schedule for multiple surveyors, care should be given to scheduling so that multiple surveyors do not overlap areas, and the risk of a surveyor mistaking a broadcast call for a cuckoo is reduced. Additionally, if surveyors are working on adjacent plots, they should communicate both during and after surveys to avoid double counting.

Pre-season Survey Period: late May to June 14. No surveys required. This spans the earliest time that cuckoos may arrive on breeding grounds, but most cuckoos present during this period are likely migrants. However, cuckoos will occasionally begin breeding during this time.

Survey Period 1: June 15 to June 30. One survey is required. This survey occurs as migrating birds are passing through, and breeding birds arrive. Although many birds detected during this time may be migrants, surveys during this time will help with seasonal survey detection interpretation, and will also allow surveyors to familiarize themselves with all survey areas.

Survey Period 2: July 1 (+ or – 3 days) to July 31 (+ or – 3 days). Two surveys are required during this period. Cuckoos encountered during this time are mostly breeders, though migrants, wandering individuals, and young of the year may be encountered. This is the period when breeding activity is most likely to be observed (e.g. copulation, food carries, alarm calls). Extra time should be taken to cautiously observe all cuckoos encountered during this time, while avoiding disrupting potentially breeding birds.

Survey Period 3: August 1 to August 15. One survey is required, and most breeding birds are finishing breeding activities and departing. Cuckoos are typically much less vocal and responsive during this time than during Survey Period 2.

Post-breeding Period: August 16 through September. Cuckoos in the southwest may initiate nesting, build second or third nests, or provide care for fledglings in this period (Halterman 2009; McNeil et al. 2013). This is particularly true in southeastern Arizona where local conditions often allow for a lengthier breeding season. Surveys during this time will help clarify cuckoo use of the site, and length of time on the site. Birds encountered during this period may also be migrants. Cuckoos are less vocal during this time than during Survey Period 2.

The best way to confirm breeding status of cuckoos detected at a site is to do follow-up visits and observe cuckoo behavior at a distance. Careful notes should be taken during these visits. Playback calls should not be used during follow up visits, and great care must be taken in order to avoid disturbing nesting birds.

Reporting Requirements and Datasheets

Reporting requirements may vary by region and entity (Federal, State, and Private, for example). Check your permits and other information from permitting agencies for reporting requirements. Although these requirements vary, there is information that is required by any permitting agency, such as the location of the area surveyed and the location and number of cuckoo detections. For

your convenience we have provided three sample datasheets. These can be obtained from any of the following websites:

https://www.fws.gov/southwest/es/Documents/R2ES/YBCU_SurveyProtocol_FINAL_DRAFT_22Apr2015.pdf

https://www.fws.gov/southwest/es/arizona/Yellow.htm

https://www.facebook.com/groups/746657762142636/

1. Yellow-billed Cuckoo Survey Seasonal Summary Form. This form is meant to be completed at the end of the survey season, to summarize data collected across the survey periods. One form can be used for each site surveyed. If required, it can be filled out and submitted at the end of the season. There are three associated documents:
    a. PDF for printing.
    b. Excel file for data entry and electronic submission. This includes a formula to convert distance and direction from the observer to correct the estimated location (UTM) of a cuckoo detection.
    c. Yellow-billed Cuckoo Survey Summary Form Instructions (Appendix 1, this document).
2. Optional Yellow-billed Cuckoo Daily Datasheet. This form can be printed and used for each day's survey, and has room for notes and additional observations. It is not currently required in any Regions, and is provided as a convenience to surveyors.
    a. PDF for printing and field use.
    b. Optional Yellow-billed Daily Datasheet Instructions (Appendix 2, this document).
3. Site Description Form. This form can be used to describe the general characteristics of the site being surveyed. The intent is for one form to be filled out for each site surveyed. This form is included in the 2015 version of the Seasonal Summary Form, so you not need to complete this form separately if you are using the older form.
    a. PDF for printing and use in the field.
    b. Excel file for data entry and electronic submission.
    c. Site Description Form Instructions (Appendix 3, this document).

Survey Methods

The survey methods described below fulfill the primary objective of assessing the presence of Yellow-billed Cuckoos within a survey area during that breeding season. This protocol is primarily a call-back technique, a proven method for eliciting response from nearby Yellow-billed Cuckoos, when conducted as described below. This technique has also been used extensively to survey for Willow Flycatchers (Sogge et al. 2010) and increases the detectability of species that occur in low densities or in dense vegetation (Johnson et al. 1981, Sogge et al. 1997). The call-back technique simulates the presence of a cuckoo in the area, which may elicit a

response from a cuckoo (if there is one in the area), increasing its detectability. At each site, surveyors should broadcast a series of recorded Yellow-billed Cuckoo contact/"kowlp" calls, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby cuckoos, this method also allows for positive identification by comparing the responding bird's vocalizations to the known Yellow-billed Cuckoo recording.

It is recommended that cuckoo surveys not be conducted at the same time as other state or federal permitted bird surveys. For example, it is preferable that a surveyor not conduct a cuckoo survey at the same time that they are conducting a Southwestern Willow Flycatcher survey or Least Bell's Vireo (*Vireo bellii pusillus*) survey. Doing so could negatively impact the detection of one or more species being surveyed and impair the ability to compare survey results to surveys where only one species was actively surveyed.

Begin surveys as soon as there is enough light to safely walk (just before sunrise) and continue, depending on the temperature, wind, rain, background noise, and other environmental factors, until 1100. Surveys should not be conducted after temperatures reach 40 degrees C (104 F). If the detectability of cuckoos is being reduced by environmental factors (e.g. excessive heat, cold, wind, or noise), surveys planned for that day should be postponed until conditions improve. Within a study area all potentially suitable habitat patches should be surveyed. A patch is defined as an area of riparian habitat 5 ha or greater in extent that is separated by at least 300 m from an adjacent patch of apparently suitable cuckoo habitat. The 5 ha is considered a typical minimum size for cuckoo occupancy, as no cuckoos have been detected attempting to nest in patches this size or smaller in Arizona or California (Halterman et al. 2001, Johnson et al. 2010). Suitable habitat falls into two types: 1. multi-layered riparian vegetation, with riparian canopy trees (at least a few within the patch) and at least one layer of understory vegetation; 2. mesquite and/or hackberry bosque, primarily in southeastern Arizona or when adjacent to habitat 1 above. Suitable breeding habitat often includes dense young riparian cottonwood/willow vegetation (Halterman 1991, Greco et al. 2002, McNeil et al. 2013).

Surveys can be conducted from the edge (within 10 m) when a patch is less than 200 m in width, provided the entire perimeter is surveyed. It is critical to survey all suitable habitat within an area. Small, linear patches may be thoroughly covered by a single transect along the perimeter. For larger sites, when suitable habitat exceeds 200 m in width, use a systematic survey path that assures complete patch coverage throughout the length and width of the site. Area with multiple, adjacent transects should be surveyed concurrently and in coordination (via text message or radio contact). This will help minimize duplicate detection of the same cuckoo, potentially on different transects/sites, and enable a more accurate territory estimation. The surveyor can skip over areas of unsuitable habitat (e.g. an extensive cobble bar) between patches, if the unsuitable habitat is at least 300 m in extent. Areas with small, narrow stringers of habitat, steep banks, and backwater sloughs can be surveyed by playback from a boat. It is the surveyor's responsibility to ensure all suitable habitat within the site is thoroughly surveyed.

The broadcast consists of five contact/kowlp calls, each spaced one minute apart. For consistency and comparability of the data, use only the call provided during the protocol training workshop (or from the authors). The recording should be played at approximately 70db. The standard survey forms can be obtained from http://www.fws.gov/southwest/es/. Negative data is

important, so complete the datasheet for all surveys conducted, regardless of detections. There are other forms which may be better suited to specific research needs. For those forms, it is best to contact specific researchers directly.

Arrive at the broadcast-point and wait at least one minute to listen for unsolicited cuckoo calls (i.e. cuckoos that may be calling before broadcast of the calls). Listen carefully for cuckoos, recognize and shift your attention from other bird species songs and calls, and focus on listening for cuckoos. The majority of responses occur after the first or second broadcast call, so surveyors need to be alert and prepared before beginning playback (McNeil et al. 2013, Carstensen et al. 2015).
If you do not hear any cuckoos during the initial listening period, begin the first broadcast. Listen and watch intently for responding cuckoos during and after each of the five broadcast calls. This includes watching for movement as silent birds may move closer to investigate. If no cuckoo is detected at the broadcast-point after five broadcast calls, continue 100 m along the transect and start a new broadcast as described above. Use additional datasheets for additional broadcast-points within the transect. Use the back of each datasheet to record observations and comments, linking the data by recording the "note #" in the right column of the survey data table on the front of the datasheet, and on the back of the datasheet along with the corresponding observations and comments.

Response to the broadcast call could take several forms. One or more Yellow-billed Cuckoos may move quietly (without calling) toward the surveyor, so it is critical to watch carefully for responding birds from any direction, including behind you. Cuckoos that fly silently toward the survey are difficult to detect and necessitate the full attention of the surveyor. In between broadcast calls, surveyors should be listening for cuckoos, and not be filling out the datasheet. Cuckoos may respond by calling from a distance, so listen for these responses. Cuckoos typically respond with the contact/kowlp call, but may also respond with a coo call or, rarely, an alarm call. When a cuckoo is detected, terminate the broadcast, as it may divert the bird from normal breeding activity or attract the attention of predators. Concentrate on observing the bird rather than immediately recording data. Several hundred cuckoos have been banded in the western United States over the last decade; carefully check cuckoos for leg bands, and carefully record the band color, combination and order.

After a cuckoo has been detected and appropriate data collected, move 300 m further along the transect before resuming the survey. This will minimize the likelihood of detecting the same cuckoo (Halterman 2009, McNeil et al 2013). While it is unusual for cuckoos to move 300 m after being detected by a surveyor, the surveyor should be aware of the possibility, attempt to track an individual's movements, and use their judgment to estimate if subsequent detections are separate individuals or the same individual. Please make note of all observations about individual movements and the reasoning used in determining number of individuals on the back of the data sheet.

When a cuckoo is encountered between broadcast points (i.e. an unsolicited detection is made while traveling to, from, or between broadcast points), stop and record all information in the same manner as if the detection was made during a broadcast. Do not broadcast calls. After making observations and recording information regarding the detection(s), move 300 m from the

point where the detection was made, along the transect. Continue with the procedures for conducting a survey broadcast.

Interpreting and Reporting Survey Results

This protocol is intended to be used to assess if a habitat patch contains a Yellow-billed Cuckoo. Therefore, the best way to interpret survey detections is a simple detection/non-detection determination. Determination of numbers and breeding status of cuckoos is more complex, and caution should be used when interpreting survey detection data. Because of the cuckoo's elusive and mobile nature, it is easy to both over- and under-estimate cuckoo populations. Over-estimation may occur when highly mobile individuals are detected on subsequent surveys hundreds of meters from their original detection and counted as "new" individuals (Halterman 2009, McNeil et al. 2013). Underestimation may occur because cuckoos vocalize infrequently, and respond and are detected less than half the time they are present during call playback (Halterman 2009).

The following information is one method of interpreting detection data, and should be used with caution. After the survey is completed, locations of cuckoos should be plotted as UTM coordinates on either USGS quad maps or in a GIS (geographic information system). Detection locations can be compared to estimate the total number of cuckoos detected at a site during a survey season. Separation of adjacent detections is based primarily on the distance between detections. If cuckoos are located greater than 300 m apart on the same survey, they are considered separate detections (Holmes et al. 2008, Halterman 2009, Henneman 2009). McNeil et al. (2013) and Ahlers et al. (2012) have developed similar methods for determining the number of Yellow-billed Cuckoo territories, and this should be consulted for a detailed interpretation of survey results.

Although it is difficult to accurately determine number of territories and breeding status, Holmes et al. (2008), and, later, the Southern Sierra Research Station developed a method of interpreting detections to estimate possible, probable, and confirmed breeding territories (Table 2). This determination is often only possible when follow-up visits are made to areas where cuckoos were detected during surveys. These visits may be part of nest searching or mist netting efforts. The following is from Holmes et al. (2008) and McNeil et al. (2013), and should be used, in addition to total detections, when reporting breeding status.

Table 2. Interpretation of results to estimate breeding status (from Holmes et al. 2008 and McNeil et al. 2013)

Estimation Type	Term	Definition
Breeding Territory Estimation	Possible breeding territory (PO)	Two or more total detections in an area during two survey periods and at least 10 days apart. For example, within a certain area, one detection made during Survey Period 2 coupled with another cuckoo detection made 10 days later, also during Survey Period 2, warrants a PO territory designation.
	Probable breeding territory (PR)	Three or more total detections in an area during at least three survey periods and at least 10 days between each detection. PO territory plus YBCUs observed carrying food (single observation), carrying a stick (single observation), traveling as a pair, or exchanging vocalizations.
	Confirmed breeding territory (CO)	Observation of copulation, stick carry to nest, carrying food (multiple observations), distraction display, nest, or fledgling.
Population estimation	Minimum breeding territory	The observed number of confirmed breeding territories (CO).
Occupancy estimation	Site occupancy	Occupancy is based on two or more total survey detections during two or more survey periods and at least 10 days apart. Multiple detections in an area over an extended period of time suggest that the area may have been used for breeding.

Section 3. Nest Searching

Nest searching

CAUTION: Because of the possibility of observer-induced nest abandonment, nest searching and monitoring should only be conducted when part of focused research activities. Special Federal and State permitting are required to conduct nest searching and monitoring. We provide general information on nesting activity and nest searching here so surveyors are familiar with the behaviors, and can avoid inadvertent use of these techniques.

Yellow-billed Cuckoos will nest in a wide variety of substrates, with placement height ranging from 1 m (3 ft) to 20 m (65 ft) (Hughes 1999). Nests are usually placed on either a fairly thin branch (horizontal or vertical) in larger trees or shrubs, or next to the trunk of a smaller diameter

at breast height (DBH) tree (Halterman 2002, 2008). Nests have been observed in a number of plant species including willow, cottonwood, alder, ash, mesquite, hackberry, seep willow (*Baccharis salicolifolia*) sycamore (*Plantanus* spp.), and tamarisk. There is usually a fairly high percentage of vegetation cover directly above the nest, and several meters around the nest (Laymon et al. 1997, Halterman 2005, McNeil et al. 2013).

Nesting cuckoos can be very sensitive to disturbance, especially during the pair formation and nest building stage. Nests located prior to the first egg are particularly susceptible to abandonment. At least five nests were abandoned during seven years of study on the Bill Williams River National Wildlife Refuge, possibly due, at least in part, to human disturbance (Halterman 2001, Halterman et al. 2009). Surveyors must be alert to cuckoos' behavioral signs of disturbance near a nest, which include alarm calls given repeatedly while watching the intruder, broken wing displays, or flying in with prey, then eating it instead of going to the nest. If these occur, the observer has been detected, the cuckoo is distressed, and the observer should move back. Recorded calls should not be used to elicit a response during nest searching and monitoring activities, as cuckoos have been observed leaving the nest in response to a recorded call.

Nest searching is done using two methods. Please use this information to avoid unintentionally searching for nests. When cuckoos make a nest exchange, typically one bird will call 10m or more from the nest, and the mate on the nest will answer (M. Halterman, unpublished data). The first method uses the observation of these behaviors. Two to three people will work together, triangulating on the vocalizations. The second method involves carefully searching all vegetation in the area where a cuckoo has vocalized several times, and a nest is suspected. Following the flight direction of cuckoos carrying food can also be used to locate nests.

If a nest is found, observers should leave the area after marking the general nest location with a GPS and making brief notes of the general description of the nest site (e.g., plant species used for nest substrate, approximate height of nest, and placement within the tree/shrub canopy). GPS readings should be taken no closer than 10 m from the nest, to avoid disturbance. A general description of the nest site should be completed soon after leaving the area. This information may be used for follow-up monitoring by an appropriately permitted individual.

Nest monitoring

If authorized to do so, surveyors can monitor active nests to determine nest fate. Nesting activity can be monitored and recorded by an observer sitting quietly 30-40 m from the nest for several hours. A blind or dense cover should be utilized for all nest monitoring and feeding observations. Signs of disturbance include an adult cuckoo giving a soft repetitive knocking call around the observer, and adults flying in with food, but not going to the nest. If these behaviors are observed for more than 20 minutes, the observer should leave the area. Also, because cuckoos are sensitive to disturbance at the nest, nest checks should only be conducted every 3-4 days (Halterman 2000). Both sexes incubate the eggs and care for the young (Nolan and Thompson 1975, Potter 1980, Payne 2005). Nest exchanges occur, on average, every two hours during incubation

(Halterman 2009). Nest exchanges increase when cuckoos are feeding nestlings, with up to 22 exchanges per day observed on the San Pedro River NCA (Halterman 2009).

Special Considerations

To avoid adverse impacts to Yellow-billed Cuckoos, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.

2. Do not play the recording more than necessary or needlessly elicit vocal responses once Yellow-billed Cuckoos have been located. This may distract breeding birds from caring for eggs or young. If cuckoos are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators. Stop playing the survey recording as soon as you have confirmed the presence of a Yellow-billed Cuckoo, and do not play the recording again until you have moved 300 m from the estimated or known location of the previously detected cuckoo.

3. Proceed cautiously while moving through Yellow-billed Cuckoo habitat. Continuously check the area around you to avoid disturbance to nests of Yellow-billed Cuckoos and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.

4. Do not approach known or suspected nests. Nest searching and monitoring require specific State and Federal permits, have their own specialized methodologies (e.g. Martin and Geupel 1993), and are not intended to be a part of this survey protocol.

5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a “dead end” trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix a small flag at least 10 m away and hidden from view of the nest. Record the compass bearing to the nest on the flagging. Report your findings to an agency cuckoo coordinator or a biologist who is permitted to monitor nests.

6. If you use flagging to mark an area where cuckoos are found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized/permitted nest monitoring,

flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.

7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, magpies, and accipiters. If such predators are in the immediate vicinity, wait for them to leave before playing the recording, or move on to the next broadcast-point.

8. Non-indigenous plants and animals can pose a significant threat to cuckoo habitat and may be unintentionally spread by field personnel, including those conducting cuckoo surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another, visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). Several non-native species of concern in survey locations are the tamarisk leaf beetle (*Diorhabda* spp.), quagga mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot's feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

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References Cited

78 FR 61621. Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus); Proposed Rule. Federal Register / Vol. 78, No. 192 / Thursday, October 3, 2013 / Proposed Rules.

79 FR 48547. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo; Proposed Rule. Federal Register / Vol. 79, No. 158 / Friday, August 15, 2014 / Proposed Rules.

79 FR 59992. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus); Final Rule. Federal Register/ Vol. 79, No. 192 / Friday, October 3, 2014 / Rules and Regulations.

Ahlers, D., and D. Moore. 2012. Yellow-billed Cuckoo Study Results – 2011: Survey Results from the Middle Rio Grande, New Mexico. U.S. Bureau of Reclamation, Technical service Center, Denver, CO.

American Ornithologists' Union. 1957. Checklist of North American Birds. Fifth edition. American Ornithologists' Union, Washington, D.C.

Barber, N.A., R.J. Marquis, and W.P. Tori. 2008. Invasive prey impacts abundance and distribution of native predators. Ecology 89: 2678-2683.

Banks, R.C. 1988. Geographic variation in the yellow-billed cuckoo. Condor 90:473-477.

Banks, R.C. 1990. Geographic variation in the yellow-billed cuckoo: corrections and comments. Condor 92:538.

Beason, J.P. 2010. Untitled summary report on distribution of yellow-billed cuckoos in Colorado and Wyoming, from Rocky Mountain Bird Observatory.

Bent, A.C. 1940. Life histories of North American cuckoos, goatsuckers, hummingbirds, and their allies. Smithsonian Institution United States National Museum, Bulletin 176. 1989 reprint by Dover Publications, New York, NY.

Carstensen, D., D. Ahlers, and D. Moore. 2015. Yellow-billed Cuckoo Study Results – 2014: Middle Rio Grande from Los Lunas to Elephant Butte Reservoir, New Mexico. U.S. Bureau of Reclamation, Technical service Center, Denver, CO.

Cavallaro, R. 2011. Breeding Yellow-billed Cuckoo Survey and Inventory - Idaho Falls District, Bureau of Land Management - Interim Report. Prepared by Idaho Department of Fish and Game, Idaho Falls, Idaho. 52 pp.

Clay, M.B. 1929. The Yellow-billed Cuckoo. Bird-lore 31: 189–190.

Conway, C.J., and J.C. Simon. 2003. Comparison of detection probability associated with burrowing owl survey methods. Journal of Wildlife Management 67(3):501-511.

Corman, T.E. and R.T. Magill. 2000. Western yellow-billed cuckoo in Arizona: 1998 and 1999 survey report. Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Technical Report 150. 49 pp.

Corman, T.E. 2005. Yellow-billed Cuckoo (*Coccyzus americanus*) *in* Arizona Breeding Bird Atlas. T.E. Corman and C. Wise-Gervais (editors). Univ. of New Mexico Press, Albuquerque, NM, pp. 202-203.

Dettling, M.D., and C.A. Howell. 2011. Status of the Yellow-billed Cuckoo along the Sacramento River in 2010. Report to California Department of Fish and Game. PRBO Contribution #1794. 47 pp.

Fleischer, R.C. 2001. Taxonomic and evolutionarily significant (ESU) status of western yellow-billed cuckoos (*Coccyzus americanus*). Admin. Report to USGS and US Fish and Wildlife Service April 22, 2001. 25 pp.

Franzreb, K.E., and S.A. Laymon. 1993. A reassessment of the taxonomic status of the yellow-billed cuckoo. Western Birds 24:17-28.

Gaines, D., and S.A. Laymon. 1984. Decline, status and preservation of the yellow-billed cuckoo in California. Western Birds 15:49-80.

Girvetz, E.H. and S.E. Greco. 2007. How to define a patch: a spatial model for hierarchically delineating organism-specific habitat patches. Landscape Ecology 22: 1131-1142.

Greco, S.E. 2012. Patch change and the shifting mosaic of an endangered bird's habitat on a large meandering river. River Research and Applications. DOI 10.1002/rra2568.

Grinnell, J., and A.H. Miller. 1944. The distribution of the birds of California. Cooper Ornithological Club, Berkeley, CA. 1986 reprint by Artemisia Press, Lee Vining, CA.

Halterman, M.D. 1991. Distribution and habitat use of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*) on the Sacramento River, California, 1987-1990. Master's Thesis, California State University, Chico, CA. 49 pp.

Halterman, M.D. 1999. Draft Western Yellow-billed Cuckoo Natural History Summary and Survey Methodology. Southern Sierra Research Station, Weldon, CA.

Halterman, M.D. 2001. Population status of the yellow-billed cuckoo at the Bill Williams River NWR and Alamo Dam, Arizona, and Southern Nevada: summer 2000. Bureau of Reclamation, Lower Colorado River Division, Boulder City, NV. 45 pp.

Halterman, M.D. 2002. Surveys and life history studies of the yellow-billed cuckoo: summer 2001. Admin. Rept., Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, NV and Bureau of Land Management, Sierra Vista, AZ. 37 pp.

Halterman, M.D. 2005. Surveys and life history studies of the yellow-billed cuckoo: summer 2004. Report to the Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, NV and Bureau of Land Management, Sierra Vista, AZ. 32 pp.

Halterman, M.D. 2008. Final report for the 2006-2007 yellow-billed cuckoo project. Report to the Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, NV.

Halterman, M. D. 2009. Sexual dimorphism, detection probability, home range, and parental care in the yellow-billed cuckoo. Ph.D. Dissertation, University of Nevada, Reno, NV.

Halterman, M.D., D.S. Gilmer, S.A. Laymon, and G.A. Falxa. 2001. Status of the yellow-billed cuckoo in California: 1999-2000. Report to the US Geological Survey, Dixon, CA. 73 pp.

Halterman, M.D., E.T. Rose, S.E. McNeil, and D. Tracy. 2009. Yellow-billed cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2008. Annual report to the U.S. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV, by Southern Sierra Research Station, Weldon, CA.

Hamilton, W.J. III, and M.E. Hamilton. 1965. Breeding characteristics of yellow-billed cuckoos in Arizona. Proceedings of the California Academy of Sciences, Fourth Series, 32:405-432.

Henneman, C. 2009. Yellow-billed cuckoo surveys in the South Fork Kern River Valley in 2008. Admin. Rept. prepared for U.S. Fish and Wildlife Service, Sacramento Office by Southern Sierra Research Station, Weldon, CA.

Holmes, J.A., C. Calvo, and M.J. Johnson. 2008. Yellow-billed Cuckoo distribution, abundance, habitat use, and breeding ecology in the Verde River Watershed of Arizona, 2004-2005. Final Report to Arizona Game and Fish Department, Heritage Department, Phoenix, AZ. 34 pp.

Hughes, J.M. 1999. Yellow-billed Cuckoo (*Coccyzus americanus*). *In* The Birds of North America, No. 148 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 28 pp.

Johnson, M.J., S.L. Durst, C.M. Calvo, L. Stewart, M.K. Sogge, G. Bland, and T. Arundel. 2008. Yellow-billed cuckoo distribution, abundance, and habitat use along the lower Colorado River and its tributaries, 2007 Annual
Report. U.S. Geological Survey Open-File Report 2008–1177.

Johnson, M.J., R.T. Magill, and C. van Riper, III. 2010. Yellow-billed cuckoo distribution and habitat associations in Arizona, 1998-1999. Pp. 197-212, In: The Colorado Plateau IV: Integrating research and resources management for effective conservation (van Riper, C., III, B. F. Wakeling, and T. D. Sisk, Eds). University of Arizona Press, Tucson, AZ. 335 pp.

Johnson, MJ., J.R. Hatten, J.A. Holmes, and P.B. Shafroth. 2012. Development of a GIS-based model of yellow-billed cuckoo breeding habitat within the lower Colorado River Multi-Species Conservation Area, San Pedro River, and Verde River, AZ. Admin. Report to Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, NV. 53 pp.

Johnson, R.R., B.T. Brown, L.T. Haight, and J.M. Simpson. 1981. Playback recordings as a special avian censusing technique. In: Estimating numbers of terrestrial birds (C.J. Ralph, and J.M Scott, Eds.). Studies in Avian Biology 6:68-75.

Koenig, W.D., and A.M. Liebhold. 2005. Effects of periodical cicada emergences on abundance and synchrony of avian populations. Ecology 86:1873-1882.

Laymon, S.A. 1980. Feeding and nesting behavior of the yellow-billed cuckoo in the Sacramento Valley. California Dept. Fish and Game, Wildlife Management Branch, Sacramento, CA. Admin. Rep. 80-2.

Laymon, S.A. 1998. Yellow-billed Cuckoo survey and Monitoring Protocol for California. Unpublished.

Laymon, S.A. 1998a. Partners in Flight Bird Conservation Plan: Yellow-billed Cuckoo (Coccyzus americanus). (http://www.prbo.org/calpif/htmldocs/species/riparian/yellow-billed_cuckoo.htm)

Laymon, S.A. and M.D. Halterman. 1985. Yellow-billed cuckoos in the Kern River Valley: 1985 population, habitat use, and management recommendations. California Dept. of Fish and Game, Nongame Bird and Mammal Section Rep. 85–06.

Laymon, S.A. and M.D. Halterman. 1987. Distribution and status of the yellow-billed cuckoo in California: 1986-1987. Final Report to the California Department of Fish and Game, Nongame Bird and Mammal Section, Wildlife Management Division, Sacramento, CA.

Laymon, S.A. and M.D. Halterman. 1989. A proposed management plan for yellow-billed cuckoos in California. Pages 272-277 *in* D. Abell, Tech. Coord., Proceedings of the California Riparian Systems Conference: protection, management, and restoration for the 1990's. USDA Forest Service Gen. Tech. Rep. PSW-110, Berkeley, CA.

Laymon, S.A., P.L Williams, and M.D. Halterman. 1997. Breeding status of the yellow-billed cuckoo in the South Fork Kern River Valley, Kern County, California: Summary Report 1985-1996. Admin. Report USDA Forest Service, Sequoia National Forest, Cannell Meadow Ranger District, Challenge Cost-share Grant #92-5-13.

Marshall, D.B., M.G. Hunter, and A.L. Contreras. 2003. Birds of Oregon: a general reference. Oregon State University Press, Corvallis, OR. 768 pp.

Martin, T.E., and G.R. Geupel. 1993. Methods for locating nests and monitoring success. Journal of Field Ornithology 64:438–449.

McKernan, R. L., and G. T. Braden. 2002. The status of Yuma clapper rail and yellow-billed cuckoo along portions of Virgin River, Muddy River, and Las Vegas Wash, Southern Nevada, 2001. Final Report to the U.S. Fish and Wildlife Service and Southern Nevada Water Authority, Las Vegas, prepared by San Bernardino County Museum, Redlands, California.

McNeil, S.E., D. Tracy, J.R. Stanek, and J.E. Stanek. 2013. Yellow-billed cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2008-2012 summary report. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV.

McNeil, S.E, D. Tracy, and C.D Cappello. (2015 in review). Loop migration and Chaco wintering by a Western Yellow-billed Cuckoo. Manuscript submitted for publication.

Nolan, V. Jr., and C.F. Thompson. 1975. The occurrence and significance of anomalous reproductive activities in two North American non-parasitic cuckoos *Coccyzus* spp. IBIS 117:496-503.

Noss, R.F., E.T. LaRoe III, and J.M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. U.S. Geological Survey, Biological Resources Division (National Biological Service), BSR no. 9501, Washington, DC.

Ohmart, R.D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Studies in Avian Biology 15:273–285.

Parametrix, Inc. and Southern Sierra Research Station, 2015. Yellow-billed cuckoo surveys and population monitoring on the lower Colorado River and tributaries, 2014. Annual Report submitted to the Bureau of Reclamation, Boulder City, Nevada. Prepared by S.E. McNeil, and D. Tracy, Southern Sierra Research Station, Weldon, California, and Parametrix, Inc., Albuquerque, New Mexico. February 2015.

Payne, R.B. 2005. The Cuckoos. Oxford University Press. Oxford, UK.

Potter, E.F. 1980. Notes on nesting yellow-billed Cuckoos. J. Field Ornithology 51:17-29.

Preble, N.A. 1957. Nesting habits of the yellow-billed cuckoo. American Midland Naturalist 57:474-482.

Pruett, C.L., D.D. Gibson, and K. Winker. 2001. Molecular “cuckoo clock” suggests listing of western yellow-billed cuckoo may be warranted. Wilson Bulletin 113:228-231.

Pulliam, H.R. 1988. Sources, sinks, and population regulation. American Naturalist 132: 652–661.

Pyle, P. 1997. Identification guide to North American birds - part 1. Slate Creek Press, Bolinas, CA. 732 pp.

Ridgway, R. 1887. A manual of North American birds. Lippincott Press, Philadelphia, PA.

Roberson, D. 1980. Rare birds of the West Coast. Woodcock Publications, Pacific Grove, CA. 496 pp.

Sechrist, J., V. Johanson, and D. Ahlers. 2009. Western Yellow-billed Cuckoo Radio Telemetry Study Results – Middle Rio Grande New Mexico – 2007-2008. U.S. Bureau of Reclamation, Technical Service Center, Denver, CO.

Sechrist, J., Paxton, E. H., Ahlers, D., Doster, R. H., and Ryan, V. M. 2012. One year of migration data for a Western Yellow-billed Cuckoo. Western Birds 43:2–11.

Sogge, M.K., R.M. Marshall, S.J. Sferra, and T.J. Tibbits. 1997. A southwestern willow flycatcher natural history summary and survey protocol. Technical Report NPS/NAUcprs/NRTR-97/12. 36 pp.

Sogge, M.K., D. Ahlers, and S.J. Sferra. 2010. A natural history summary and survey protocol for the Southwestern Willow Flycatcher: U.S. Geological Survey Techniques and Methods 2A-10. 38 pp.

Stanek, J. R., and J. E. Stanek. 2012. Yellow-billed Cuckoo Occupancy, Breeding, and Habitat Use in the South Fork Kern River Valley, 2012 Annual Report. Report to the US Fish and Wildlife Service, Sacramento Office, Sacramento, CA.

Stiles, F.G., and A.F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell University Press, Ithaca, New York.

Stoleson, S., and D. Finch. 1998. Breeding bird activity along the Gila River in the Gila-Cliff valley. Unpublished data. USFS- Rocky Mountain Research Station, Albuquerque, NM.

Tomlinson, C. 2010. Yellow-billed cuckoo – Candidate Species Assessment – Coccyzus americanus, Nevada – April 14, 2010. Attachment in email to Karen Leyse, U.S. Fish and Wildlife Service, Sacramento, California. April 14, 2010. 12 pp

U.S. Department of Interior. 1994. The impact of Federal programs on wetlands, Vol. II, a report to Congress by the Secretary of the Interior, Washington, DC, March 1994.

United States Fish and Wildlife Service (USFWS). 2001. Endangered and threatened wildlife and plants; 12-month finding for a petition to list the Yellow-billed Cuckoo (*Coccyzus*

americanus) in the Western Continental United States. Federal Register. 50 CFR Part 17:38611-626.

Woodward, H.D, S.H. Stoleson, and D.M. Finch. 2003. Yellow-billed cuckoos on the Gila National Forest: presence-absence, abundance, and habitat. Final report for the 2002 Field Season. US Dept. of Agriculture Forest Service, Rocky Mountain Research Station, Albuquerque, NM.

Appendix 1. Instructions for completing the Yellow-billed Cuckoo Survey Seasonal Summary Form.

NOTE- CHECK YOUR PERMIT – REPORTING REQUIREMENTS VARY BETWEEN REGIONS

These instructions are provided as guidance for completing the Survey Summary Form. It is important to complete all fields of the datasheet using a standardized format as described. Write clearly so that others can easily read the data. In addition to documenting sites with cuckoos, it is important to know areas where cuckoos were not detected; datasheets for these areas would have all information on the datasheet completed.

Attach the following: (1) copy of USGS quad/topographical map or similar (REQUIRED) of survey area, outlining survey site and location of cuckoo detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected cuckoos or their nests; (3) photos (if taken) of the interior of the patch, exterior of the patch, and overall site. Submit completed forms to both the appropriate state Yellow-billed Cuckoo coordinator and the US Fish and Wildlife Service (USFWS). Forms can also be completed digitally and submitted via email with attached or embedded topographic maps and photographs.

We recommend scanning or otherwise imaging data sheets immediately after the day's survey is completed. In the event of loss or damage to the data sheet, the information can be salvaged.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the cuckoo survey coordinators for each state and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your state or USFWS cuckoo coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the state or USFWS cuckoo coordinator). If you are uncertain if the site was previously surveyed, contact your state or USFWS cuckoo coordinator.

County. Record the county where the site is located.

State. Record the state where the site is located.

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Elevation. This can be obtained from a handheld GPS unit, USGS quad map, or a GIS elevation layer. Please use the most accurate information available. Please record data in meters.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Site Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units.

Datum. For uniformity of data, please use NAD83.

Ownership. Circle the appropriate owner for the site (BLM, Reclamation, NPS, USFWS, USFS, Tribal, State, Private, or other (Municipal/County)).

Was site surveyed in previous year? Circle yes or no.

If yes, what site name was used? If the site was surveyed in the previous year, record the site name used in the previous year.

Survey Visit #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. Note: A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple sub-sites and use separate survey forms for each. Casual, pre-season, supplemental, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the comments section on page 2 or in the survey continuation sheet.

Observer(s). Record your first initial(s) and last name(s).

Date: Indicate the date that the survey was conducted using the format mm/dd/yyyy.

Start and Stop. Record the start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hrs. Calculate the total hours, rounded to the nearest tenth (0.1) hour, based on time spent surveying the site and the number of surveyors. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed different sections of one site concurrently and independently, sum the number of hours each observer spent surveying the site.

Total Number of YBCUs detected. Record the total number of unique individual adult/fledgling Yellow-billed Cuckoos detected during this particular survey. Do not count nestlings. (But do record whether nestlings or fledglings were found in the comments section.)

Detection Type. Record how the cuckoo was detected using two codes. First, record whether the detection was "Incidental" (with a code of "I") if the cuckoo not was detected during the 6 minutes of each call playback survey point. If the cuckoo was detected during a Call playback survey, record it as a "P". Second, record whether the detection was A = aural (you only heard a cuckoo), V = Visual (you only saw it), or B = both (you heard and saw it).

Vocalization Type. If the detection was aural, record the type of vocalization heard as "CON" = Contact/kowlp, "COO" = coo, "ALA" = alarm (soft knocker call) ,"OV" = other (and describe the "other" vocalization under notes section.

Playback Number (#). Record the number of times the 'kowlp' call was played before the cuckoo responded.

Behavior Code. Record the appropriate breeding behavior code(s), for the behavior observed using the following codes (listed on the datasheet).

Surveyor Detection Coordinates. Enter the UTM Easting (E) and Northing (N) for the location of the surveyor when the cuckoo was detected. The direction (compass bearing) and distance to the detected cuckoo are estimated from this point.

Distance. Estimate as accurately as possible, the distance in meters to the detected cuckoo.

Bearing. Estimate, as accurately as possible, the compass bearing in degrees to the detected cuckoo from the surveyor location. The compass declination should be set to the magnetic declination of the survey area. Magnetic declination values can be located on USGS 7.5 minute quad maps or can be found using an internet search for "your state" + magnetic declination.

Cuckoo Number (#). Record a sequential number, starting with the number 1 for the first observation of the survey, in the row pertaining to the broadcast - point in which the observation was made. Use this reference number for other note-worthy information in the note section on the datasheet - record the cuckoo number and detailed notes regarding your observations including breeding behavior.

Corrected Coordinates. The Yellow-billed Cuckoo location is calculated based on the surveyor's location, distance, and bearing. Use the provided "Yellow-Billed Cuckoo Survey Summary Form for electronic submission" datasheet, which will calculate these coordinates.

Survey Summary. At the end of the survey season, complete the survey summary on the front page of the datasheet, near the bottom. Record the total number of detections made (across all surveys at the site); the number of possible breeding territories (see interpreting and reporting survey results in the protocol); and the total number of survey hours (the sum of all hours spent surveying the site).

Notes. As described above, for each detection during which a cuckoo was observed, record the Note # followed by detailed notes describing the observation(s), or other note-worthy information. Attach additional pages or use the continuation sheet if needed.

Page 2: Yellow-billed Cuckoo Survey Seasonal Summary Form, continued

Yellow-billed Cuckoo survey and detection form, continued: Please use this form for additional detections, follow-up visits, and any other circumstance when more detail is needed. Please use the detailed instructions above for filling out the form.

Page 2 of Survey Form

Name of Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Provide the reporting individual's phone number; include the area code.

E-mail. Provide the reporting individual's E-mail.

U.S. Fish and Wildlife Service (USFWS) Permit #. List the full number of the required federal permit under which the survey was completed.

State Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State wildlife agency permit.

Site Name. Same as for page 1 of the survey form.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Did you survey the same general area during each visit to this site this year? Yes/No. Circle Yes or No; if No, summarize in the comments below.

If site was surveyed last year, did you survey the same general area this year? Yes/No. Circle Yes or No; if No, record the reason and how the survey varied in the comments below.

Overall Vegetation Characteristics: This describes the overall vegetation characteristic for the site, namely which species predominantly comprise the tree/shrub layer. Check one of the following categories:

Native broadleaf plants - >75 % of the tree/shrub layer of the site is composed of native broadleaf plants.

Exotic/introduced plants - >75 % of the tree/shrub layer of the site is composed of exotic/introduced plants.

Mixed native and exotic plants (mostly native) – 51% -75% of the tree/shrub layer of the site is composed of native broadleaf plants.

Mixed native and exotic plants (mostly exotic) – 51% -75% of the tree/shrub layer of the site is composed of exotic/introduced plants.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate. Specify units used.

Estimated Canopy Cover. Estimate the percent canopy cover for the site.

Overstory Vegetation. Estimate the percent cover provided by the dominant overstory plant species at the site: cottonwood, tamarisk, Goodding's willow, Russian olive, coyote willow, and 'other". If other than the species listed, specify the species.

Average height of understory canopy. The understory canopy comprises a distinct layer (that does not have to be present throughout the site) below the overstory canopy. Provide the best estimate of the average height of the top of the understory canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate. Specify units used.

Estimated Understory Canopy Cover. Estimate the percent understory canopy cover for the site.

Understory Vegetation. Estimate the percent cover provided by the dominant understory plant species at the site: cottonwood, tamarisk, Baccharis, Goodding's willow, Russian olive, New Mexico olive, coyote willow, and 'other". If other than the species listed, specify the species.

Was surface water or saturated soil present at or within 300 meters of the site? Circle yes or no.

Was this true of all patches surveyed? Circle yes or no.
Comments. Provide comments regarding differences between survey patches within the site. For example, if the average canopy for the site is 30% cover, but within one patch it is 60%, describe this. Also note any significant differences between dominant overstory and understory vegetation among patches within the site. Document these differences with photographs whenever possible and reference comments to photos number whenever available. Note potential threats (e.g., livestock, ORV, hunting, etc.) to the site. If *Diorhabda* beetles are observed, contact your

USFWS and state cuckoo coordinator immediately. Attach additional pages or use the continuation sheet if needed.

Page 2 of Survey Summary Form

Yellow-billed Cuckoo survey and detection form, continued: Please use this form for additional detections, follow-up visits, and any other circumstance when more detail is needed. Please use the detailed instructions above for filling out the form.

Appendix 2. Instructions for Completing the OPTIONAL Yellow-billed Cuckoo Daily Datasheet

Total YBCU detections: at the end of the survey, record the total number of cuckoos detected during the survey. This is the actual number of detections. Interpretation of survey results (i.e. detections vs. number of cuckoos actually present) can be discussed in your report, but not here.

Page __ of __ : It is important to track number of pages, especially when datasheets are scanned.

Surveyor name: Record the first and last name of the primary surveyor.

Surveyor email: Record the best email address for the primary surveyor.

Surveyor phone number: Record the best phone number for the primary surveyor.

Site Code: Letter or alphanumeric code that denotes a particular site, intended to track sites throughout the season and across years. When applicable, you may use the same code identification as for Southwestern Willow Flycatcher sites.

Site Name: Write the full, unique name of the site to be surveyed. When applicable, you may use the same site name identification as for Southwestern Willow Flycatcher sites (Obtain these from your USFWS office).

Survey Period: The survey period in which the survey is being conducted (1-4), as defined in the protocol. Period 1 (one survey required): June 15-June 30. Period 2 (two surveys required): July 1 –July 31. Period 3 (one survey required): August 1-August 15.

Visit #: In many cases, this will be the same as the survey period, as most sites will be surveyed only once during a survey period. If more than one visit is conducted within one or more survey periods, number the visits sequentially, from the start of the survey season to the end. Such visits are typically for follow-up to determine breeding status.

Date: The month (mm) / day (dd) / year (yyyy) the survey is conducted.

Drainage: The name of the river, stream, or drainage where the site is located.

State, County: State two letter code (i.e. AZ); County full name (i.e. Coconino)

Additional Observers: First and last name of all additional surveyors.

Survey Start/End Time (hhmm): Write in the time of the start and end of the initial broadcast-point count (at the transect starting point) using the hour and minute format in military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Wind (0-5): Record wind measured with an anemometer. Alternatively, record the Beaufort wind code (0 through 5; Page 2 of form) as it applies to the strength of the wind during the survey. Record the average wind condition, not the maximum condition (e.g., periods of gusty winds). Do not survey if wind is greater than code 4.

Cloud Cover: Record cloud cover as: clear (C: <25%), partly overcast (PO: 25%-49%), mostly overcast (MO: 50-74%), or overcast (O: 75%+) If there are patches of clouds in different areas of the sky, try to visualize gathering all of them together into one part of the sky and recording what percent of cloud cover that would represent.

Precip (0-5): Record the appropriate code (0 through 5). Surveyors should not be surveying if rain is more than an intermittent drizzle. See chart on datasheet, Pg. 2.

Noise (0-3): Record the noise code (0-3) that applies to background noise conditions during the transect, as it relates to your ability to hear cuckoos. Record the average noise conditions, not the maximum condition. 0 = Quiet - no noise that interferes with bird detection. 1 = Faint Noise - slight noise that has only a minimal effect of bird detection. 2 = Moderate Noise - probably can't hear some birds beyond 100m. 3 = Loud Noise - Only the closest birds are detected. See chart on datasheet, Pg. 2.

Temperature: Record the ambient temperature; specify if collected in Fahrenheit or Celsius.

NAD: Surveyors should be using NAD 83.

UTM Start/Stop: Enter the UTM Easting (E) and Northing (N) for the transect starting point, and again for the end of the transect.

Start and Stop GPS Accuracy: The accuracy of the GPS reading for the UTMs, recorded in meters.

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units.

General survey data.

Call Point Start Time (hhmm): Write in the time of the start of the individual broadcast-point count (when the surveyor first arrives at the point) using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Survey Call Point UTM Coordinates: Enter the UTM Northing (N) and Easting (E) for the individual survey point.

Waypoint Number: Record this if you are saving them on your GPS unit.

Yellow-billed Cuckoo detections:

(Reminder: When a cuckoo is detected at a point, terminate the broadcast. **Do not continue to play the recording once a cuckoo is detected.)**

Detection #: When a cuckoo is detected, record a unique number for the detection. If it is the first detection of the survey visit, the detection number is "1". If more than one cuckoo is detected at the point, record the second detection in the next row on the data sheet, and record the detection number as "2". In the columns to the left (Point Start Time, UTM coordinates) record "" to denote that these values are the same as those in the row directly above. Also, if more than one cuckoo is detected at a point, be sure to thoroughly describe your observations under "Notes". If you think the same cuckoo is detected later at a different point during the survey or incidentally before or after the survey, give that bird a new detection number, but make a note of this. .

Time of Detection: Record the time that the cuckoo was detected, using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Record how the cuckoo was detected. **I = Incidental** (between call broadcast points) or **P = Playback** (following broadcast calls).

Detection type: **A = Aural**, **V = Visual**, or **B = Both**. If the cuckoo was detected both by sight and sound (i.e., "B"), write in parenthesis the order in which the type of detections occurred. For example, "B (A/V), and describe the detection(s) under "Note #" as detailed below.

Compass Bearing (^{o}): Record the estimated compass bearing, in degrees, to the detected cuckoo. The compass declination should be set to zero.

Estimated Distance (m): Record the horizontal distance in meters between the broadcast point (where you are standing), and the location or presumed location of the cuckoo where you first detect it.

Accuracy of Estimate (Est. Accuracy): Indicate relative accuracy of your estimate using the codes shown in Table 1. Determine your pace by counting your steps per measured distance. Recalibrate your pace prior to and throughout the field season to ensure accuracy. Code reminders are on Pg. 2 of the datasheet.

Table 1. Codes for quantifying the degree of accuracy in estimating the distance to a detected cuckoo.

Accuracy Code	Explanation
1	Measured distance, using laser rangefinder or pacing, to a known location.
2	Measured distance, using laser rangefinder or pacing, to an estimated location.
3	Estimated location of detection and distance, feel confident it was within **25 m** of true location.
4	Estimated location of detection and distance, feel confident it was within **50 m** of true location.

5	Estimated location of detection and distance, feel confident it was within **100 m** of true location.
6	Little confidence in your estimate, a complete "guesstimate".

Vocal codes (Vocalization codes): Record the appropriate code (see Pg. 2, data sheet), or series of codes for any calls heard when you made the detection. Use more than one code, when appropriate.

Behavior/Breeding: Record the appropriate breeding behavior code(s), for the behavior observed using the codes on Pg. 2 data sheet. You may enter more than one code in this box. Note that if you use Vocal Exchange (VEX) you will enter data in 2 rows, one for each bird. Use more than one code, when appropriate.

Note #: To record observations of cuckoo detections, or other note-worthy information, first record a sequential number, starting with the number 1 for the first observation of the survey, in the row pertaining to the broadcast - point in which the observation was made. Use the space on the bottom of the data sheet to record detailed notes regarding your observations. Use the back of the data sheet if more space is needed.

***:** Two blank columns are provided so surveyors can record additional information that may be of interest, such as cicada presence, presence of other avian species of interest, etc.

Data Entry, Data Proof, Data Scan: These are provided for QA/QC of your data.

Review your federal and state permit requirements. Be sure to submit appropriate forms and reports on time to USFWS and other agencies. Retain a copy for your records.

Appendix 3. Instructions for Completing the Yellow-billed Cuckoo Survey Site Description Form

These instructions are provided as guidance for completing the Yellow-billed Cuckoo Survey Site Description Form. It is important to complete all fields of the datasheet using a standardized format as described. Type or write clearly so that others can easily read the data. Describe any unique habitat features in Comments.

We recommend scanning or otherwise imaging data sheets immediately after the day's survey is completed. In the event of loss or damage to the data sheet, the information can be salvaged.

Date report completed: Indicate the date that the survey was conducted using the format mm/dd/yyyy.

Site Name: Write the full, unique name of the site to be surveyed. When applicable, you may use the same site name identification as for Southwestern Willow Flycatcher sites (Obtain these from your USFWS office).

State. Record the state where the site is located.

County. Record the county where the site is located.

Name of Reporting individual: Record the first and last name of the primary surveyor.

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone #: Record the best phone number for the primary surveyor.

Email: Record the best email address for the primary surveyor.

U.S. Fish and Wildlife Service (USFWS) Permit #. List the full number of the required federal permit under which the survey was completed.

State Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State wildlife agency permit.

Site Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet.

UTM Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units.

NAD: Surveyors should be using NAD 83.

USGS Quad Name(s). Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps. Please list the names of all Quads covered by the survey site.
Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Elevation. This can be obtained from a handheld GPS unit, USGS Quad map, or a GIS elevation layer. Please use the most accurate information available. Please record data in meters.

Name of nearest Creek, River, Wetland, or Lake. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Ownership. Circle the appropriate owner for the site (BLM, Reclamation, NPS, USFWS, USFS, Tribal, State, Private, or Other (Municipal/County)).

Was site surveyed in previous year? Circle yes or no.

If yes, what site name was used? If the site was surveyed in the previous year, record the site name used in the previous year.

Did you survey the same general area during each visit to this site this year? Yes/No. Circle Yes or No; if No, summarize in the comments below.

If site was surveyed last year, did you survey the same general area this year? Yes/No. Circle Yes or No; if No, record the reason and how the survey varied in the comments below.

Native/Exotic:

Native broadleaf plants - >75 % of the tree/shrub layer of the site is composed of native broadleaf plants.

Mixed native and exotic plants (mostly native) – 51% -75% of the tree/shrub layer of the site is composed of native broadleaf plants.

Mixed native and exotic plants (mostly exotic) – 51% -75% of the tree/shrub layer of the site is composed of exotic/introduced plants.

Exotic/introduced plants - >75 % of the tree/shrub layer of the site is composed of exotic/introduced plants.

Overstory Vegetation. Provide the scientific names of the five most common species in the overstory, and the estimated percent cover provided each species. It is possible for there to be an overstory present with no understory. Use the following cover categories: <1%; 10%, 25%, 50%, 75%, 90%, 100%.

Average height of canopy. Provide the best estimate of the average height, in meters, of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Estimated Overall Canopy Cover. Estimate the overall percent canopy cover for the site.

Understory Vegetation. The understory canopy comprises a distinct woody layer (that does not have to be present throughout the site) below the overstory canopy. For example, a cottonwood overstory might have a willow understory. It's also possible that there may only be an overstory, with no understory. Willow or mesquite, for example, may have no understory. Provide the scientific names of the five most common species in the understory, and the estimated percent cover provided each species. Use the following cover categories: <1%; 10%, 25%, 50%, 75%, 90%, 100%.

Average height of understory canopy. Provide the best estimate of the average height, in meters, of the top of the understory canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Estimated Overall Understory Cover. Estimate the percent understory cover for the site.

Describe adjacent habitat: Describe the types of habitat adjacent to the survey area. Include upland vegetation type, such as agricultural or residential areas, roads, and any other relevant information.

Adjacent Habitat. Provide the names of the five most common types of adjacent habitat, and the estimated percent cover provided each type. Alternatively, you can list up to five types of surrounding land use. For example: Fallow Ag field, 50%; suburb, 25%, Walnut orchard, 25%. Use the following cover categories: <1%; 10%, 25%, 50%, 75%, 90%, 100%.

Was surface water or saturated soil present at or within 300 meters of the site? Circle yes or no.

Was this true of all patches surveyed? Circle yes or no.

Comments. Provide comments regarding differences between survey patches within the site. For example, if the average canopy for the site is 30% cover, but within one patch it is 60%, describe this. Also note any significant differences between dominant overstory and understory vegetation among patches within the site. Document these differences with photographs whenever possible and reference comments to photos number whenever available. Note potential threats (e.g.,

livestock, ORV, hunting, etc.) to the site. If *Diorhabda* beetles are observed, contact your USFWS and State cuckoo coordinator immediately. Attach additional pages or use the continuation sheet if needed.

PAGE 2. The first four sections are required in case pages become separated.

Site Name.

Name of Reporting Individual.

Phone Number.

E-mail.

Map: Attach the following: (1) copy of USGS quad/topographical map or similar (REQUIRED) of survey area, outlining survey site and location of cuckoo detections; (2) sketch or aerial photo showing site location, patch shape, openings, survey route, location of any detected cuckoos or their nests; (3) photos (if taken) of the interior of the patch, exterior of the patch, and overall site. Submit completed forms to both the appropriate State Yellow-billed Cuckoo coordinator and the US Fish and Wildlife Service (USFWS) as required by your permits. When required or recommended, forms should be completed digitally (Microsoft Word or Excel) and submitted via email with attached or embedded topographic maps and photographs.

A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo

DRAFT May 2016

Cover: Western Yellow-billed Cuckoo. Photograph taken by Murrelet Halterman

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A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo.

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A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo

By Murrelet D. Halterman, Independent Researcher; Matthew J. Johnson and Jennifer A. Holmes, Colorado Plateau Research Station, Northern Arizona university; and Stephen A. Laymon, US Fish and Wildlife Service

Purpose

Our intent is to detail the current standard survey protocol and survey data interpretation for the western Distinct Population Segment (DPS) of Yellow-billed Cuckoos (*Coccyzus americanus*). It is intended to determine if a habitat patch contains one or more Yellow-billed Cuckoos, and is not designed to establish the exact distribution and abundance of cuckoos at a site. This protocol is intended to maximize detectability and efficiency; determining precise Yellow-billed Cuckoo numbers, locations, and breeding status requires many more visits and additional observation. This survey protocol also does not address issues and techniques associated with nest monitoring or other cuckoo research activities, but we discuss basic natural history and nest searching information in order to enhance surveyor understanding. This document is not intended to provide comprehensive coverage of that information. For more information on Yellow-billed Cuckoo biology see Hughes (1999), the final listing rule (79 FR 59992) and proposed critical habitat rule (79 FR 48547) for the species, and reports cited in this document.

Background

As early as 1944 the species was noted to be declining in California due to habitat loss and alteration (Grinnell and Miller 1944). The western population of the Yellow-billed Cuckoo was petitioned for listing as a federally endangered species in 1999 (USFWS 2001). In 2002 the western DPS was determined to be warranted but precluded for listing by higher priority species. On October 3, 2013 the proposed rule to list the western DPS of the Yellow-billed Cuckoo as a Threatened species was published in the Federal Register (78 FR 61621) and on October 3, 2014 the final listing rule was published (79 FR 59992) and the listing went into effect November 3, 2014.

At the time of the initial petition in 1999, little was known of the extent of the western population outside of California. Since then there has been additional research on distribution, ecology, and habitat use of the Yellow-billed Cuckoo in the western United States. We now have information on the population distribution in most of the western states, although there are still many areas that have not been thoroughly surveyed.

Breeding populations exist in California in the Sacramento Valley along the Sacramento River and some tributaries (although recent surveys found no evidence of breeding (Dettling and Howell 2011)), the South Fork Kern River, and restoration sites near Blythe on the lower Colorado River (Figure 1; Halterman et al 2001, McNeil et al 2013, Stanek and Stanek 2012). In Arizona, cuckoos are known to breed primarily within the Bill Williams, Big Sandy , Agua Fria,

Verde River, Gila River, Santa Cruz and San Pedro river watersheds, as well as multiple restoration sites along the lower Colorado River (Corman and Magill 2002, Halterman 2009, Johnson et al. 2010, McNeil et al. 2013). In New Mexico they breed on the Gila River and the middle Rio Grande (Stoleson and Finch 1998, Woodward et al. 2002, Ahlers and Moore 2012). In Colorado there are small numbers along the Colorado River and upper Rio Grande (Beason 2010). There are no known breeding populations in Oregon (Marshall et al. 2003). In Idaho there is reported breeding on the Snake River (Cavallaro 2011). In Nevada they may occasionally breed on the Carson, Virgin and Muddy Rivers (Halterman 2001, McKernan and Braden 2002, Tomlinson 2010, McNeil et al. 2013).

Figure 1. Range of the western Distinct Population Segment of the Yellow-billed Cuckoo.

In order to advance our understanding of the distribution of Yellow-billed Cuckoos, we need an effective and standardized survey protocol and uniform reporting of survey results. Cuckoos seldom call on their own and have a relatively low level of responsiveness to playback (Halterman 2009), and thus can be difficult to detect, making it difficult to accurately track populations. This document is intended to provide clear guidelines to agencies, consultants, volunteers, and researchers, to monitor Yellow-billed Cuckoo populations and determine habitat

occupancy. Because of the similarity of habitat use and survey techniques, some information was borrowed with permission from the SWFL protocol (Sogge et al. 2010).

Section 1. Natural History

Breeding Range and Taxonomy

Western Yellow-billed Cuckoos historically bred throughout riparian systems of western North America from southern British Columbia to northwestern Mexico (Hughes 1999). They inhabited the deciduous riparian woodlands once lining most rivers and streams. Since at least the 1850s, Yellow-billed Cuckoo populations have declined dramatically (Roberson 1980, Gaines and Laymon 1984, Laymon and Halterman 1987) and breeding cuckoos have been extirpated over much of the western range, including British Columbia, Oregon, and Washington (Hughes 1999). Although the western Yellow-billed Cuckoo has been described as a subspecies called the California Cuckoo (*Coccyzus americanus occidentalis*) (Ridgeway 1887, AOU 1956), there has been debate about its taxonomic status. There is research that both supports (Franzreb and Laymon 1993, Pruett et al. 2001), and refutes subspecies status (Banks 1988 and 1990, Fleischer 2001). The range of the Distinct Population Segment of the Yellow-billed Cuckoo is essentially the same as the range of the subspecies.

Migration and Winter Range

The Yellow-billed Cuckoo is a Neotropical migrant bird that winters in South America east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (78 FR 61621). The winter range and migration routes of the western Yellow-billed Cuckoo are poorly known. Eastern and western cuckoos may intermingle on the wintering grounds and in migration, or they may have separate wintering grounds and migration routes. Geolocator data is available from one single cuckoo captured during the breeding season on the middle Rio Grande River in New Mexico (Sechrist et al. 2012). This data indicates that the bird spent five months, from late November through April, in eastern Bolivia, southwestern Brazil, Paraguay, and northeastern Argentina. This cuckoo traveled south to southern Sonora, Mexico, in late July, then back to the Rio Grande before migrating southeast through Texas and eastern Mexico in August and September, and Honduras, Panama, and Columbia in October, and the upper Amazon basin in November. In the Spring it followed a different migration route through Brazil, Columbia, Venezuela, the Caribbean, the Yucatan Peninsula in Mexico, to the lower Rio Grande, then to the Conchas River in Chihuahua, Mexico, then back to the Rio Grande near its original capture point in early July (Sechrist et al. 2012, 78 FR 61621). There's little additional information on the western Yellow-billed Cuckoo's migration routes. Research indicates that the San Pedro River, and the lower Colorado River and its tributaries are migratory corridors (Halterman 2009) and a migrating flock was recorded by Miller (1950) in the Cape region of Baja California Sur in late May or early June (78 FR 61621).

Breeding Habitat

Breeding western Yellow-billed Cuckoos are riparian obligates and currently nest almost exclusively in low to moderate elevation riparian woodlands with native broadleaf trees and shrubs that are 20 hectares (ha) (50 acres (ac)) or more in extent within arid to semiarid

landscapes (Hughes 1999, 79 FR 59992). They are most commonly associated with cottonwood–willow–dominated vegetation cover, but the composition of dominant riparian vegetation can vary across its range. In California, habitat often consists of willows (*Salix* spp) mixed with Fremont cottonwoods (*Populus fremontii*) and, in other portions of its range, narrow-leaf cottonwood (*Populus augustifolia*) and mesquite (*Prosopis* spp.) are important habitat components. In Arizona, habitat may also contain box elder (*Acer negundo*), Arizona alder (*Alnus oblongifolia*), Arizona walnut (*Juglans major*), Arizona sycamore (*Platanus wrightii*), oak (*Quercus* spp.), netleaf hackberry (*Celtis reticulata*), velvet ash (*Fraxinus velutina*), Mexican elderberry (*Sambuccus mexicanus*), tamarisk (*Tamarix* spp.), and *Baccharis* ssp.; (Corman and Magill 2000, Corman 2005, Johnson et al. 2010). Occupancy rates (the percent of patches surveyed with at least one cuckoo detection) in Arizona were highest in cottonwood/willow/ash/ mesquite habitat (70.7% occupancy), cottonwood/willow/ash/mesquite/with less than 75% tamarisk habitat (60.7% occupancy), and mesquite bosque/hackberry habitat (60.0% occupancy). Yellow-billed Cuckoos were much less common in sycamore/cottonwood habitat (46.2% occupancy), sycamore/alder/willow/ash/walnut habitat (33.3% occupancy), and habitat comprised of greater than 75% tamarisk cover (33.3% occupancy; Johnson et al. 2010).

At the landscape level, the amount of cottonwood–willow-dominated vegetation cover and the width of riparian habitat influence western Yellow-billed Cuckoo breeding distribution (Gaines and Laymon 1984, Halterman 1991, Holmes et al. 2008, Givertz and Greco 2009, Johnson et al. 2012, 79 FR 59992). Riparian patches used by breeding cuckoos vary in size and shape, ranging from a relatively contiguous stand of mixed native/exotic vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Yellow-billed Cuckoos mainly nest in patches that are as large as 80 ha (several hundred ac); for example, San Pedro River, Arizona or Elephant Butte Reservoir, New Mexico, but they will nest in areas as small as 20 ha (Beal Lake Conservation Area at Havasu National Wildlife Refuge in Arizona (McNeil et. al. 2013). They have not been found nesting in isolated patches 0.4–0.8 ha (1-2 ac) or narrow, linear riparian habitats that are less than 10-20 meters (m) (33-66 ft) wide, although single birds have been detected in such isolated patches or linear habitats during migration or the early breeding season (mid-late June). In California, Yellow-billed Cuckoos are most likely to be found in patches of willow–cottonwood riparian habitat greater than 80 ha (200 ac) in size. Yellow-billed Cuckoos rarely used smaller patches of habitat (under 20 ha in size), particularly when patches were distant from other patches of riparian habitat (Laymon and Halterman 1989). In Arizona, on the lower Colorado River, Yellow-billed Cuckoos used large patches of habitat (> 20 ha) and areas with dense canopy closure for nesting (McNeil et al. 2013), and habitat modeling identified several important features associated with cuckoo breeding habitat: (1) a 4.5 ha (11.1 ac) core area of dense cottonwood-willow vegetation and (2) a large (72 ha/178 ac) native forest surrounding the core (Johnson et al 2012). The odds of cuckoo occurrence decreased rapidly as the amount of tamarisk cover increased or when cottonwood-willow vegetation was scarce (Johnson et al. 2012). On the Verde River in Arizona, sites occupied by cuckoos were at least 100 m (330 feet) wide; 79% of occupied sites were over 200 m (650 ft) wide, and 92% had at least 5 ha (12 ac) of mesquite in the uplands bordering the riparian patch. On average, occupied sites were larger than unoccupied sites (mean riparian patch width of occupied sites was 253 m (830 ft), and 134 m (440 ft) for unoccupied sites (Holmes et al. 2008).

At large spatial scales, cuckoos have been observed using newly formed sapling stands of riparian vegetation, first documented on the Sacramento River (Halterman 1991). Since then, cuckoos have been recorded using flood irrigated, fast-growing, restoration habitat that was less than a year old for foraging, and less than two years old for nesting (McNeil et al. 2013). Ahlers et al. (2014) found increasing numbers of cuckoos on the middle Rio Grande River in NM, likely in response to an increase of young riparian habitat through natural regeneration. The same was found on the Kern River where the majority of detections and all of the nests were found within the relatively younger habitat (Stanek and Stanek 2012). Johnson et al. (2008) found cuckoos nesting at a newly formed site, with three years old willows, on the Lake Mead/ Colorado River Delta, over 100 km from the nearest known breeding population. Although the mechanisms driving these fluctuations are unknown, it seems likely that availability of suitable breeding habitat and prey abundance are driving factors behind these changes (Greco 2012, Koenig and Leibhold 2005, Barber at al. 2008, Johnson et al. 2008, McNeil et al. 2013).

Yellow-billed Cuckoo habitat can be characterized and quantified in a number of ways, depending on the objectives of the observers. For the purposes of this protocol, we use a relatively simple approach, similar to that used in the Southwestern Willow Flycatcher (*Empidonax traillii extimus*) protocol (Sogge et al. 2010), that can be used to broadly describe and classify survey sites based on woody plant species composition and habitat structure. As described above, these, along with patch size and connectivity, have been documented as important components of cuckoo habitat, but they are likely not the only ones. Measuring other potentially important aspects of cuckoo habitat such as food availability, predators, hydrology, and environmental factors such as temperature and humidity, are beyond the scope of this protocol.

The general categories used to characterize cuckoo habitat in this protocol are based on the composition of the tree/shrub vegetation at the site: native broadleaf (>75% of cover from native trees/shrubs); exotic/introduced (>75% of cover from exotic trees/shrubs); mixed native/exotic-mostly native (51% - 75% cover from native trees/shrubs); and mixed native/exotic-mostly exotic (51% - 75% cover from exotic trees/shrubs). Each site's canopy and understory canopy height, canopy and understory canopy cover, and the cover of particular dominant plant species in the canopy and understory canopy are also recorded.

The native broadleaf tree/shrub category for breeding sites within the Western Yellow-billed Cuckoo range are described above, and often have a distinct overstory of willow, cottonwood, or other broadleaf trees, with recognizable sub-canopy layers and an understory of mixed species trees and shrubs, including tamarisk. Sites are classified as native broadleaf if greater than 75% of the cover is contributed by native broadleaf species. Exotic/introduced are sites where exotic/introduced trees/shrubs contribute 75% or greater of the vegetation cover. These sites are typically dominated by tamarisk or Russian olive (*Elaeagnus angustifolia*). Mixed native/exotic sites ("mixed exotic native-mostly native" and "mixed exotic native-mostly exotic) include mixtures of native broadleaf trees and shrubs mixed with exotic/introduced species such as tamarisk and Russian olive. The exotics are primarily in the understory canopy, but may be a component of the canopy, and the native/exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat. If a particular site is dominated primarily by natives (i.e. 51% - 75% native) it is classified as mixed exotic native-

mostly native. If it is dominated primarily by exotics/introduced species (i.e. 51% - 75% exotic) it is classified as mixed exotic native-mostly exotic.

The ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high too poor to unsuitable; the best habitats are those in which cuckoo reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding cuckoos. Small habitat patches may also provide critical stopover sites for refueling and resting during migration. There also may not be enough cuckoos in a given area, particularly at the periphery of its current range, to fill all available habitat.

Breeding Chronology and Biology

Western Yellow-billed Cuckoos are late spring migrants. In Arizona and California, a few individuals occasionally arrive in mid- to late May, but the majority do not arrive until mid-June, with late migrants straggling into early July (Corman 2005; Laymon 1998a). Nesting typically occurs between late June and late July, but may occasionally begin as early as late May, and continue into September. Cuckoos have been observed in California as late as mid-September (M. Halterman, pers. obs., McNeil and Tracy 2013, Parametrix and SSRS 2015) and mid-October in southeastern Arizona (Corman 2005). In southeastern Arizona (and possibly in other parts of the southwest), nesting may regularly continue into September, with some birds occasionally noted feeding older fledglings into early October (Corman and Magill 2000, Halterman 2002).

Nests and Eggs

Both adults build the nest, incubate the eggs, and brood and feed the young. Nest building may take as little as half a day, with additional material added to the nest as incubation proceeds (Halterman 2009). Nests are typically well-concealed in dense vegetation (Halterman 2002; Laymon et al. 1997; McNeil et al 2013). Typical clutch size varies from two to four eggs, but exceptionally one and five egg clutches have been observed. Larger clutches are likely the result of conspecific parasitism (Hughes 1999; Laymon et al 1997; Laymon 1998a; McNeil et al. 2013). Eggs, which are a pale bluish-green, are usually laid every second day, but the interval may be variable (Hughes 1999). Eggs are incubated from 9-11 days (Hughes 1999) and young cuckoos fledge five to eight days after hatching, with six days being typical (Laymon and Halterman 1985, Halterman 2009). Males incubate the eggs at night, and both sexes alternate incubation and nestling care during the day (Halterman 2009, Payne 2005). Males appear to be the primary caregiver of the young post-fledging (Halterman 2009).

Typically Western Yellow-billed Cuckoos have one brood per year (Ehrlich et al 1988). In California at the South Fork Kern River, in years of abundant food resources, two and even three broods have successfully fledged. Double brooding was observed in less than half of the 12 years of study there and triple brooding was observed only once (Laymon 1998a). Double broods have been regularly observed on the upper San Pedro River (Halterman 2009) and on the lower

Colorado and Bill Williams rivers (McNeil et al. 2013). Triple broods have occasionally been observed at these sites.

Fledglings continue to be dependent on the adults for approximately 14-21 days, seeking food from adults by giving short "cuk-cuk-cuk" calls. At approximately 14 days, fledglings give louder calls, but appear to lack the full range of adult vocalizations. The fledglings may continue to be dependent on the adults until they are 28-32 days old (Halterman 2009, McNeil et al. 2013). Young birds can be distinguished for several weeks post-fledging by the paler yellow coloration on the bill, and a shorter tail with slightly paler coloration (dark gray instead of black; Pyle 1997). It is very difficult to see these subtleties in the field, however, and aging fully-grown juveniles can be problematic for all but the most experienced observers (Halterman 2008).

Vocalizations

Cuckoos call infrequently, with an unsolicited vocalization rate of one call/hour (Halterman 2009). Their vocalizations are described by Hughes (1999) and others (Bent 1940, Hamilton and Hamilton 1965, Potter 1980). Common calls include variations of the contact call. This is a series of "kuk" notes with or without "kowlp" notes, given by both sexes (Halterman 2009; Hughes 1999). Also commonly heard is the "coo" call, apparently given primarily by females (Halterman 2009). A very soft "coo" call seems to be given by adults to nestlings. Adults also give an alarm consisting of a low "wooden knocking" call, continued until the threat leaves the area. This call is typically given in the vicinity of a nest or fledgling. Calls are described in detail in the Survey Protocol Section, Yellow-billed Cuckoo Identification, below.

Food and Foraging

Cuckoos eat a wide variety of prey items. These are primarily large arthropods such as cicadas, katydids, grasshoppers, and caterpillars, but may also include small lizards, frogs, spiders, tent caterpillars, and a variety of other insects. There is evidence to suggest that population levels and breeding may be closely tied to abundance of certain food items (Clay 1929, Bent 1940, Preble 1957, Hamilton and Hamilton 1965, Nolan and Thompson 1975, Laymon 1980, Koenig and Liebhold 2005, Halterman 2009, McNeil et al. 2013). Cuckoos typically perch inconspicuously while visually searching nearby vegetation for prey (Hamilton and Hamilton 1965, Stiles and Skutch 1989). This foraging method contributes to the difficulty of detection. They may venture out into surrounding low vegetation (flooded fields, younger habitat, sacaton (*Sporobolus* sp.) grassland) after observing prey items while perched in the riparian (Halterman 2002; McNeil et al. 2013).

Site Fidelity and Local Population Fluctuations

Little is known about population substructure, dispersal of young and post-breeding adults, juvenile and adult site fidelity, or the factors influencing breeding site detection and selection. Research indicates that the San Pedro River, lower Colorado River and tributaries are migratory corridors, in addition to being breeding areas (Halterman 2009). Cuckoos were captured and equipped with transmitters in suitable nesting habitat on these rivers; and many of these birds left the area before breeding. A small number of birds that left their banding location were detected

in the same season at other riparian sites. These within-season movements varied from 1 km to nearly 500 km (Halterman 2002, McNeil et al. 2013). Additional research is needed at other sites, particularly with more northern populations, to determine if these movements occur range wide.

Between-year fluctuations in estimated populations have been observed at multiple locations throughout the range. From 1997 to 2004, the estimated population on the Bill Williams River fluctuated between 6 and 28 pairs (20 to 78 survey detections/year; Halterman 2008). The estimated population of the South Fork Kern River fluctuated from less than 5 pairs to more than 20 pairs over a 12 year period (Laymon et al. 1997). The population on the San Pedro River fluctuated greatly from 2001 to 2007, with numbers halving from 2003 to 2006, then apparently doubling from 2006 to 2007 (Halterman 2008). Populations on the Sacramento River have shown year-to-year fluctuations (Halterman 1991) and decade-to-decade fluctuations (Laymon and Halterman 1987, Halterman et al. 2001, Dettling and Howell 2011).

The methods used to estimate population size varied between studies, but it is clear that Yellow-billed Cuckoo populations increase or decrease locally well beyond the expected fluctuations of a closed population. These studies indicate a species that is not only capable of, but likely adapted to, locating and utilizing resources that are highly variable in time and space. Multiple years of surveying are therefore required to obtain a reasonable estimation of occupancy, habitat use, and distribution.

Little is known about survivorship of Yellow-billed Cuckoos, though the Institute for Bird Populations reports an estimated annual survival probability of 50% (NBII/MAPS Avian Demographics Query Interface). Limited data from the San Pedro River, Arizona, with color-banded birds, indicates that a small percentage of the population (about 5%) returns to the breeding sites each year (Halterman 2009). On the lower Colorado River, primarily in LCR-MSCP habitat creation sites, about 10% of the banded birds were recaptured in the area one or more years after initial capture (McNeil et al. 2013). Returning birds on the San Pedro were re-sighted approximately 25 m (80 ft) and over 2 km (1.2 miles) from their banding location (Halterman 2009). Returning birds banded as adults on the lower Colorado River were re-sighted between approximately 25 m (80 ft) and 40 km (25 miles) from their banding location (McNeil et al. 2013). Returning birds banded as nestlings/fledglings on the Lower Colorado River were re-sighted between ~30 m (100 ft) to ~80 km (50 miles) from their banding location (McNeil et al. 2013). Breeding pairs of banded cuckoos at this site were found using the same territory for up to three years (Laymon 1998a).

Threats to the Cuckoo and Habitat

The decline of the western Yellow-billed Cuckoo is primarily the result of riparian habitat loss and degradation. Within the three states with the highest historical number of Yellow-billed Cuckoos, past riparian habitat losses are estimated to be about 90 to 95 percent in Arizona, 90 percent in New Mexico, and 90 to 99 percent in California (Ohmart 1994, USDOI 1994, Noss et al. 1995) Many of these habitat losses occurred historically, and although habitat destruction continues, many past impacts have ramifications that are ongoing and affect the size, extent, and quality of riparian vegetation within the range of the western Yellow-billed Cuckoo. Principal causes of riparian habitat destruction, modification, and degradation in the range have occurred

from alteration of hydrology due to dams, water diversions, management of river flow that differs from natural hydrological patterns, channelization, and levees and other forms of bank stabilization that encroach into the floodplain (79 FR 48547). These losses are further exacerbated by conversion of floodplains for agricultural uses, such as crops and livestock grazing. In combination with altered hydrology, these threats promote the conversion of existing primarily native habitats to monotypic stands of non-native vegetation, reducing the suitability of riparian habitats for the cuckoo.

Because of the absence or near absence of nesting by Yellow-billed Cuckoos in monotypic stands of tamarisk and other nonnative vegetation, the available literature suggests that conversion of native or mixed (native and non-native) riparian woodlands to nearly monotypic stands of tamarisk and other non-native vegetation, coupled with the inability of native vegetation to regenerate under altered hydrological conditions, is a significant threat to the western Yellow-billed Cuckoo now and in the future (79 FR 48547). Non-native vegetation occurs across most of the range; its establishment can be caused by altered hydrology or other disturbances, which are widespread throughout the range. Non-native vegetation is expected to increasingly modify and decrease habitat for the western Yellow-billed Cuckoo within a majority of its range in the United States and northern Mexico. Other threats to riparian habitat include long-term drought and climate change.

Section 2. Survey Protocol

This basic protocol has changed little since it was first written in 1998 (Laymon 1998) and expanded in 1999 (Halterman 1999). There have been a number of refinements as research has increased our knowledge of this elusive species. The greatest change is in interpretation of results. Previous versions of this protocol have been used effectively to survey hundreds of sites in the western United States.

Yellow-billed Cuckoos are challenging to survey for a number of reasons. They have a low unsolicited calling rate, averaging about one call/hour making standard point count surveys particularly ineffective (Halterman 2009). They have large home ranges, with average 95% kernel home ranges varying from 19.5 ha (48.2 ac) to 42.3 ha (104.5 ac), depending on location, breeding status, and gender of the individual (Halterman 2009, McNeil et al. 2013, Sechrist et al. 2009). This brevity of peak of activity, along with the potential for double and triple brooding, further complicates complete survey coverage. The peak of cuckoo nesting activity lasts only about one month, with breeding activity of the western DPS of the Yellow-billed Cuckoo peaking in July (Laymon et al. 1997, Halterman 1991, 2009; McNeil et al. 2013), but in some years breeding can start in May and end in September. Detection rates also peak during July and drop off dramatically after mid-August regardless of breeding status (Laymon et al 1997, Halterman 2008, Ahlers 2012, McNeil et al. 2013). Males and females are sexually monomorphic in appearance and in many behaviors (Halterman 2009). Breeding can only be confirmed by finding an active nest, seeing fledglings, distraction or alarm displays, or copulation. These render interpretation of survey results problematic. Given these challenges, no methodology can assure 100% detection rates. This protocol does provide an effective tool for detecting cuckoos when surveys are conducted by trained surveyors.

The secretive and sometimes subtle life history characteristics of this species influence how Yellow-billed Cuckoo surveys should be conducted and form the basis upon which this protocol was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding cuckoo absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for this and other rare and secretive species (Johnson et al 1981, Sogge et al. 1997, Conway and Simon 2003).

The primary objective of this protocol is to provide a standardized survey technique to detect Yellow-billed Cuckoos, estimate breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the experience, preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with Yellow-billed Cuckoos or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to visually distinguish Yellow-billed Cuckoos from similar species, and be able to distinguish Yellow-billed Cuckoo calls from similar vocalizations of other species. Visual sightings of cuckoos are relatively rare and often fleeting, and surveyors experienced with bird identification and behavioral observations of nesting birds will be best able to understand these brief observations. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and ability to remain alert and aware of cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and among sites, and among years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on cuckoo status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

Like previous versions, this revised protocol is based on call-playback techniques. However, it includes changes in the timing of surveys to increase the probability of detecting cuckoos and to help determine if detected cuckoos are breeders or migrants. A detailed description of surveys and timing is discussed in the section "Timing and Number of Visits." The current survey data sheets are easier to use and submit than previous versions, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that they are comparable to the current and widely used Southwestern Willow Flycatcher (SWFL) survey forms.

This protocol is intended to determine if a habitat patch contains Yellow-billed Cuckoos, and is not designed to establish the location of nests or the exact distribution and abundance of cuckoos at a site. Determining precise cuckoo numbers and locations requires many more visits and additional time observing behavior. This survey protocol also does not address issues and techniques associated with nest monitoring or other cuckoo research activities. Those efforts are beyond the scope needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to cuckoos. If nest monitoring is a required component of your study, personnel experienced with and permitted for nest searching and monitoring must be included in the project. We provide general information on nest searching so surveyors will recognize the behavior of cuckoos near a nest, and thus avoid unnecessary disturbance around a nest that might cause nest abandonment or predation.

Biologists who are not expert birders or specialists with Yellow-billed Cuckoos can effectively use this protocol. However, please note that prior to conducting any surveys, all surveyors are required to attend or have attended a U.S. Fish and Wildlife Service (USFWS)-approved Yellow-billed Cuckoo survey training workshop, and have knowledge and experience with bird identification, survey techniques, avian breeding behavior, and ecology sufficient to effectively apply this protocol.

Non-Protocol (Exploratory) Surveys

Under special circumstances, it may be permissible to use call-playback in a way that does not follow the protocol. They are intended to assess whether an area merits full protocol surveys, and to increase general distribution knowledge. These exploratory surveys will allow agency personnel (or others working with their approval) to survey 1-3 times at sites that are not scheduled for regular surveys. These exploratory surveys are not intended to be conducted in project areas. These surveys are not intended to estimate the distribution and abundance of cuckoos at the site, and can only be conducted by individuals with all appropriate State and Federal permits and permissions.

Permits

Federal endangered species 10(a) 1(A) recovery permits are required to conduct surveys for Yellow-billed Cuckoos in all USFWS regions where the western Yellow-billed Cuckoo DPS breeds. State permits may also be required, and both federal and state permits may take several months to obtain so please plan ahead. Permits or permission are often required to access potential survey locations. The level of permitting will depend on the applicant's expertise in observing and handling cuckoos and attending a USFWS-approved Yellow-billed Cuckoo survey protocol workshop.

Permits will cover a range of activities, and will depend on the applicants experience level and needs. Permits are required for the following activities: surveys, nest searching and monitoring, banding adults and nestlings, attaching transmitters to cuckoos, radio telemetry, and blood and feather sample collection.

Pre-Survey Preparation

Pre-survey preparation is essential to conducting efficient, quality surveys. It is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results. All surveyors are required to attend a USFWS-approved, survey protocol workshop prior to conducting surveys and should carefully study the Yellow-billed Cuckoo Identification section, below. It is especially critical for surveyors to be familiar with Yellow-billed Cuckoo vocalizations before going in the field. Surveyors should study calls, songs, drawings, photographs, and videos (if available) of Yellow-billed Cuckoos. An excellent source of vocalizations is the xeno-canto website (www.xeno-canto.org). This site is a community shared bird-sound database.

Surveyors should also become familiar with cuckoo habitat. If possible, visit as many known Yellow-billed Cuckoo breeding sites as possible and study photos of cuckoo habitat. Such visits are usually part of the Yellow-billed Cuckoo survey protocol workshops. All visits should be coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to cuckoos. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective cuckoo coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if cuckoos have been previously detected at the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where cuckoos have previously been detected. However, please realize if it has been several years since a location has been surveyed, some habitat sections may have changed, for better or worse. As an example, newer riparian sections may have developed in size and density to become appropriate nesting/foraging areas.

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. It is the individual surveyor's responsibility to survey all suitable habitat within the respective site. It's best to layout and walk transects in advance of the surveys. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and transect start and stop points (if previously surveyed), where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant water, muddy or swampy conditions, and quicksand, crawling through dense thickets, and exposure to rattlesnakes, skunks, and biting insects.

The day before conducting the survey, set a time for departure to the site. Surveying generally occurs in the early morning, beginning just before sunrise and continuing, depending on environmental factors (including noise levels), until 1100 or until temperatures reach 40C/104F whichever comes first. Know the directions to the survey site and estimate the time it will take to

get to the first point by driving and walking, possibly in the dark. If possible, preload you're GPS (or other navigation device) with survey transects and survey points. Your departure time for the following morning should ensure arrival at the starting point approximately one hour before sunrise. If the survey takes more than two hours, make an effort to start at the opposite end of the transect for each survey round, so that all points are surveyed in the earlier hours. This may not always be logistically possible.

It is imperative that all surveyors exercise safety first. Be aware of hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

Table 1. List of items for conducting Yellow-billed Cuckoo surveys.

Required Items	**Details**
USGS Map and/or aerial photo (orthorectified; color photocopies) of survey area	A marked copy is required to be attached to survey datasheets submitted at the end of the season. The survey site needs to be delineated and detections clearly marked. If the survey area differed between visits, individual surveys should be delineated.
Broadcast equipment (e.g., Audio device, and speakers) and batteries	Must be capable of broadcasting recorded calls 100 m without distortion (recommended speaker volume of 70 db). Having a fully charged device and extra batteries as well as back-up/extra broadcast equipment is highly recommended to avoid abandoning a survey due to equipment failure. Use only the provided contact call for broadcast.
Standardized survey form	Multiple copies for each survey.
Recorded contact/kowlp calls	Acquired by attending Yellow-billed Cuckoo protocol workshop.
Binoculars	A pair with 7-10 power that can provide crisp images in poor lighting conditions.
GPS device with extra batteries	With start and stop UTMs for previously surveyed areas. All surveyor locations at time of detection should be recorded as waypoints. The compass direction and distance to individual detections are recorded from the waypoint.
Compass	The compass bearing is taken, and distance to the detected cuckoo(s) is estimated, from the surveyor's waypoint. The compass feature on the GPS unit is often much more difficult to use in the field than a compass. A compass may also help surveyors navigate through the patch more easily than using the GPS.
Clipboard or electronic device	Survey results and observations should be recorded directly onto the survey data form to ensure that all required data is collected and recorded.
Pens, Pencils, and Sharpies	Take multiples of each.
Device to record time	Use the GPS unit, watch, or phone
Optional Items	**Details**
Cell phone/portable radio	For communication between surveyors and for safety.

Camera	Helpful for habitat photos of survey sites, especially where cuckoos are found.
Laser Rangefinder	For measuring distance to detections (if possible) and height of trees.
Hard copy of start/stop UTMs	Use as a back-up for the GPS unit.

Yellow-billed Cuckoo Identification

Yellow-billed Cuckoos are a slender, medium-sized bird, about 30 cm in length, and weighing about 60 grams. The upperparts are grey-brown, the underside is clean white, and the tail is long with white spots at the end of the central rectrices. A flash of bright rufous in the wings is usually visible in flight, and occasionally while perched. The legs are blue-gray, but are seldom visible since cuckoos typically perch so that the legs are hidden under the belly. The bill is long and slightly down-curved, with a mostly black upper mandible and lower mandible ranging from yellow to orange with a black tip. Flight is generally direct and agile. Sexes are similar, and although females average larger than males, this difference is seldom visible in the field (Pyle 1997, Halterman 2009). In general, look for a slender bird with a bright white chest, long tail, and grey-brown head contrasting with a white throat.

When seen clearly, this species is unmistakable. Often you will only have a fleeting glimpse of a bird, so you need to quickly assess what you've seen. Be sure to study all available photos and video of cuckoos. Familiarization with images of both cuckoos and similar species will aid in rapid and correct identification in the field. There are a number of species that can be mistaken for cuckoos when seen briefly. These include:

1. Ash-throated Flycatchers (*Myiarchus cinerascens*) are the most similar to cuckoos, with a slender build, rufous in the wings, a relatively long tail, and agile flight pattern. They often fly closer during cuckoo call playback. The breast typically appears gray, the head is "puffy", and there is no strong contrast between brown upperparts and white underparts. Look for the shorter bill and tail when this species is perched.
2. Mourning Doves (*Zenaida macroura*) are heavier, the breast appears tan/gray, the tail is pointed, and the flight is relatively heavy and direct.
3. White-winged Doves (*Zenaida asiatica*) are much larger, with tan/gray breast, and show a bold flash of white in the wings in flight.
4. Northern Mockingbirds (*Mimus polyglottos*) are slender with a relatively long tail tipped with white. Look for the large white wing patches and lack of strong contrast between the chest and back.
5. The rusty flash of a Northern Flicker's (*Colaptes auratus*) wings are reminiscent of the rufous flash in a cuckoo's wings, but either calls or subsequent views will aid in correct identification.
6. Brown-crested Flycatchers (*Myiarchus tyrannulus*) are also similar, but the bright yellow belly and the larger head facilitate correct identification.
7. Loggerhead Shrikes (*Lanius ludovicianus*) and both California (*Toxostoma redivivum*) and Crissal thrashers (*Toxostoma crissale*) may also look like cuckoos when seen fleetingly.

The majority of Yellow-billed Cuckoo detections are from birds that are heard but never seen (Halterman et al 2001; Halterman 2009, McNeil et al. 2013), so it is critically important to know

the calls of this species as well as similar species. There are two commonly heard calls, which can be given by males or females. Each call can be confused with calls of a number of other birds, especially when heard at a distance. We will discuss each in detail:

1. Contact call - also referred to as the "kowlp" call. This is a series of a variable number of "kuk" notes followed by a variable number of "kowlp" notes. This can be given at any time during the breeding season. Individuals may give calls with variable combinations of kuks and kowlps, and may omit one or the other of the notes altogether. Although distinctive when heard clearly, there are several species with similar calls, particularly when heard from a distance. The most similar species is the Yellow-breasted Chat (*Icteria virens*), which sometimes appears to give calls mimicking the cadence of cuckoo calls following playback. Chats also typically give a single diagnostic sharp "chuck". Familiarization with the calls of this species is critical to correct identification where the two co-occur. Pied-billed Grebe (*Podilymbus podiceps*) calls can also sound very similar to cuckoo calls; the fact that the call emanates from a wetland will usually help distinguish this species, though this call is loud, carries well, and the presence of a wetland may not be known. Less similar, but still worth learning, are most woodpecker and accipiter calls.

2. Coo call. This is given with greatest frequency in the early and middle part of the breeding season. It typically consists of a 5-8 evenly-pitched and evenly-spaced "coo" notes, ending with 1-3 notes on a lower pitch. The number of coo notes may vary from one or two notes to several minutes of continuous calling. Although diagnostic when heard clearly, there are a number of species with similar calls. The most similar is Greater Roadrunner (*Geococcyx californianus*); its call is a series of "coos" which drop in pitch with each note. Distant notes of both Mourning and White-winged dove calls can sound almost identical to cuckoo coos, but the pattern is very different, with only 1-3 coo notes heard. Both dove species typically repeat their calls, so the initially questionable coo can usually be identified with careful attention. Other sounds which, when heard from a distance and at the edge of hearing, could be (and have been) confused with the cuckoo coo call include noisy cows, barking dogs, and machinery.

Less commonly heard, but important to know, is the cuckoo alarm call, sometimes called the knocker call. This is a short series of soft wooden "kuk-kuk-kuk-kuk" notes. This is typically given near a nest or fledglings, but can be heard anytime a cuckoo is disturbed. The call typically is given multiple times, and at relatively close range. It is best to assume that the alarmed bird is near a nest or young, particularly in July and August, and leave the area to avoid further disturbance.

An excellent source of vocalizations of all these species is the xeno-canto website (www.xeno-canto.org). This site is a community shared bird-sound database.

Timing and Number of Visits

The timing of this protocol is intended to assess Yellow-billed Cuckoo presence, and potentially estimate abundance and distribution. Accurate population determination is beyond the scope of

this protocol, but conducting surveys during the peak of breeding activity will increase the probability of detecting any cuckoos that are present. This call-playback technique detects cuckoos that may otherwise be overlooked. Multiple surveys at each site are important, and with appropriate effort, avian biologists without extensive experience with cuckoos can find and verify Yellow-billed Cuckoo presence.

There are three survey periods. Surveys are conducted for the sole purpose of assessing whether Yellow-billed Cuckoos are present at a site. A minimum of four survey visits are required (Figure 2). Four surveys conducted during the three survey periods listed in Figure 2 will have an 80% probability of detecting an individual cuckoo (Carstensen et al. 2015, Halterman 2009) and a 95% probability of detecting cuckoos, when they are present at a site during the breeding season (McNeil et al. 2013, Carstensen et al. 2015).

Prior to the field season, we suggest developing a sampling schedule, based on the survey periods (Figure 2) and the number and extent of sites to be surveyed. Yellow-billed Cuckoo surveys should be scheduled to begin after a thorough training session (including attending a survey protocol workshop). Initiation of sampling is tailored to the phenology of the Yellow-billed Cuckoo in the study region, and is generally timed to begin after resident individuals have arrived, presumably to breed, within the region. Due to differences in breeding seasons across the western US, a survey window of ± 3 days is acceptable for the start and end of each survey period. Each survey site is visited a minimum of four times within the breeding season, with a minimum of 12 days and a maximum of 15 days between surveys at a particular site.

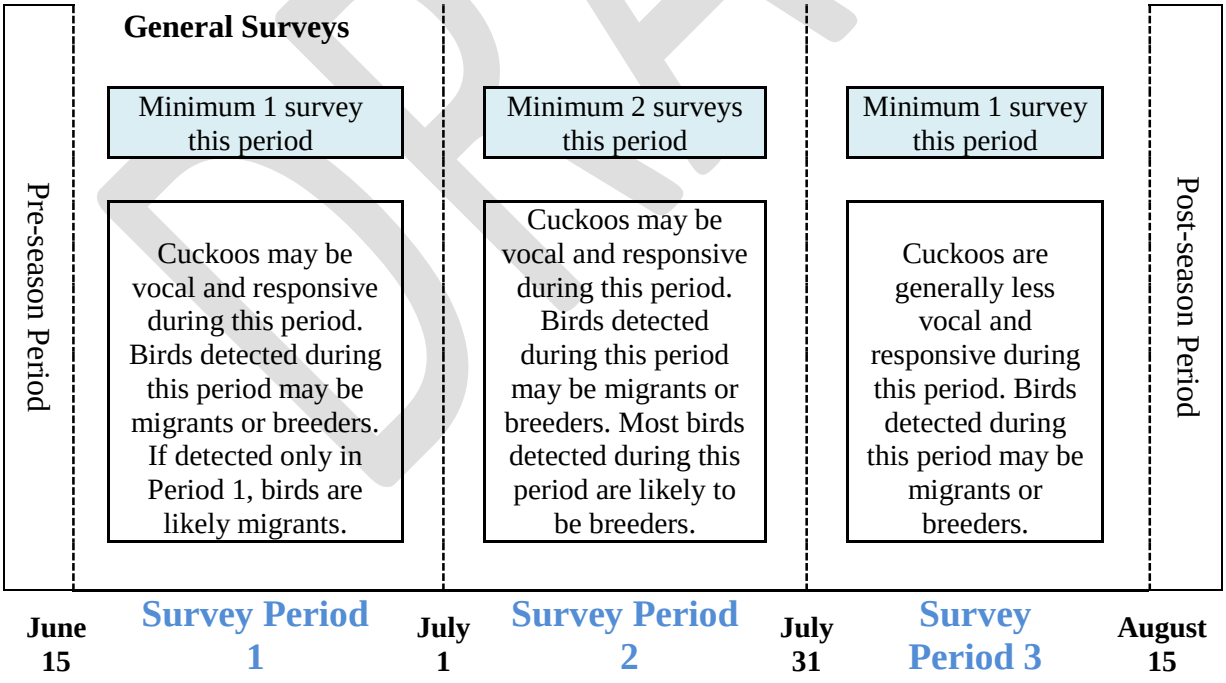

Figure 2. Recommended number and timing of visits during each survey period for Yellow-billed Cuckoo surveys.

If breeding confirmation is required, more visits will be needed and they must be conducted by surveyors permitted to search for nests. Even with additional effort, it may not be possible to verify breeding activity during a season. When developing a survey schedule for multiple surveyors, care should be given to scheduling so that multiple surveyors do not overlap areas, and the risk of a surveyor mistaking a broadcast call for a cuckoo is reduced. Additionally, if surveyors are working on adjacent plots, they should communicate both during and after surveys to avoid double counting.

Pre-season Survey Period: late May to June 14. No surveys required. This spans the earliest time that cuckoos may arrive on breeding grounds, but most cuckoos present during this period are likely migrants. However, cuckoos will occasionally begin breeding during this time.

Survey Period 1: June 15 to June 30. One survey is required. This survey occurs as migrating birds are passing through, and breeding birds arrive. Although many birds detected during this time may be migrants, surveys during this time will help with seasonal survey detection interpretation, and will also allow surveyors to familiarize themselves with all survey areas.

Survey Period 2: July 1 (+ or – 3 days) to July 31 (+ or – 3 days). Two surveys are required during this period. Cuckoos encountered during this time are mostly breeders, though migrants, wandering individuals, and young of the year may be encountered. This is the period when breeding activity is most likely to be observed (e.g. copulation, food carries, alarm calls). Extra time should be taken to cautiously observe all cuckoos encountered during this time, while avoiding disrupting potentially breeding birds.

Survey Period 3: August 1 to August 15. One survey is required, and most breeding birds are finishing breeding activities and departing. Cuckoos are typically much less vocal and responsive during this time than during Survey Period 2.

Post-breeding Period: August 16 through September. Cuckoos in the southwest may initiate nesting, build second or third nests, or provide care for fledglings in this period (Halterman 2009; McNeil et al. 2013). This is particularly true in southeastern Arizona where local conditions often allow for a lengthier breeding season. Surveys during this time will help clarify cuckoo use of the site, and length of time on the site. Birds encountered during this period may also be migrants. Cuckoos are less vocal during this time than during Survey Period 2.

The best way to confirm breeding status of cuckoos detected at a site is to do follow-up visits and observe cuckoo behavior at a distance. Careful notes should be taken during these visits. Playback calls should not be used during follow up visits, and great care must be taken in order to avoid disturbing nesting birds.

Reporting Requirements and Datasheets

Reporting requirements may vary by region and entity (Federal, State, and Private, for example). Check your permits and other information from permitting agencies for reporting requirements. Although these requirements vary, there is information that is required by any permitting agency, such as the location of the area surveyed and the location and number of cuckoo detections. For

your convenience we have provided three sample datasheets. These can be obtained from any of the following websites:

https://www.fws.gov/southwest/es/Documents/R2ES/YBCU_SurveyProtocol_FINAL_DRAFT_22Apr2015.pdf

https://www.fws.gov/southwest/es/arizona/Yellow.htm

https://www.facebook.com/groups/746657762142636/

1. Yellow-billed Cuckoo Survey Seasonal Summary Form. This form is meant to be completed at the end of the survey season, to summarize data collected across the survey periods. One form can be used for each site surveyed. If required, it can be filled out and submitted at the end of the season. There are three associated documents:
    a. PDF for printing.
    b. Excel file for data entry and electronic submission. This includes a formula to convert distance and direction from the observer to correct the estimated location (UTM) of a cuckoo detection.
    c. Yellow-billed Cuckoo Survey Summary Form Instructions (Appendix 1, this document).
2. Optional Yellow-billed Cuckoo Daily Datasheet. This form can be printed and used for each day's survey, and has room for notes and additional observations. It is not currently required in any Regions, and is provided as a convenience to surveyors.
    a. PDF for printing and field use.
    b. Optional Yellow-billed Daily Datasheet Instructions (Appendix 2, this document).
3. Site Description Form. This form can be used to describe the general characteristics of the site being surveyed. The intent is for one form to be filled out for each site surveyed. This form is included in the 2015 version of the Seasonal Summary Form, so you not need to complete this form separately if you are using the older form.
    a. PDF for printing and use in the field.
    b. Excel file for data entry and electronic submission.
    c. Site Description Form Instructions (Appendix 3, this document).

Survey Methods

The survey methods described below fulfill the primary objective of assessing the presence of Yellow-billed Cuckoos within a survey area during that breeding season. This protocol is primarily a call-back technique, a proven method for eliciting response from nearby Yellow-billed Cuckoos, when conducted as described below. This technique has also been used extensively to survey for Willow Flycatchers (Sogge et al. 2010) and increases the detectability of species that occur in low densities or in dense vegetation (Johnson et al. 1981, Sogge et al. 1997). The call-back technique simulates the presence of a cuckoo in the area, which may elicit a

response from a cuckoo (if there is one in the area), increasing its detectability. At each site, surveyors should broadcast a series of recorded Yellow-billed Cuckoo contact/"kowlp" calls, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby cuckoos, this method also allows for positive identification by comparing the responding bird's vocalizations to the known Yellow-billed Cuckoo recording.

It is recommended that cuckoo surveys not be conducted at the same time as other state or federal permitted bird surveys. For example, it is preferable that a surveyor not conduct a cuckoo survey at the same time that they are conducting a Southwestern Willow Flycatcher survey or Least Bell's Vireo (*Vireo bellii pusillus*) survey. Doing so could negatively impact the detection of one or more species being surveyed and impair the ability to compare survey results to surveys where only one species was actively surveyed.

Begin surveys as soon as there is enough light to safely walk (just before sunrise) and continue, depending on the temperature, wind, rain, background noise, and other environmental factors, until 1100. Surveys should not be conducted after temperatures reach 40 degrees C (104 F). If the detectability of cuckoos is being reduced by environmental factors (e.g. excessive heat, cold, wind, or noise), surveys planned for that day should be postponed until conditions improve. Within a study area all potentially suitable habitat patches should be surveyed. A patch is defined as an area of riparian habitat 5 ha or greater in extent that is separated by at least 300 m from an adjacent patch of apparently suitable cuckoo habitat. The 5 ha is considered a typical minimum size for cuckoo occupancy, as no cuckoos have been detected attempting to nest in patches this size or smaller in Arizona or California (Halterman et al. 2001, Johnson et al. 2010). Suitable habitat falls into two types: 1. multi-layered riparian vegetation, with riparian canopy trees (at least a few within the patch) and at least one layer of understory vegetation; 2. mesquite and/or hackberry bosque, primarily in southeastern Arizona or when adjacent to habitat 1 above. Suitable breeding habitat often includes dense young riparian cottonwood/willow vegetation (Halterman 1991, Greco et al. 2002, McNeil et al. 2013).

Surveys can be conducted from the edge (within 10 m) when a patch is less than 200 m in width, provided the entire perimeter is surveyed. It is critical to survey all suitable habitat within an area. Small, linear patches may be thoroughly covered by a single transect along the perimeter. For larger sites, when suitable habitat exceeds 200 m in width, use a systematic survey path that assures complete patch coverage throughout the length and width of the site. Area with multiple, adjacent transects should be surveyed concurrently and in coordination (via text message or radio contact). This will help minimize duplicate detection of the same cuckoo, potentially on different transects/sites, and enable a more accurate territory estimation. The surveyor can skip over areas of unsuitable habitat (e.g. an extensive cobble bar) between patches, if the unsuitable habitat is at least 300 m in extent. Areas with small, narrow stringers of habitat, steep banks, and backwater sloughs can be surveyed by playback from a boat. It is the surveyor's responsibility to ensure all suitable habitat within the site is thoroughly surveyed.

The broadcast consists of five contact/kowlp calls, each spaced one minute apart. For consistency and comparability of the data, use only the call provided during the protocol training workshop (or from the authors). The recording should be played at approximately 70db. The standard survey forms can be obtained from http://www.fws.gov/southwest/es/. Negative data is

important, so complete the datasheet for all surveys conducted, regardless of detections. There are other forms which may be better suited to specific research needs. For those forms, it is best to contact specific researchers directly.

Arrive at the broadcast-point and wait at least one minute to listen for unsolicited cuckoo calls (i.e. cuckoos that may be calling before broadcast of the calls). Listen carefully for cuckoos, recognize and shift your attention from other bird species songs and calls, and focus on listening for cuckoos. The majority of responses occur after the first or second broadcast call, so surveyors need to be alert and prepared before beginning playback (McNeil et al. 2013, Carstensen et al. 2015).
If you do not hear any cuckoos during the initial listening period, begin the first broadcast. Listen and watch intently for responding cuckoos during and after each of the five broadcast calls. This includes watching for movement as silent birds may move closer to investigate. If no cuckoo is detected at the broadcast-point after five broadcast calls, continue 100 m along the transect and start a new broadcast as described above. Use additional datasheets for additional broadcast-points within the transect. Use the back of each datasheet to record observations and comments, linking the data by recording the "note #" in the right column of the survey data table on the front of the datasheet, and on the back of the datasheet along with the corresponding observations and comments.

Response to the broadcast call could take several forms. One or more Yellow-billed Cuckoos may move quietly (without calling) toward the surveyor, so it is critical to watch carefully for responding birds from any direction, including behind you. Cuckoos that fly silently toward the survey are difficult to detect and necessitate the full attention of the surveyor. In between broadcast calls, surveyors should be listening for cuckoos, and not be filling out the datasheet. Cuckoos may respond by calling from a distance, so listen for these responses. Cuckoos typically respond with the contact/kowlp call, but may also respond with a coo call or, rarely, an alarm call. When a cuckoo is detected, terminate the broadcast, as it may divert the bird from normal breeding activity or attract the attention of predators. Concentrate on observing the bird rather than immediately recording data. Several hundred cuckoos have been banded in the western United States over the last decade; carefully check cuckoos for leg bands, and carefully record the band color, combination and order.

After a cuckoo has been detected and appropriate data collected, move 300 m further along the transect before resuming the survey. This will minimize the likelihood of detecting the same cuckoo (Halterman 2009, McNeil et al 2013). While it is unusual for cuckoos to move 300 m after being detected by a surveyor, the surveyor should be aware of the possibility, attempt to track an individual's movements, and use their judgment to estimate if subsequent detections are separate individuals or the same individual. Please make note of all observations about individual movements and the reasoning used in determining number of individuals on the back of the data sheet.

When a cuckoo is encountered between broadcast points (i.e. an unsolicited detection is made while traveling to, from, or between broadcast points), stop and record all information in the same manner as if the detection was made during a broadcast. Do not broadcast calls. After making observations and recording information regarding the detection(s), move 300 m from the

point where the detection was made, along the transect. Continue with the procedures for conducting a survey broadcast.

Interpreting and Reporting Survey Results

This protocol is intended to be used to assess if a habitat patch contains a Yellow-billed Cuckoo. Therefore, the best way to interpret survey detections is a simple detection/non-detection determination. Determination of numbers and breeding status of cuckoos is more complex, and caution should be used when interpreting survey detection data. Because of the cuckoo's elusive and mobile nature, it is easy to both over- and under-estimate cuckoo populations. Over-estimation may occur when highly mobile individuals are detected on subsequent surveys hundreds of meters from their original detection and counted as "new" individuals (Halterman 2009, McNeil et al. 2013). Underestimation may occur because cuckoos vocalize infrequently, and respond and are detected less than half the time they are present during call playback (Halterman 2009).

The following information is one method of interpreting detection data, and should be used with caution. After the survey is completed, locations of cuckoos should be plotted as UTM coordinates on either USGS quad maps or in a GIS (geographic information system). Detection locations can be compared to estimate the total number of cuckoos detected at a site during a survey season. Separation of adjacent detections is based primarily on the distance between detections. If cuckoos are located greater than 300 m apart on the same survey, they are considered separate detections (Holmes et al. 2008, Halterman 2009, Henneman 2009). McNeil et al. (2013) and Ahlers et al. (2012) have developed similar methods for determining the number of Yellow-billed Cuckoo territories, and this should be consulted for a detailed interpretation of survey results.

Although it is difficult to accurately determine number of territories and breeding status, Holmes et al. (2008), and, later, the Southern Sierra Research Station developed a method of interpreting detections to estimate possible, probable, and confirmed breeding territories (Table 2). This determination is often only possible when follow-up visits are made to areas where cuckoos were detected during surveys. These visits may be part of nest searching or mist netting efforts. The following is from Holmes et al. (2008) and McNeil et al. (2013), and should be used, in addition to total detections, when reporting breeding status.

Table 2. Interpretation of results to estimate breeding status (from Holmes et al. 2008 and McNeil et al. 2013)

Estimation Type	Term	Definition
Breeding Territory Estimation	Possible breeding territory (PO)	Two or more total detections in an area during two survey periods and at least 10 days apart. For example, within a certain area, one detection made during Survey Period 2 coupled with another cuckoo detection made 10 days later, also during Survey Period 2, warrants a PO territory designation.
	Probable breeding territory (PR)	Three or more total detections in an area during at least three survey periods and at least 10 days between each detection. PO territory plus YBCUs observed carrying food (single observation), carrying a stick (single observation), traveling as a pair, or exchanging vocalizations.
	Confirmed breeding territory (CO)	Observation of copulation, stick carry to nest, carrying food (multiple observations), distraction display, nest, or fledgling.
Population estimation	Minimum breeding territory	The observed number of confirmed breeding territories (CO).
Occupancy estimation	Site occupancy	Occupancy is based on two or more total survey detections during two or more survey periods and at least 10 days apart. Multiple detections in an area over an extended period of time suggest that the area may have been used for breeding.

Section 3. Nest Searching

Nest searching

CAUTION: Because of the possibility of observer-induced nest abandonment, nest searching and monitoring should only be conducted when part of focused research activities. Special Federal and State permitting are required to conduct nest searching and monitoring. We provide general information on nesting activity and nest searching here so surveyors are familiar with the behaviors, and can avoid inadvertent use of these techniques.

Yellow-billed Cuckoos will nest in a wide variety of substrates, with placement height ranging from 1 m (3 ft) to 20 m (65 ft) (Hughes 1999). Nests are usually placed on either a fairly thin branch (horizontal or vertical) in larger trees or shrubs, or next to the trunk of a smaller diameter

at breast height (DBH) tree (Halterman 2002, 2008). Nests have been observed in a number of plant species including willow, cottonwood, alder, ash, mesquite, hackberry, seep willow (*Baccharis salicolifolia*) sycamore (*Plantanus* spp.), and tamarisk. There is usually a fairly high percentage of vegetation cover directly above the nest, and several meters around the nest (Laymon et al. 1997, Halterman 2005, McNeil et al. 2013).

Nesting cuckoos can be very sensitive to disturbance, especially during the pair formation and nest building stage. Nests located prior to the first egg are particularly susceptible to abandonment. At least five nests were abandoned during seven years of study on the Bill Williams River National Wildlife Refuge, possibly due, at least in part, to human disturbance (Halterman 2001, Halterman et al. 2009). Surveyors must be alert to cuckoos' behavioral signs of disturbance near a nest, which include alarm calls given repeatedly while watching the intruder, broken wing displays, or flying in with prey, then eating it instead of going to the nest. If these occur, the observer has been detected, the cuckoo is distressed, and the observer should move back. Recorded calls should not be used to elicit a response during nest searching and monitoring activities, as cuckoos have been observed leaving the nest in response to a recorded call.

Nest searching is done using two methods. Please use this information to avoid unintentionally searching for nests. When cuckoos make a nest exchange, typically one bird will call 10m or more from the nest, and the mate on the nest will answer (M. Halterman, unpublished data). The first method uses the observation of these behaviors. Two to three people will work together, triangulating on the vocalizations. The second method involves carefully searching all vegetation in the area where a cuckoo has vocalized several times, and a nest is suspected. Following the flight direction of cuckoos carrying food can also be used to locate nests.

If a nest is found, observers should leave the area after marking the general nest location with a GPS and making brief notes of the general description of the nest site (e.g., plant species used for nest substrate, approximate height of nest, and placement within the tree/shrub canopy). GPS readings should be taken no closer than 10 m from the nest, to avoid disturbance. A general description of the nest site should be completed soon after leaving the area. This information may be used for follow-up monitoring by an appropriately permitted individual.

Nest monitoring

If authorized to do so, surveyors can monitor active nests to determine nest fate. Nesting activity can be monitored and recorded by an observer sitting quietly 30-40 m from the nest for several hours. A blind or dense cover should be utilized for all nest monitoring and feeding observations. Signs of disturbance include an adult cuckoo giving a soft repetitive knocking call around the observer, and adults flying in with food, but not going to the nest. If these behaviors are observed for more than 20 minutes, the observer should leave the area. Also, because cuckoos are sensitive to disturbance at the nest, nest checks should only be conducted every 3-4 days (Halterman 2000). Both sexes incubate the eggs and care for the young (Nolan and Thompson 1975, Potter 1980, Payne 2005). Nest exchanges occur, on average, every two hours during incubation

(Halterman 2009). Nest exchanges increase when cuckoos are feeding nestlings, with up to 22 exchanges per day observed on the San Pedro River NCA (Halterman 2009).

Special Considerations

To avoid adverse impacts to Yellow-billed Cuckoos, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.

2. Do not play the recording more than necessary or needlessly elicit vocal responses once Yellow-billed Cuckoos have been located. This may distract breeding birds from caring for eggs or young. If cuckoos are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators. Stop playing the survey recording as soon as you have confirmed the presence of a Yellow-billed Cuckoo, and do not play the recording again until you have moved 300 m from the estimated or known location of the previously detected cuckoo.

3. Proceed cautiously while moving through Yellow-billed Cuckoo habitat. Continuously check the area around you to avoid disturbance to nests of Yellow-billed Cuckoos and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.

4. Do not approach known or suspected nests. Nest searching and monitoring require specific State and Federal permits, have their own specialized methodologies (e.g. Martin and Geupel 1993), and are not intended to be a part of this survey protocol.

5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a “dead end” trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix a small flag at least 10 m away and hidden from view of the nest. Record the compass bearing to the nest on the flagging. Report your findings to an agency cuckoo coordinator or a biologist who is permitted to monitor nests.

6. If you use flagging to mark an area where cuckoos are found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized/permitted nest monitoring,

flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.

7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, magpies, and accipiters. If such predators are in the immediate vicinity, wait for them to leave before playing the recording, or move on to the next broadcast-point.

8. Non-indigenous plants and animals can pose a significant threat to cuckoo habitat and may be unintentionally spread by field personnel, including those conducting cuckoo surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another, visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). Several non-native species of concern in survey locations are the tamarisk leaf beetle (*Diorhabda* spp.), quagga mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot's feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

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References Cited

78 FR 61621. Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus); Proposed Rule. Federal Register / Vol. 78, No. 192 / Thursday, October 3, 2013 / Proposed Rules.

79 FR 48547. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo; Proposed Rule. Federal Register / Vol. 79, No. 158 / Friday, August 15, 2014 / Proposed Rules.

79 FR 59992. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus); Final Rule. Federal Register/ Vol. 79, No. 192 / Friday, October 3, 2014 / Rules and Regulations.

Ahlers, D., and D. Moore. 2012. Yellow-billed Cuckoo Study Results – 2011: Survey Results from the Middle Rio Grande, New Mexico. U.S. Bureau of Reclamation, Technical service Center, Denver, CO.

American Ornithologists' Union. 1957. Checklist of North American Birds. Fifth edition. American Ornithologists' Union, Washington, D.C.

Barber, N.A., R.J. Marquis, and W.P. Tori. 2008. Invasive prey impacts abundance and distribution of native predators. Ecology 89: 2678-2683.

Banks, R.C. 1988. Geographic variation in the yellow-billed cuckoo. Condor 90:473-477.

Banks, R.C. 1990. Geographic variation in the yellow-billed cuckoo: corrections and comments. Condor 92:538.

Beason, J.P. 2010. Untitled summary report on distribution of yellow-billed cuckoos in Colorado and Wyoming, from Rocky Mountain Bird Observatory.

Bent, A.C. 1940. Life histories of North American cuckoos, goatsuckers, hummingbirds, and their allies. Smithsonian Institution United States National Museum, Bulletin 176. 1989 reprint by Dover Publications, New York, NY.

Carstensen, D., D. Ahlers, and D. Moore. 2015. Yellow-billed Cuckoo Study Results – 2014: Middle Rio Grande from Los Lunas to Elephant Butte Reservoir, New Mexico. U.S. Bureau of Reclamation, Technical service Center, Denver, CO.

Cavallaro, R. 2011. Breeding Yellow-billed Cuckoo Survey and Inventory - Idaho Falls District, Bureau of Land Management - Interim Report. Prepared by Idaho Department of Fish and Game, Idaho Falls, Idaho. 52 pp.

Clay, M.B. 1929. The Yellow-billed Cuckoo. Bird-lore 31: 189–190.

Conway, C.J., and J.C. Simon. 2003. Comparison of detection probability associated with burrowing owl survey methods. Journal of Wildlife Management 67(3):501-511.

Corman, T.E. and R.T. Magill. 2000. Western yellow-billed cuckoo in Arizona: 1998 and 1999 survey report. Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Technical Report 150. 49 pp.

Corman, T.E. 2005. Yellow-billed Cuckoo (*Coccyzus americanus*) *in* Arizona Breeding Bird Atlas. T.E. Corman and C. Wise-Gervais (editors). Univ. of New Mexico Press, Albuquerque, NM, pp. 202-203.

Dettling, M.D., and C.A. Howell. 2011. Status of the Yellow-billed Cuckoo along the Sacramento River in 2010. Report to California Department of Fish and Game. PRBO Contribution #1794. 47 pp.

Fleischer, R.C. 2001. Taxonomic and evolutionarily significant (ESU) status of western yellow-billed cuckoos (*Coccyzus americanus*). Admin. Report to USGS and US Fish and Wildlife Service April 22, 2001. 25 pp.

Franzreb, K.E., and S.A. Laymon. 1993. A reassessment of the taxonomic status of the yellow-billed cuckoo. Western Birds 24:17-28.

Gaines, D., and S.A. Laymon. 1984. Decline, status and preservation of the yellow-billed cuckoo in California. Western Birds 15:49-80.

Girvetz, E.H. and S.E. Greco. 2007. How to define a patch: a spatial model for hierarchically delineating organism-specific habitat patches. Landscape Ecology 22: 1131-1142.

Greco, S.E. 2012. Patch change and the shifting mosaic of an endangered bird's habitat on a large meandering river. River Research and Applications. DOI 10.1002/rra2568.

Grinnell, J., and A.H. Miller. 1944. The distribution of the birds of California. Cooper Ornithological Club, Berkeley, CA. 1986 reprint by Artemisia Press, Lee Vining, CA.

Halterman, M.D. 1991. Distribution and habitat use of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*) on the Sacramento River, California, 1987-1990. Master's Thesis, California State University, Chico, CA. 49 pp.

Halterman, M.D. 1999. Draft Western Yellow-billed Cuckoo Natural History Summary and Survey Methodology. Southern Sierra Research Station, Weldon, CA.

Halterman, M.D. 2001. Population status of the yellow-billed cuckoo at the Bill Williams River NWR and Alamo Dam, Arizona, and Southern Nevada: summer 2000. Bureau of Reclamation, Lower Colorado River Division, Boulder City, NV. 45 pp.

Halterman, M.D. 2002. Surveys and life history studies of the yellow-billed cuckoo: summer 2001. Admin. Rept., Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, NV and Bureau of Land Management, Sierra Vista, AZ. 37 pp.

Halterman, M.D. 2005. Surveys and life history studies of the yellow-billed cuckoo: summer 2004. Report to the Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, NV and Bureau of Land Management, Sierra Vista, AZ. 32 pp.

Halterman, M.D. 2008. Final report for the 2006-2007 yellow-billed cuckoo project. Report to the Bureau of Reclamation, Lower Colorado Regional Office, Boulder City, NV.

Halterman, M. D. 2009. Sexual dimorphism, detection probability, home range, and parental care in the yellow-billed cuckoo. Ph.D. Dissertation, University of Nevada, Reno, NV.

Halterman, M.D., D.S. Gilmer, S.A. Laymon, and G.A. Falxa. 2001. Status of the yellow-billed cuckoo in California: 1999-2000. Report to the US Geological Survey, Dixon, CA. 73 pp.

Halterman, M.D., E.T. Rose, S.E. McNeil, and D. Tracy. 2009. Yellow-billed cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2008. Annual report to the U.S. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV, by Southern Sierra Research Station, Weldon, CA.

Hamilton, W.J. III, and M.E. Hamilton. 1965. Breeding characteristics of yellow-billed cuckoos in Arizona. Proceedings of the California Academy of Sciences, Fourth Series, 32:405-432.

Henneman, C. 2009. Yellow-billed cuckoo surveys in the South Fork Kern River Valley in 2008. Admin. Rept. prepared for U.S. Fish and Wildlife Service, Sacramento Office by Southern Sierra Research Station, Weldon, CA.

Holmes, J.A., C. Calvo, and M.J. Johnson. 2008. Yellow-billed Cuckoo distribution, abundance, habitat use, and breeding ecology in the Verde River Watershed of Arizona, 2004-2005. Final Report to Arizona Game and Fish Department, Heritage Department, Phoenix, AZ. 34 pp.

Hughes, J.M. 1999. Yellow-billed Cuckoo (*Coccyzus americanus*). *In* The Birds of North America, No. 148 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 28 pp.

Johnson, M.J., S.L. Durst, C.M. Calvo, L. Stewart, M.K. Sogge, G. Bland, and T. Arundel. 2008. Yellow-billed cuckoo distribution, abundance, and habitat use along the lower Colorado River and its tributaries, 2007 Annual
Report. U.S. Geological Survey Open-File Report 2008–1177.

Johnson, M.J., R.T. Magill, and C. van Riper, III. 2010. Yellow-billed cuckoo distribution and habitat associations in Arizona, 1998-1999. Pp. 197-212, In: The Colorado Plateau IV: Integrating research and resources management for effective conservation (van Riper, C., III, B. F. Wakeling, and T. D. Sisk, Eds). University of Arizona Press, Tucson, AZ. 335 pp.

Johnson, MJ., J.R. Hatten, J.A. Holmes, and P.B. Shafroth. 2012. Development of a GIS-based model of yellow-billed cuckoo breeding habitat within the lower Colorado River Multi-Species Conservation Area, San Pedro River, and Verde River, AZ. Admin. Report to Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, NV. 53 pp.

Johnson, R.R., B.T. Brown, L.T. Haight, and J.M. Simpson. 1981. Playback recordings as a special avian censusing technique. In: Estimating numbers of terrestrial birds (C.J. Ralph, and J.M Scott, Eds.). Studies in Avian Biology 6:68-75.

Koenig, W.D., and A.M. Liebhold. 2005. Effects of periodical cicada emergences on abundance and synchrony of avian populations. Ecology 86:1873-1882.

Laymon, S.A. 1980. Feeding and nesting behavior of the yellow-billed cuckoo in the Sacramento Valley. California Dept. Fish and Game, Wildlife Management Branch, Sacramento, CA. Admin. Rep. 80-2.

Laymon, S.A. 1998. Yellow-billed Cuckoo survey and Monitoring Protocol for California. Unpublished.

Laymon, S.A. 1998a. Partners in Flight Bird Conservation Plan: Yellow-billed Cuckoo (Coccyzus americanus). (http://www.prbo.org/calpif/htmldocs/species/riparian/yellow-billed_cuckoo.htm)

Laymon, S.A. and M.D. Halterman. 1985. Yellow-billed cuckoos in the Kern River Valley: 1985 population, habitat use, and management recommendations. California Dept. of Fish and Game, Nongame Bird and Mammal Section Rep. 85–06.

Laymon, S.A. and M.D. Halterman. 1987. Distribution and status of the yellow-billed cuckoo in California: 1986-1987. Final Report to the California Department of Fish and Game, Nongame Bird and Mammal Section, Wildlife Management Division, Sacramento, CA.

Laymon, S.A. and M.D. Halterman. 1989. A proposed management plan for yellow-billed cuckoos in California. Pages 272-277 *in* D. Abell, Tech. Coord., Proceedings of the California Riparian Systems Conference: protection, management, and restoration for the 1990's. USDA Forest Service Gen. Tech. Rep. PSW-110, Berkeley, CA.

Laymon, S.A., P.L Williams, and M.D. Halterman. 1997. Breeding status of the yellow-billed cuckoo in the South Fork Kern River Valley, Kern County, California: Summary Report 1985-1996. Admin. Report USDA Forest Service, Sequoia National Forest, Cannell Meadow Ranger District, Challenge Cost-share Grant #92-5-13.

Marshall, D.B., M.G. Hunter, and A.L. Contreras. 2003. Birds of Oregon: a general reference. Oregon State University Press, Corvallis, OR. 768 pp.

Martin, T.E., and G.R. Geupel. 1993. Methods for locating nests and monitoring success. Journal of Field Ornithology 64:438–449.

McKernan, R. L., and G. T. Braden. 2002. The status of Yuma clapper rail and yellow-billed cuckoo along portions of Virgin River, Muddy River, and Las Vegas Wash, Southern Nevada, 2001. Final Report to the U.S. Fish and Wildlife Service and Southern Nevada Water Authority, Las Vegas, prepared by San Bernardino County Museum, Redlands, California.

McNeil, S.E., D. Tracy, J.R. Stanek, and J.E. Stanek. 2013. Yellow-billed cuckoo distribution, abundance and habitat use on the lower Colorado River and tributaries, 2008-2012 summary report. Bureau of Reclamation, Multi-Species Conservation Program, Boulder City NV.

McNeil, S.E, D. Tracy, and C.D Cappello. (2015 in review). Loop migration and Chaco wintering by a Western Yellow-billed Cuckoo. Manuscript submitted for publication.

Nolan, V. Jr., and C.F. Thompson. 1975. The occurrence and significance of anomalous reproductive activities in two North American non-parasitic cuckoos *Coccyzus* spp. IBIS 117:496-503.

Noss, R.F., E.T. LaRoe III, and J.M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. U.S. Geological Survey, Biological Resources Division (National Biological Service), BSR no. 9501, Washington, DC.

Ohmart, R.D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Studies in Avian Biology 15:273–285.

Parametrix, Inc. and Southern Sierra Research Station, 2015. Yellow-billed cuckoo surveys and population monitoring on the lower Colorado River and tributaries, 2014. Annual Report submitted to the Bureau of Reclamation, Boulder City, Nevada. Prepared by S.E. McNeil, and D. Tracy, Southern Sierra Research Station, Weldon, California, and Parametrix, Inc., Albuquerque, New Mexico. February 2015.

Payne, R.B. 2005. The Cuckoos. Oxford University Press. Oxford, UK.

Potter, E.F. 1980. Notes on nesting yellow-billed Cuckoos. J. Field Ornithology 51:17-29.

Preble, N.A. 1957. Nesting habits of the yellow-billed cuckoo. American Midland Naturalist 57:474-482.

Pruett, C.L., D.D. Gibson, and K. Winker. 2001. Molecular “cuckoo clock” suggests listing of western yellow-billed cuckoo may be warranted. Wilson Bulletin 113:228-231.

Pulliam, H.R. 1988. Sources, sinks, and population regulation. American Naturalist 132: 652–661.

Pyle, P. 1997. Identification guide to North American birds - part 1. Slate Creek Press, Bolinas, CA. 732 pp.

Ridgway, R. 1887. A manual of North American birds. Lippincott Press, Philadelphia, PA.

Roberson, D. 1980. Rare birds of the West Coast. Woodcock Publications, Pacific Grove, CA. 496 pp.

Sechrist, J., V. Johanson, and D. Ahlers. 2009. Western Yellow-billed Cuckoo Radio Telemetry Study Results – Middle Rio Grande New Mexico – 2007-2008. U.S. Bureau of Reclamation, Technical Service Center, Denver, CO.

Sechrist, J., Paxton, E. H., Ahlers, D., Doster, R. H., and Ryan, V. M. 2012. One year of migration data for a Western Yellow-billed Cuckoo. Western Birds 43:2–11.

Sogge, M.K., R.M. Marshall, S.J. Sferra, and T.J. Tibbits. 1997. A southwestern willow flycatcher natural history summary and survey protocol. Technical Report NPS/NAUcprs/NRTR-97/12. 36 pp.

Sogge, M.K., D. Ahlers, and S.J. Sferra. 2010. A natural history summary and survey protocol for the Southwestern Willow Flycatcher: U.S. Geological Survey Techniques and Methods 2A-10. 38 pp.

Stanek, J. R., and J. E. Stanek. 2012. Yellow-billed Cuckoo Occupancy, Breeding, and Habitat Use in the South Fork Kern River Valley, 2012 Annual Report. Report to the US Fish and Wildlife Service, Sacramento Office, Sacramento, CA.

Stiles, F.G., and A.F. Skutch. 1989. A guide to the birds of Costa Rica. Cornell University Press, Ithaca, New York.

Stoleson, S., and D. Finch. 1998. Breeding bird activity along the Gila River in the Gila-Cliff valley. Unpublished data. USFS- Rocky Mountain Research Station, Albuquerque, NM.

Tomlinson, C. 2010. Yellow-billed cuckoo – Candidate Species Assessment – Coccyzus americanus, Nevada – April 14, 2010. Attachment in email to Karen Leyse, U.S. Fish and Wildlife Service, Sacramento, California. April 14, 2010. 12 pp

U.S. Department of Interior. 1994. The impact of Federal programs on wetlands, Vol. II, a report to Congress by the Secretary of the Interior, Washington, DC, March 1994.

United States Fish and Wildlife Service (USFWS). 2001. Endangered and threatened wildlife and plants; 12-month finding for a petition to list the Yellow-billed Cuckoo (*Coccyzus*

americanus) in the Western Continental United States. Federal Register. 50 CFR Part 17:38611-626.

Woodward, H.D, S.H. Stoleson, and D.M. Finch. 2003. Yellow-billed cuckoos on the Gila National Forest: presence-absence, abundance, and habitat. Final report for the 2002 Field Season. US Dept. of Agriculture Forest Service, Rocky Mountain Research Station, Albuquerque, NM.

Appendix 1. Instructions for completing the Yellow-billed Cuckoo Survey Seasonal Summary Form.

NOTE- CHECK YOUR PERMIT – REPORTING REQUIREMENTS VARY BETWEEN REGIONS

These instructions are provided as guidance for completing the Survey Summary Form. It is important to complete all fields of the datasheet using a standardized format as described. Write clearly so that others can easily read the data. In addition to documenting sites with cuckoos, it is important to know areas where cuckoos were not detected; datasheets for these areas would have all information on the datasheet completed.

Attach the following: (1) copy of USGS quad/topographical map or similar (REQUIRED) of survey area, outlining survey site and location of cuckoo detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected cuckoos or their nests; (3) photos (if taken) of the interior of the patch, exterior of the patch, and overall site. Submit completed forms to both the appropriate state Yellow-billed Cuckoo coordinator and the US Fish and Wildlife Service (USFWS). Forms can also be completed digitally and submitted via email with attached or embedded topographic maps and photographs.

We recommend scanning or otherwise imaging data sheets immediately after the day's survey is completed. In the event of loss or damage to the data sheet, the information can be salvaged.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the cuckoo survey coordinators for each state and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your state or USFWS cuckoo coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the state or USFWS cuckoo coordinator). If you are uncertain if the site was previously surveyed, contact your state or USFWS cuckoo coordinator.

County. Record the county where the site is located.

State. Record the state where the site is located.

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Elevation. This can be obtained from a handheld GPS unit, USGS quad map, or a GIS elevation layer. Please use the most accurate information available. Please record data in meters.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Site Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units.

Datum. For uniformity of data, please use NAD83.

Ownership. Circle the appropriate owner for the site (BLM, Reclamation, NPS, USFWS, USFS, Tribal, State, Private, or other (Municipal/County)).

Was site surveyed in previous year? Circle yes or no.

If yes, what site name was used? If the site was surveyed in the previous year, record the site name used in the previous year.

Survey Visit #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. Note: A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple sub-sites and use separate survey forms for each. Casual, pre-season, supplemental, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the comments section on page 2 or in the survey continuation sheet.

Observer(s). Record your first initial(s) and last name(s).

Date: Indicate the date that the survey was conducted using the format mm/dd/yyyy.

Start and Stop. Record the start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hrs. Calculate the total hours, rounded to the nearest tenth (0.1) hour, based on time spent surveying the site and the number of surveyors. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed different sections of one site concurrently and independently, sum the number of hours each observer spent surveying the site.

Total Number of YBCUs detected. Record the total number of unique individual adult/fledgling Yellow-billed Cuckoos detected during this particular survey. Do not count nestlings. (But do record whether nestlings or fledglings were found in the comments section.)

Detection Type. Record how the cuckoo was detected using two codes. First, record whether the detection was "Incidental" (with a code of "I") if the cuckoo not was detected during the 6 minutes of each call playback survey point. If the cuckoo was detected during a Call playback survey, record it as a "P". Second, record whether the detection was A = aural (you only heard a cuckoo), V = Visual (you only saw it), or B = both (you heard and saw it).

Vocalization Type. If the detection was aural, record the type of vocalization heard as "CON" = Contact/kowlp, "COO" = coo, "ALA" = alarm (soft knocker call) ,"OV" = other (and describe the "other" vocalization under notes section.

Playback Number (#). Record the number of times the 'kowlp' call was played before the cuckoo responded.

Behavior Code. Record the appropriate breeding behavior code(s), for the behavior observed using the following codes (listed on the datasheet).

Surveyor Detection Coordinates. Enter the UTM Easting (E) and Northing (N) for the location of the surveyor when the cuckoo was detected. The direction (compass bearing) and distance to the detected cuckoo are estimated from this point.

Distance. Estimate as accurately as possible, the distance in meters to the detected cuckoo.

Bearing. Estimate, as accurately as possible, the compass bearing in degrees to the detected cuckoo from the surveyor location. The compass declination should be set to the magnetic declination of the survey area. Magnetic declination values can be located on USGS 7.5 minute quad maps or can be found using an internet search for "your state" + magnetic declination.

Cuckoo Number (#). Record a sequential number, starting with the number 1 for the first observation of the survey, in the row pertaining to the broadcast - point in which the observation was made. Use this reference number for other note-worthy information in the note section on the datasheet - record the cuckoo number and detailed notes regarding your observations including breeding behavior.

Corrected Coordinates. The Yellow-billed Cuckoo location is calculated based on the surveyor's location, distance, and bearing. Use the provided "Yellow-Billed Cuckoo Survey Summary Form for electronic submission" datasheet, which will calculate these coordinates.

Survey Summary. At the end of the survey season, complete the survey summary on the front page of the datasheet, near the bottom. Record the total number of detections made (across all surveys at the site); the number of possible breeding territories (see interpreting and reporting survey results in the protocol); and the total number of survey hours (the sum of all hours spent surveying the site).

Notes. As described above, for each detection during which a cuckoo was observed, record the Note # followed by detailed notes describing the observation(s), or other note-worthy information. Attach additional pages or use the continuation sheet if needed.

Page 2: Yellow-billed Cuckoo Survey Seasonal Summary Form, continued

Yellow-billed Cuckoo survey and detection form, continued: Please use this form for additional detections, follow-up visits, and any other circumstance when more detail is needed. Please use the detailed instructions above for filling out the form.

Page 2 of Survey Form

Name of Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Provide the reporting individual's phone number; include the area code.

E-mail. Provide the reporting individual's E-mail.

U.S. Fish and Wildlife Service (USFWS) Permit #. List the full number of the required federal permit under which the survey was completed.

State Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State wildlife agency permit.

Site Name. Same as for page 1 of the survey form.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Did you survey the same general area during each visit to this site this year? Yes/No. Circle Yes or No; if No, summarize in the comments below.

If site was surveyed last year, did you survey the same general area this year? Yes/No. Circle Yes or No; if No, record the reason and how the survey varied in the comments below.

Overall Vegetation Characteristics: This describes the overall vegetation characteristic for the site, namely which species predominantly comprise the tree/shrub layer. Check one of the following categories:

Native broadleaf plants - >75 % of the tree/shrub layer of the site is composed of native broadleaf plants.

Exotic/introduced plants - >75 % of the tree/shrub layer of the site is composed of exotic/introduced plants.

Mixed native and exotic plants (mostly native) – 51% -75% of the tree/shrub layer of the site is composed of native broadleaf plants.

Mixed native and exotic plants (mostly exotic) – 51% -75% of the tree/shrub layer of the site is composed of exotic/introduced plants.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate. Specify units used.

Estimated Canopy Cover. Estimate the percent canopy cover for the site.

Overstory Vegetation. Estimate the percent cover provided by the dominant overstory plant species at the site: cottonwood, tamarisk, Goodding's willow, Russian olive, coyote willow, and 'other". If other than the species listed, specify the species.

Average height of understory canopy. The understory canopy comprises a distinct layer (that does not have to be present throughout the site) below the overstory canopy. Provide the best estimate of the average height of the top of the understory canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate. Specify units used.

Estimated Understory Canopy Cover. Estimate the percent understory canopy cover for the site.

Understory Vegetation. Estimate the percent cover provided by the dominant understory plant species at the site: cottonwood, tamarisk, Baccharis, Goodding's willow, Russian olive, New Mexico olive, coyote willow, and 'other". If other than the species listed, specify the species.

Was surface water or saturated soil present at or within 300 meters of the site? Circle yes or no.

Was this true of all patches surveyed? Circle yes or no.
Comments. Provide comments regarding differences between survey patches within the site. For example, if the average canopy for the site is 30% cover, but within one patch it is 60%, describe this. Also note any significant differences between dominant overstory and understory vegetation among patches within the site. Document these differences with photographs whenever possible and reference comments to photos number whenever available. Note potential threats (e.g., livestock, ORV, hunting, etc.) to the site. If *Diorhabda* beetles are observed, contact your

USFWS and state cuckoo coordinator immediately. Attach additional pages or use the continuation sheet if needed.

Page 2 of Survey Summary Form

Yellow-billed Cuckoo survey and detection form, continued: Please use this form for additional detections, follow-up visits, and any other circumstance when more detail is needed. Please use the detailed instructions above for filling out the form.

Appendix 2. Instructions for Completing the OPTIONAL Yellow-billed Cuckoo Daily Datasheet

Total YBCU detections: at the end of the survey, record the total number of cuckoos detected during the survey. This is the actual number of detections. Interpretation of survey results (i.e. detections vs. number of cuckoos actually present) can be discussed in your report, but not here.

Page __ of __ : It is important to track number of pages, especially when datasheets are scanned.

Surveyor name: Record the first and last name of the primary surveyor.

Surveyor email: Record the best email address for the primary surveyor.

Surveyor phone number: Record the best phone number for the primary surveyor.

Site Code: Letter or alphanumeric code that denotes a particular site, intended to track sites throughout the season and across years. When applicable, you may use the same code identification as for Southwestern Willow Flycatcher sites.

Site Name: Write the full, unique name of the site to be surveyed. When applicable, you may use the same site name identification as for Southwestern Willow Flycatcher sites (Obtain these from your USFWS office).

Survey Period: The survey period in which the survey is being conducted (1-4), as defined in the protocol. Period 1 (one survey required): June 15-June 30. Period 2 (two surveys required): July 1 –July 31. Period 3 (one survey required): August 1-August 15.

Visit #: In many cases, this will be the same as the survey period, as most sites will be surveyed only once during a survey period. If more than one visit is conducted within one or more survey periods, number the visits sequentially, from the start of the survey season to the end. Such visits are typically for follow-up to determine breeding status.

Date: The month (mm) / day (dd) / year (yyyy) the survey is conducted.

Drainage: The name of the river, stream, or drainage where the site is located.

State, County: State two letter code (i.e. AZ); County full name (i.e. Coconino)

Additional Observers: First and last name of all additional surveyors.

Survey Start/End Time (hhmm): Write in the time of the start and end of the initial broadcast-point count (at the transect starting point) using the hour and minute format in military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Wind (0-5): Record wind measured with an anemometer. Alternatively, record the Beaufort wind code (0 through 5; Page 2 of form) as it applies to the strength of the wind during the survey. Record the average wind condition, not the maximum condition (e.g., periods of gusty winds). Do not survey if wind is greater than code 4.

Cloud Cover: Record cloud cover as: clear (C: <25%), partly overcast (PO: 25%-49%), mostly overcast (MO: 50-74%), or overcast (O: 75%+) If there are patches of clouds in different areas of the sky, try to visualize gathering all of them together into one part of the sky and recording what percent of cloud cover that would represent.

Precip (0-5): Record the appropriate code (0 through 5). Surveyors should not be surveying if rain is more than an intermittent drizzle. See chart on datasheet, Pg. 2.

Noise (0-3): Record the noise code (0-3) that applies to background noise conditions during the transect, as it relates to your ability to hear cuckoos. Record the average noise conditions, not the maximum condition. 0 = Quiet - no noise that interferes with bird detection. 1 = Faint Noise - slight noise that has only a minimal effect of bird detection. 2 = Moderate Noise - probably can't hear some birds beyond 100m. 3 = Loud Noise - Only the closest birds are detected. See chart on datasheet, Pg. 2.

Temperature: Record the ambient temperature; specify if collected in Fahrenheit or Celsius.

NAD: Surveyors should be using NAD 83.

UTM Start/Stop: Enter the UTM Easting (E) and Northing (N) for the transect starting point, and again for the end of the transect.

Start and Stop GPS Accuracy: The accuracy of the GPS reading for the UTMs, recorded in meters.

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units.

General survey data.

Call Point Start Time (hhmm): Write in the time of the start of the individual broadcast-point count (when the surveyor first arrives at the point) using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Survey Call Point UTM Coordinates: Enter the UTM Northing (N) and Easting (E) for the individual survey point.

Waypoint Number: Record this if you are saving them on your GPS unit.

Yellow-billed Cuckoo detections:

(Reminder: When a cuckoo is detected at a point, terminate the broadcast. **Do not continue to play the recording once a cuckoo is detected.)**

Detection #: When a cuckoo is detected, record a unique number for the detection. If it is the first detection of the survey visit, the detection number is "1". If more than one cuckoo is detected at the point, record the second detection in the next row on the data sheet, and record the detection number as "2". In the columns to the left (Point Start Time, UTM coordinates) record "" to denote that these values are the same as those in the row directly above. Also, if more than one cuckoo is detected at a point, be sure to thoroughly describe your observations under "Notes". If you think the same cuckoo is detected later at a different point during the survey or incidentally before or after the survey, give that bird a new detection number, but make a note of this. .

Time of Detection: Record the time that the cuckoo was detected, using the hour and minute format using military time. Fill in all four digits. Examples are 0630 (6:30 am), 1300 (1:00 pm).

Record how the cuckoo was detected. **I = Incidental** (between call broadcast points) or **P = Playback** (following broadcast calls).

Detection type: **A = Aural**, **V = Visual**, or **B = Both**. If the cuckoo was detected both by sight and sound (i.e., "B"), write in parenthesis the order in which the type of detections occurred. For example, "B (A/V), and describe the detection(s) under "Note #" as detailed below.

Compass Bearing (^{o}): Record the estimated compass bearing, in degrees, to the detected cuckoo. The compass declination should be set to zero.

Estimated Distance (m): Record the horizontal distance in meters between the broadcast point (where you are standing), and the location or presumed location of the cuckoo where you first detect it.

Accuracy of Estimate (Est. Accuracy): Indicate relative accuracy of your estimate using the codes shown in Table 1. Determine your pace by counting your steps per measured distance. Recalibrate your pace prior to and throughout the field season to ensure accuracy. Code reminders are on Pg. 2 of the datasheet.

Table 1. Codes for quantifying the degree of accuracy in estimating the distance to a detected cuckoo.

Accuracy Code	Explanation
1	Measured distance, using laser rangefinder or pacing, to a known location.
2	Measured distance, using laser rangefinder or pacing, to an estimated location.
3	Estimated location of detection and distance, feel confident it was within **25 m** of true location.
4	Estimated location of detection and distance, feel confident it was within **50 m** of true location.

5	Estimated location of detection and distance, feel confident it was within **100 m** of true location.
6	Little confidence in your estimate, a complete "guesstimate".

Vocal codes (Vocalization codes): Record the appropriate code (see Pg. 2, data sheet), or series of codes for any calls heard when you made the detection. Use more than one code, when appropriate.

Behavior/Breeding: Record the appropriate breeding behavior code(s), for the behavior observed using the codes on Pg. 2 data sheet. You may enter more than one code in this box. Note that if you use Vocal Exchange (VEX) you will enter data in 2 rows, one for each bird. Use more than one code, when appropriate.

Note #: To record observations of cuckoo detections, or other note-worthy information, first record a sequential number, starting with the number 1 for the first observation of the survey, in the row pertaining to the broadcast - point in which the observation was made. Use the space on the bottom of the data sheet to record detailed notes regarding your observations. Use the back of the data sheet if more space is needed.

***:** Two blank columns are provided so surveyors can record additional information that may be of interest, such as cicada presence, presence of other avian species of interest, etc.

Data Entry, Data Proof, Data Scan: These are provided for QA/QC of your data.

Review your federal and state permit requirements. Be sure to submit appropriate forms and reports on time to USFWS and other agencies. Retain a copy for your records.

Appendix 3. Instructions for Completing the Yellow-billed Cuckoo Survey Site Description Form

These instructions are provided as guidance for completing the Yellow-billed Cuckoo Survey Site Description Form. It is important to complete all fields of the datasheet using a standardized format as described. Type or write clearly so that others can easily read the data. Describe any unique habitat features in Comments.

We recommend scanning or otherwise imaging data sheets immediately after the day's survey is completed. In the event of loss or damage to the data sheet, the information can be salvaged.

Date report completed: Indicate the date that the survey was conducted using the format mm/dd/yyyy.

Site Name: Write the full, unique name of the site to be surveyed. When applicable, you may use the same site name identification as for Southwestern Willow Flycatcher sites (Obtain these from your USFWS office).

State. Record the state where the site is located.

County. Record the county where the site is located.

Name of Reporting individual: Record the first and last name of the primary surveyor.

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone #: Record the best phone number for the primary surveyor.

Email: Record the best email address for the primary surveyor.

U.S. Fish and Wildlife Service (USFWS) Permit #. List the full number of the required federal permit under which the survey was completed.

State Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State wildlife agency permit.

Site Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet.

UTM Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units.

NAD: Surveyors should be using NAD 83.

USGS Quad Name(s). Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps. Please list the names of all Quads covered by the survey site.
Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Elevation. This can be obtained from a handheld GPS unit, USGS Quad map, or a GIS elevation layer. Please use the most accurate information available. Please record data in meters.

Name of nearest Creek, River, Wetland, or Lake. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Ownership. Circle the appropriate owner for the site (BLM, Reclamation, NPS, USFWS, USFS, Tribal, State, Private, or Other (Municipal/County)).

Was site surveyed in previous year? Circle yes or no.

If yes, what site name was used? If the site was surveyed in the previous year, record the site name used in the previous year.

Did you survey the same general area during each visit to this site this year? Yes/No. Circle Yes or No; if No, summarize in the comments below.

If site was surveyed last year, did you survey the same general area this year? Yes/No. Circle Yes or No; if No, record the reason and how the survey varied in the comments below.

Native/Exotic:

Native broadleaf plants - >75 % of the tree/shrub layer of the site is composed of native broadleaf plants.

Mixed native and exotic plants (mostly native) – 51% -75% of the tree/shrub layer of the site is composed of native broadleaf plants.

Mixed native and exotic plants (mostly exotic) – 51% -75% of the tree/shrub layer of the site is composed of exotic/introduced plants.

Exotic/introduced plants - >75 % of the tree/shrub layer of the site is composed of exotic/introduced plants.

Overstory Vegetation. Provide the scientific names of the five most common species in the overstory, and the estimated percent cover provided each species. It is possible for there to be an overstory present with no understory. Use the following cover categories: <1%; 10%, 25%, 50%, 75%, 90%, 100%.

Average height of canopy. Provide the best estimate of the average height, in meters, of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Estimated Overall Canopy Cover. Estimate the overall percent canopy cover for the site.

Understory Vegetation. The understory canopy comprises a distinct woody layer (that does not have to be present throughout the site) below the overstory canopy. For example, a cottonwood overstory might have a willow understory. It's also possible that there may only be an overstory, with no understory. Willow or mesquite, for example, may have no understory. Provide the scientific names of the five most common species in the understory, and the estimated percent cover provided each species. Use the following cover categories: <1%; 10%, 25%, 50%, 75%, 90%, 100%.

Average height of understory canopy. Provide the best estimate of the average height, in meters, of the top of the understory canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Estimated Overall Understory Cover. Estimate the percent understory cover for the site.

Describe adjacent habitat: Describe the types of habitat adjacent to the survey area. Include upland vegetation type, such as agricultural or residential areas, roads, and any other relevant information.

Adjacent Habitat. Provide the names of the five most common types of adjacent habitat, and the estimated percent cover provided each type. Alternatively, you can list up to five types of surrounding land use. For example: Fallow Ag field, 50%; suburb, 25%, Walnut orchard, 25%. Use the following cover categories: <1%; 10%, 25%, 50%, 75%, 90%, 100%.

Was surface water or saturated soil present at or within 300 meters of the site? Circle yes or no.

Was this true of all patches surveyed? Circle yes or no.

Comments. Provide comments regarding differences between survey patches within the site. For example, if the average canopy for the site is 30% cover, but within one patch it is 60%, describe this. Also note any significant differences between dominant overstory and understory vegetation among patches within the site. Document these differences with photographs whenever possible and reference comments to photos number whenever available. Note potential threats (e.g.,

livestock, ORV, hunting, etc.) to the site. If *Diorhabda* beetles are observed, contact your USFWS and State cuckoo coordinator immediately. Attach additional pages or use the continuation sheet if needed.

PAGE 2. The first four sections are required in case pages become separated.

Site Name.

Name of Reporting Individual.

Phone Number.

E-mail.

Map: Attach the following: (1) copy of USGS quad/topographical map or similar (REQUIRED) of survey area, outlining survey site and location of cuckoo detections; (2) sketch or aerial photo showing site location, patch shape, openings, survey route, location of any detected cuckoos or their nests; (3) photos (if taken) of the interior of the patch, exterior of the patch, and overall site. Submit completed forms to both the appropriate State Yellow-billed Cuckoo coordinator and the US Fish and Wildlife Service (USFWS) as required by your permits. When required or recommended, forms should be completed digitally (Microsoft Word or Excel) and submitted via email with attached or embedded topographic maps and photographs.

UTAH PRAIRIE DOG OCCUPANCY AND HABITAT SURVEY PROTOCOL FOR FEDERAL SECTION 7 CONSULTATIONS

May 2014

The purpose of Utah prairie dog occupancy and habitat surveys is to determine if Utah prairie dogs inhabit a proposed project Action Area (see Glossary), and determine if a proposed action may affect this species. Surveys provide management agencies and developers with sufficient resource information to help ensure that proposed projects are planned and implemented to avoid and minimize impacts in compliance with the Endangered Species Act. Please note that Occupancy and Habitat Surveys are not the same as pre-construction actions intended to protect or further define Utah prairie dog habitat. If Utah prairie dog habitat is identified within the Action Area, the subsequent consultation with the U.S. Fish and Wildlife Service (USFWS) may identify other needed actions or additional surveys to be completed prior to construction.

It is important to note that this survey protocol expresses our scientific opinion on adequate Utah prairie dog survey methods. Our knowledge is continuously developing and changing, therefore this protocol, based upon the best scientific and commercial data available, is a work in progress. This protocol will be modified as new information becomes available. Circumstances may dictate that Utah prairie dog surveys be conducted differently on a case by case basis. If surveys cannot be accomplished pursuant to this protocol, please contact the Utah Ecological Services Field Office for guidance on survey methods before proceeding.

Results of Utah prairie dog surveys must be entered on the approved Utah Prairie Dog Occupancy/Habitat Survey Form (see last page).

Surveyor Qualifications

- Surveys may only be conducted by certified individuals. Certified surveyors (see Glossary) are those who have completed a USFWS approved Utah prairie dog survey training course. Results of surveys conducted by non-certified personnel will not be acceptable as the basis for assessing potential impacts to Utah prairie dogs.
- The surveyor training course must be successfully completed at least once every four

years. Significant changes in the protocol may require re-certification before the end of a surveyor's four year authorization period. The USFWS will notify certified surveyors of the need for early re-certification should such changes occur. Certified surveyors must carry training certification cards when conducting surveys.

Pre-Survey Coordination

- Utah prairie dog surveys must be conducted by USFWS certified surveyors (see Glossary) in order to met ESA Section 7 requirements.
- Prior to conducting surveys, certified surveyors must coordinate with the Authorizing Federal Agency (see Glossary) to identify the Action Area (see Glossary) and survey requirements.
- Surveys will encompass all (100%) suitable habitat in the Action Area, including both public and privately owned lands. The Authorizing Federal Agency may, however, in coordination with USFWS, adjust survey requirements as follows: 1) The Authorizing Federal Agency may provide additional maps of suspected or important habitats that will also require Utah prairie dog surveys. 2) The Authorizing Federal Agency may identify areas, if any, that will be exempt from surveys based on habitat suitability, previous survey results, or other factors.
- Maps of mapped Utah prairie dog habitat (see Glossary) within the Action Area can be obtained from Utah Division of Wildlife Resources (UDWR). A Government Records Access and Management Act (GRAMA) request for these maps must be submitted to the UDWR Southern Region Office, 1470 N. Airport Rd., Cedar City, UT 84721 (435-865-6100 or prairiedogsurvey@utah.gov).
- Written permission from the legal landowner or lessee is required to legally access privately owned lands. If access cannot be obtained to privately owned lands in the Action Area, the surveyor must use other accessible vantage points, optics, aerial photos, audio cues, other technology, and interviews of knowledgeable land managers and agency biologists to assess prairie dog occupancy and extent of suitable habitat. If the above methods are not available or do not provide adequate data for the Authorizing Federal Agency to make a conclusive decision concerning occupancy, then the inaccessible land in question must be assumed to support occupied Utah prairie dog

habitat. Surveyors must note on the survey forms and in completion reports those properties for which legal access could not be obtained and the method(s) used to assess the same.

- Survey results will not be considered valid if they are not collected following this protocol and any specific stipulations identified by the authorizing agency(ies). Authorizing Federal Agencies that are not land management agencies must coordinate all survey details with the USFWS.

Survey Season

- **Active Season** – Generally April 1 through August 31; dates may vary depending on site-specific conditions. Active season surveys can only be conducted when the ground is sufficiently snow free.
- **Dormant Season** – Generally September 1 through March 31; dates may vary depending on site-specific conditions. Dormant season surveys can only be conducted when the ground is sufficiently snow free.
- The determination of the applicable Active/Dormant Season and whether conditions are "sufficiently snow free" will be made by the Authorizing Federal Agency, based on site-specific conditions. Additionally, the Authorizing Federal Agency may determine that site conditions are not conducive to accurate and reliable dormant season surveys, and may require surveys to be conducted only during the active season. If the Authorizing Federal Agency is not a land management agency, these determinations will be made by the USFWS.

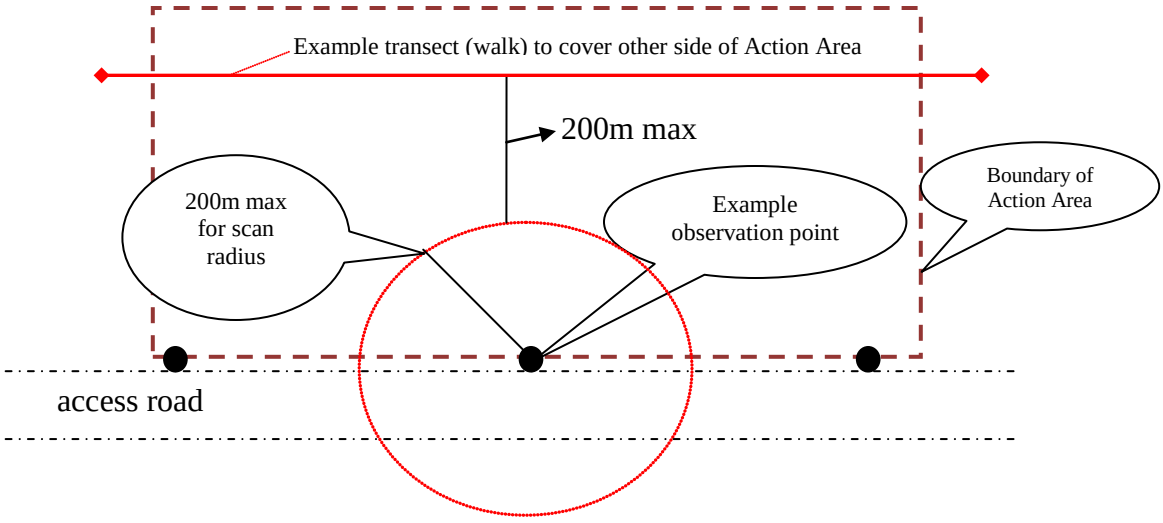
Habitat Assessment Survey

This protocol will be applied to all (100%) suitable habitat within the survey boundaries determined by the Authorizing Federal Agency and USFWS (see Pre-Survey Coordination). There is a two tiered level of intensity for habitat surveys: Low Intensity and High Intensity. The required survey level will be determined by the Authorizing Federal Agency. If the Authorizing Federal Agency is not a land management agency, this determination will be made by the USFWS.

- **Low Intensity Level Surveys:**

  Surveys of suitable habitat that are intended to identify any previously unknown Utah prairie dog habitat (see Utah Prairie Dog Habitat Classification below) areas within the historic range. Generally conducted in locations ≥5 miles from any known and/or mapped Utah prairie dog habitat, where previous surveys or professional knowledge of the local management biologists indicate that the likelihood of occupied Utah prairie dog habitat is low.

  i. All suitable habitat in the Action Area must be surveyed by foot and/or vehicle (on established roads only) to insure 100% visual coverage.
  ii. Aerial methods are not allowed.
  iii. Vehicle surveyors must stop every ¼ mile (400 m), or more frequently, and get out of the vehicle to walk and obtain clear views in order to scan surrounding areas with suitable optics for the presence of prairie dogs. The surveyor must also listen for Utah prairie dog vocalizations throughout the survey to locate prairie dogs. Scans should not attempt to clear more than 200m (using binoculars or scopes) in either direction – if suitable habitat exists beyond 200m from the observation point, additional transects should be driven, or walked if no road access, (see diagram for example). The surveyor should spend a minimum of 5 minutes at each observation point scanning and listening for Utah prairie dogs.



  iv. If no Utah prairie dogs or their sign are observed within the entire Action Area, the results of the Low Intensity Level survey will be considered valid for two (2) years from the following March 31 (e.g. if a survey is completed May 15, 2014

the survey is valid until March 31, 2017). If any new biological information becomes available during this time which indicates the potential presence of Utah prairie dogs in the Action Area, or if any changes are made to the size, scope, and/or nature of the proposed project before or during implementation, survey expiration dates may change and additional surveys may be required during the course of the project.

v. If any Utah prairie dogs or their sign are observed anywhere within the Action Area during the Low Intensity Level Survey, then High Intensity Level Surveys (see below) will be required in those areas of Utah prairie dog activity.

- **High Intensity Level Surveys:**

  Surveys of suitable habitat intended to identify the extent of Utah prairie dog habitat in areas suspected of containing Utah prairie dogs. Generally conducted within <5 miles of known and/or mapped Utah prairie dog habitat areas where previous surveys or professional knowledge of the local management biologists indicate that occupied prairie dog habitat may occur.

  i. All (100%) suitable habitat in the Action Area must be surveyed.
  ii. The surveyor must walk parallel transects no more than 30 meters apart through the entire area of suitable habitat searching 15m on both sides of the transect for burrows and other prairie dog sign. Surveyors must walk transects using a compass or GPS unit for orientation, ensuring that all suitable habitat within the entire action area is adequately surveyed. Care must be taken as to not trample burrows.
  iii. Surveyors must stop periodically and scan surrounding areas with suitable optics for the presence of prairie dogs. The surveyor must also listen for Utah prairie dog vocalizations throughout the survey to locate prairie dogs.
  iv. The results of the High Intensity Level survey are only valid from the date conducted through to the following March 31 (e.g. if a survey is completed May 15, 2014, the survey is valid until March 31, 2015). If a project is not implemented until after the following March 31, and/or if there are gaps in construction activity within the same year (generally one week or more), new surveys may be required.

Utah Prairie Dog Habitat Classification

Portions of suitable habitat that support Utah prairie dog burrows, mounds or other sign of the presence (past or recent) of Utah prairie dogs are considered "Utah prairie dog habitat" and will be classified as follows:

- **Occupied Utah Prairie Dog Habitat:**
  i. Active Season: Any area where Utah prairie dogs are seen or heard, or any Functional Utah prairie dog Burrows (see Glossary) are found and show evidence of recent prairie dog activity (fresh digging, scat, fresh tracks).
  ii. Dormant Season: Any Utah prairie dog burrows (functional or not functional) or any Utah prairie dog mound system (see Glossary) is found, even if no other signs of Utah prairie dogs are present.
  iii. If legal access cannot be obtained to any portion of the Action Area, please refer to the instructions under the Pre-Survey Coordination section on page 2.

- **Unoccupied (previously supported) Utah Prairie Dog Habitat:**
  i. Active Season: No Utah prairie dogs are seen or heard and Utah prairie dog burrows are found but are not Functional; or Functional Utah prairie dog burrows or mound systems are found but there is no evidence of prairie dogs: such as fresh digging, scat or tracks.
  ii. Dormant Season: Unoccupied habitat cannot be determined during the dormant season. If any Utah prairie dog burrows are found (functional or not functional), or there is any evidence of a prairie dog mound system, they must be documented and will be assumed occupied.

Utah Prairie Dog Counts

If occupied Utah prairie dog habitat is found, those areas will be counted according to the following Utah Prairie Dog Count Protocol:

- Counts will be conducted only on calm, sunny days when cloud cover is < 40 % and the ground is snow free. Avoid extremes of heat and cold. Surveys should be discontinued if winds exceed 3 on the Beaufort scale (>12 mph), if cloud cover exceeds 40%, if clouds cast moving shadows across the colony, or if otherwise inclement weather is encountered.

Counts are generally made between 0800 and 1800 hours, but should be timed to coincide with periods when prairie dogs are most active above ground according to the season and elevation. For example, avoid counting at mid-day at low elevations during mid-summer. Peaks in Utah prairie dog activity generally occur from ½ hour after sunrise to 10:00 a.m., and then from 3:00 p.m. to ½ hour before sunset.

- Counts should be made from a vantage point which provides an unobstructed view of the entire colony. If this is not possible, surveyors should choose a few good vantage points from which to count easily identifiable portions of the colony, count each of these subdivided areas and arrive at a composite count for the colony by summing these partial counts. In this latter case, special care should be taken to avoid over counting. At least three counts will be made at each colony. If the counts continue to rise, counting must continue until the number of prairie dogs reaches a plateau or begins to decrease. The surveyor should record the maximum total number of prairie dogs observed (see survey form).
- Surveyors should approach colonies to be counted in such a way that they avoid disturbing the resident prairie dogs. However, there is wide variability in prairie dog behavior between locations. In areas where the prairie dogs are habituated to people, such as in town, it may be helpful to wait a brief time after arriving to allow Utah prairie dogs to acclimate to the observer. The surveyor can then slowly scan the colony from one end to the other with binoculars or spotting scope and count all prairie dogs visible in the colony. This method often does not work in areas where people or vehicles may be perceived as a disturbance or predator by the prairie dogs. In these cases, it is preferable to park vehicles out of sight of the colony and walk closer. Often it is best to conduct the first count as soon as prairie dogs are visible. The surveyor should progressively move closer and count each time they move until prairie dog numbers begin to decline. As stated above, record the maximum number of prairie dogs seen on the survey form.

Utah Prairie Dog Habitat Mapping

- The surveyor must determine the extent of all Utah prairie dog habitat encountered, whether occupied or unoccupied. GIS polygons of Utah prairie dog habitat must be

created by marking the locations of all perimeter burrows within the Action Area with a GPS device.

- The surveyor shall assign each new individual Utah prairie dog habitat polygon they discover a unique Polygon ID # (see Glossary). Individual habitat polygons are those areas in which all nearest neighbor burrows are within 730 ft. (222.5 m; Utah prairie dog foraging distance) of one another. Mapped habitat polygons received from UDWR should be identified by their existing UDWR assigned colony identifiers. All data pertaining to each habitat polygon will be tied to a unique Polygon ID# or UDWR assigned colony identifier.
- These unique Polygon ID#s and/or identifiers must be used and recorded on the Survey Data Form along with any subsequent GIS attribute data. All survey results will be provided to the authorizing agency as an ESRI compatible product (shapefile or personal geodatabase) that is in the UTM Zone 12 North NAD 1983 datum. Spatial data must be attributed in a table (see Table 1 for example attribute table), and include metadata following ESRI standards.

Table 1. Example attribute table for the Polygon shapefile.

Polygon ID #	Surveyor	Land Use	Polygon Status	Total # of UPDs	Date of Survey
KRP01	J. Cliff; S. Rubt; K. Kirken	US	Unoccupied	0	5/18/2014
KRP02	J. Cliff; S. Rubt; K. Kirken	RP	Occupied	8	5/18/2014
KRP03	J. Cliff; K. Kirken	DC	Occupied	14	5/18/2014
KRP04	S. Liner; B. Box	IP	Unoccupied	0	5/18/2014
KRP05	S. Liner; B. Box; R. Sunner	IC	Unoccupied	0	5/18/2014
KRP06	S. Liner; B. Box; R. Sunner	BG	Occupied	5	5/19/2014
KRP07	B. Box; R. Sunner	US	Unoccupied	0	5/19/2014

Data/Report Submission

- Survey data must be provided to the Authorizing Federal Agency in the approved format within the timeframe determined by the authorizing agency. The Authorizing Federal Agency may accept, reject, or ask for additional information on the surveys. They may also conduct field checks of survey data to validate results. The Authorizing Federal Agency will coordinate results with USFWS. Authorizing Federal Agencies are responsible for providing copies of data to UDWR.

- Complete data/report submission includes a written report summarizing methodology and results, completed survey forms, maps and geospatial data. Methodology sections and maps must clearly define low intensity and high intensity level survey areas. Vehicle and foot survey areas must be delineated within the low intensity survey areas. Reports must include both positive and negative survey results. Negative data includes all areas in the Action Area that were determined to be unsuitable habitat; and suitable habitat that was surveyed but showed no evidence of Utah prairie dogs or their burrows. Reports must identify the action area, all suitable habitat that was surveyed, and the presence of all identified Utah prairie dog habitat areas (occupied and unoccupied). Survey forms submitted with negative data only need the top portion of the form completed.
- The authorizing agency will make the appropriate effects determination of the proposed action.

GLOSSARY

Action Area: The entire right-of-way or exterior boundary of a proposed action plus the appropriate buffer (see definition of Buffer Type).

Active Season Survey: Surveys that occur generally from April 1 through August 31 when prairie dogs are most active above ground, including breeding and rearing of young. The determination of the applicable Active Season will be made by the Authorizing Federal Agency. If the Authorizing Federal Agency is not a land management agency, the U.S. Fish and Wildlife Service will make this determination.

Authorizing Federal Agency: For projects on federal lands; the authorizing agency is the agency which administers the lands where the proposed project occurs and from whom a permit or other authorization is needed before the project may be implemented. This is most commonly the Bureau of Land Management, U.S. Forest Service, or National Park Service.

For projects on private lands with a federal nexus, the Authorizing Federal Agency is the federal agency connected to the private lands action (see definition of Federal Nexus). If the authorizing federal agency is not a land management agency, it must coordinate all survey details with the U.S. Fish and Wildlife Service.

Buffer Type: For projects that temporarily impact Utah prairie dog habitat (do not extend into the following breeding season and the habitat can feasibly be restored), or those projects with small permanent surface or buried structures that do not substantially alter Utah prairie dog habitat or behavior, the buffer is a 1100 foot zone extending out from the proposed project right-of-way or exterior boundary. For projects with large permanent surface or buried structures that may substantially alter Utah prairie dog habitat or behavior, or extend into the following breeding season, the buffer zone extends outward ½ mile from the proposed project right-of-way or exterior boundary. The buffer type will be determined by the Authorizing Federal Agency in coordination with the U.S. Fish and Wildlife Service.

Certified Surveyor: An individual who has completed a U.S. Fish and Wildlife Service approved Utah Prairie Dog Surveyor Course within the last 4 years.

Dormant Season Survey: Surveys that occur generally from September 1 through March 31 when prairie dogs are less active above ground and are often below ground for long periods of time. The determination of the applicable Dormant Season will be made by the Authorizing Federal Agency. If the authorizing federal agency is not a land management agency, the U.S. Fish and Wildlife Service will make this determination.

Federal Nexus: A federal nexus may occur for projects on private lands. Any private actions that are federalized for purposes of NEPA through a key federal decision must be considered as connected actions and included within the scope of the federal agency's decision making. A "federalized" project is one for which the agency has discretion to authorize or permit the action, or proposes to contribute substantial funds, equipment or staff to implement.

Functional Burrow: Any Utah prairie dog burrow that is structurally suitable to house Utah prairie dogs (entirely open, partially filled with dirt, or open but blocked by sticks, weeds,

cobwebs, or other debris). Burrows that are less than 3" in diameter are not considered potential prairie dog burrows. Whenever a surveyor is uncertain of the species of origin when identifying burrows or mounds, they must err on the side of the Utah prairie dog and report the site. Follow-up visits may be made by the U.S. Fish and Wildlife Service, Utah Division of Wildlife Resources, and/or the Authorizing Federal Agency to verify the species.
Note: The species of origin (the species that originally dug the burrow or created the mound) and the current occupant of the burrow must be considered.

Government Records Access and Management Act (GRAMA): A Utah State law which in part "provides guidelines for both disclosure and restrictions on access to government records, which are based on the equitable weighing of the pertinent interests and which are consistent with nationwide standards of information practices." UDWR is the official curator of Utah prairie dog maps. Distribution of this information must be consistent with GRAMA.

Historic Utah Prairie Dog Range: All suitable habitats in the following areas: all of Beaver, Iron and Piute Counties; Garfield County – the Aquarius Plateau and west of the Escalante Mountains, including Tropic Valley; Kane County – the main stem Sevier River Valley and East Fork Sevier River Valley, including primary tributaries; Juab County – areas south and east of SR132; Millard County – areas east of the San Francisco Mountains, Cricket Mountains and the Sevier River; Sanpete County – the Sevier River Valley; Sevier County – areas west of, and including, the Old Woman Plateau and west of SR72, including the Tidwell Slopes; Washington County - all areas in the Kanarra Creek and Ash Creek drainages; Wayne County – west of the Water Pocket Fold.

High Intensity Level Surveys: Surveys of suitable habitat intended to identify the extent of Utah prairie dog habitat in areas suspected of containing Utah prairie dogs. Generally are conducted within <5 miles of known and/or mapped Utah prairie dog habitat areas where previous surveys or professional knowledge of the local management biologists indicate that occupied prairie dog habitat may occur.

Land Use: Surface management of the area being surveyed. Classifications include Rangeland/Dry Pasture (RP), Irrigated Pasture (IP), Irrigated Cropland (IC), Dryland Crop (DC), Bare/Fallow Ground (BG), and Urban/Suburban (US).

Low Intensity Level Survey: Surveys of suitable habitat that are intended to identify any previously unknown Utah prairie dog habitat areas. Generally conducted in locations ≥5 miles from any known and/or mapped Utah prairie dog habitat where previous surveys or professional knowledge of the local management biologists indicate that the likelihood of occupied prairie dog habitat is low.

Mapped Habitat: Any and all areas within the species' range that were mapped since 1972 as currently or historically occupied by Utah prairie dogs. Official maps of Utah prairie dog habitat are maintained by the UDWR and are updated annually.

Mound System: A mound is the pile of earth, gravel, sand, rocks, or debris associated with making a burrow hole in the ground. A Utah prairie dog mound system is identified as 3 or more prairie dog mounds clustered within a 10m diameter space. If any evidence of a Utah prairie dog

mound system is found, the area must be mapped and reported as Utah prairie dog habitat. Whenever a surveyor is uncertain of the species of origin when identifying burrows or mounds, they must err on the side of the Utah prairie dog and report the site. Follow-up visits may be made by the U.S. Fish and Wildlife Service, Utah Division of Wildlife Resources, and/or the Authorizing Federal Agency to verify the species.
Note: The species of origin (the species that originally dug the burrow or created the mound) and the current occupant of the burrow must be considered.

Occupied Utah Prairie Dog Habitat: During the Active Season: Any area where Utah prairie dogs are seen or heard, or any Functional Utah prairie dog burrows (see definition of Functional Burrow) are found and show evidence of recent prairie dog activity (fresh digging, scat, fresh tracks).

During the Dormant Season: Any Utah prairie dog burrows (functional or not functional), or any Utah prairie dog mound system (see definition of mound system) is found, even if no other signs of Utah prairie dogs are present.

If legal access cannot be obtained to any portion of the Action Area, please refer to the instructions under the Pre-Survey Coordination section on page 2.

Polygon ID #: The ID number is a unique identifier for each Utah prairie dog habitat polygon that is defined by the surveyor and provides a means to link the spatial data of that polygon with the data captured on the survey form. The polygon is either Occupied or Unoccupied by Utah prairie dogs.

Polygon Status: Utah prairie dog habitat polygons are classified as occupied or unoccupied.

Suitable Habitat: Habitat capable of supporting Utah prairie dogs including grassland or low-density sagebrush sites, agricultural fields, vacant lots, and other areas as identified by the Authorizing Federal Agency. Habitat previously mapped by the Utah Division of Wildlife Resources must be treated as suitable, regardless of current vegetative status.

Unoccupied (previously supported) Utah Prairie Dog Habitat: During the Active Season: No Utah prairie dogs are seen or heard and Utah prairie dog burrows are found but are not Functional (see definition of Functional Burrow); or Functional Utah prairie dog burrows or mound systems are found but there is no evidence of prairie dogs: such as fresh digging, scat or tracks.

During the Dormant Season: Unoccupied habitat cannot be determined during the dormant season. If any Utah prairie dog burrows are found (functional or not functional), or there is any evidence of a prairie dog mound system, they must be documented and will be assumed occupied.

Utah prairie dog habitat: Portions of suitable habitat that support Utah prairie dog burrows, mounds, or other sign of the presence (past or recent) of Utah prairie dogs.

Utah Prairie Dog Occupancy / Habitat Survey Form

Summary Information:

Project Name: _____ Start Survey Date: ____/____/_____ End Survey Date: ____/_____/_____

Project Location: T. ____ R. ____ Section(s) _____ ¼ ¼ _____ County: _____

Acres of Suitable Habitat surveyed in Action Area: _____ Buffer Type (check one): ☐1100' buffer ☐½ mile buffer

Survey Season (check one): ☐Active Season ☐Dormant Season

Surveyors: _____ Surveyor Organization/Agency: _____

Location Description: _____

Comments: _____

Site Specific Information (fill out the information below for sites where you verify or suspect the presence of Utah prairie dog habitat):

Polygon ID #	Polygon Status (O or U)	Count Date	Count Start Time	Land Use	UPD Sign (Y/N)						UPD Counts (Total #)	Count Weather		NOTES
					Functional Burrows	Mounds	Vocal-izations	Scat	Tracks	Digging		Cloud Cover	Wind Speed	(For each UPD habitat polygon, note presence of other spp. burrows if known, and habitat description)

- Project Name: defined by surveyor
- Start Survey Date: DD/MM/YYYY
- End Survey Date: DD/MM/YYYY
- Project Location: Township, Range, Section, Quarter Quarter
- County: county name
- Action area: entire right-of-way or exterior boundary of the proposed action plus the appropriate buffer
- Buffer Type: see Glossary
- Survey Season: Active or Dormant (see Glossary)
- Surveyors: write out full name(s) (e.g. John Doe)
- Survey Organization/Agency: write out full name
- Location Description: (vegetation type, landmarks, etc.)
- Polygon ID#: Required unique identifier for each Utah Prairie Dog habitat polygon; this field must link to the associated shapefile
- Polygon Status: is either Occupied or Unoccupied
- Start Time: military time (i.e. 0900 – 1300)
- Land Use:
  - RP - Rangeland/Dry Pasture
  - IP - Irrigated Pasture
  - IC - Irrigated Cropland
  - DC - Dryland Crop
  - BG - Bare/Fallow Ground
  - US - Urban/Suburban
- Utah prairie dog (UPD) Burrows & Other Sign:
  - Any Functional (not collapsed) UPD Burrows observed?(Y/N)
  - Any UPD Mounds observed? (Y/N)
  - Any UPD vocalizations heard? (Y/N)
  - Any UPD scat observed? (Y/N)
  - Any UPD tracks observed? (Y/N)
  - Any UPD digging observed? (Y/N)
- UPD Counts: Total Number of UPDs observed
- Cloud Cover: 1 = 0-20%; 2 = 21-40%; 3 = >41%
  DO NOT SURVEY IF CLOUD COVER = 3
- Wind Speed (Beaufort Scale)
  - 0 = 0-1 mph: Smoke rises vertically.
  - 1 = 1-3 mph: Wind motion visible in smoke.
  - 2 = 3-7 mph: Wind felt on exposed skin, leaves rustle.
  - 3 = 8-12 mph: Leaves and smaller twigs in constant motion.
  - 4 = 13-17 mph: Dust and loose paper raised, small branches begin to move.
  - 5 = 18-24 mph: Branches of a moderate size move, small trees begin to sway.
  - 6+ = ≥ 25 mph: Large branches in motion through hurricane force.

  DO NOT SURVEY IF WIND SPEED >3 (>12 mph)

Agency Use Only	
Reviewer:	
Accepted/ Rejected:	
New Habitat:	
Known Habitat (Complexes / Colonies):	
Comments:	
Survey valid:	

USGS
science for a changing world

Prepared in cooperation with the Bureau of Reclamation and the U.S. Fish and Wildlife Service

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

Chapter 10 of
Section A, Biological Science
Book 2, Collection of Environmental Data

Techniques and Methods 2A-10

U.S. Department of the Interior
U.S. Geological Survey

Cover: Southwestern Willow Flycatcher. Photograph taken by Susan Sferra, U.S. Fish and Wildlife Service.

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U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

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Figures

Conversion Factors

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
gram (g)	0.03527	ounce, avoirdupois (oz)
hectare (ha)	2.471	acre
kilometer (km)	0.6214	mile (mi)
meter (m)	3.281	foot (ft)
millimeter (mm)	0.03937	inch (in.)

Abbreviations and Acronyms

GPS	Global Positioning System
NDVI	Normalized Difference Vegetation Index
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

By Mark K. Sogge, U.S. Geological Survey; Darrell Ahlers, Bureau of Reclamation; and Susan J. Sferra, U.S. Fish and Wildlife Service

Background

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) has been the subject of substantial research, monitoring, and management activity since it was listed as an endangered species in 1995. When proposed for listing in 1993, relatively little was known about the flycatcher's natural history, and there were only 30 known breeding sites supporting an estimated 111 territories rangewide (Sogge and others, 2003a). Since that time, thousands of presence/absences surveys have been conducted throughout the historical range of the flycatcher, and many studies of its natural history and ecology have been completed. As a result, the ecology of the flycatcher is much better understood than it was just over a decade ago. In addition, we have learned that the current status of the flycatcher is better than originally thought: as of 2007, the population was estimated at approximately 1,300 territories distributed among approximately 280 breeding sites (Durst and others, 2008a).

Concern about the Southwestern Willow Flycatcher on a rangewide scale was brought to focus by Unitt (1987), who described declines in flycatcher abundance and distribution throughout the Southwest. *E. t. extimus* populations declined during the 20th century, primarily because of habitat loss and modification from activities, such as dam construction and operation, groundwater pumping, water diversions, and flood control. In 1991, the U.S. Fish and Wildlife Service (USFWS) designated the Southwestern Willow Flycatcher as a candidate category 1 species (U.S. Fish and Wildlife Service, 1991). In July 1993, the USFWS proposed to list *E. t. extimus* as an endangered species and to designate critical habitat under the Act (U.S. Fish and Wildlife Service, 1993). A final rule listing *E. t. extimus* as endangered was published in February 1995 (U.S. Fish and Wildlife Service, 1995); critical habitat was designated in 1997 (U.S. Fish and Wildlife Service, 1997). The USFWS Service released a Recovery Plan for the Southwestern Willow Flycatcher in 2002 (U.S. Fish and Wildlife Service, 2002), and re-designated critical habitat in 2005 (U.S. Fish and Wildlife Service, 2005).

In addition to its federal status, the Southwestern Willow Flycatcher is listed as an endangered species or species of concern in Arizona (Arizona Game and Fish Department, 2006), New Mexico (New Mexico Department of Game and Fish, 1996), California (California Department of Fish and Game, 1991), and Utah (Utah Division of Wildlife Resources, 1997).

Sound management and conservation of an endangered species like the Southwestern Willow Flycatcher requires current, detailed information on its abundance and distribution. This requires, among other things, identifying where flycatchers are and are not breeding, and annual monitoring of as many breeding areas as possible. Such efforts require effective, standardized survey protocols and consistent reporting, at both local and regional levels. However, the Willow Flycatcher is a difficult species to identify and survey for. Moreover, inconsistent or ineffective surveys are of limited value, can produce misleading information (including "false positives" and "false negatives"), hinder regional and rangewide analyses, and waste limited resources.

We developed this document to provide a standardized survey protocol and a source of basic ecological and status information on the flycatcher. The first section summarizes the current state of knowledge regarding Southwestern Willow Flycatcher natural history, based on a wide array of published and unpublished literature. Emphasis is given to information relevant to flycatcher conservation and management, and to conducting and interpreting surveys. The second section details a standard survey protocol that provides for consistent data collection, reporting, and interpretation. This protocol document builds on and supersedes previous versions, the most recent of which was Sogge and others (1997a). In this update, we incorporate over a decade of new science and survey results, and refine the survey methodology to clarify key points. Further, we update the standard survey data sheets and provide guidelines on how to fill in the requested information. Amidst these revisions, the basic approach of the survey protocol has remained unchanged—multiple surveys at each survey area within the same breeding season, the use of the call-playback technique using flycatcher vocalizations to increase the probability of detection, and verification of species identity through its diagnostic song.

Section 1. Natural History

Breeding Range and Taxonomy

The Willow Flycatcher is a widespread species that breeds across much of the conterminous United States (Sedgwick, 2000). Four subspecies commonly are recognized in North America, with each occupying a distinct breeding range (fig. 1): *E. t. adastus*, ranging across the northern Rocky Mountains and Great Basin; *E. t. brewsteri*, found west of the Sierra Nevada and Cascade Mountains along the Pacific Slope; *E. t. extimus*, the Southwestern Willow Flycatcher, which breeds across the Southwest; and *E. t. traillii*, ranging east of the northern Rocky Mountains. Although the overall subspecies' ranges are distinct, Sedgwick (2001) and Paxton (2008) noted interbreeding/gradation zones in the boundary area between *E. t. extimus* and *E. t. adastus*.

The breeding range of the Southwestern Willow Flycatcher includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah: specific range boundaries are delineated in the subspecies' recovery plan (U.S. Fish and Wildlife Service, 2002). Unitt (1987) included western Texas in the subspecies' range, but recent breeding records from western Texas are lacking. Records of probable breeding Southwestern Willow Flycatchers in Mexico are few and restricted to extreme northern Baja California and Sonora (Unitt, 1987; Wilbur, 1987). Although recent data are lacking, the USFWS does include parts of northern Mexico in its description of *E. t. extimus* breeding range (U.S. Fish and Wildlife Service, 2002).

Although they appear very similar to most observers, experienced taxonomist or those using specialized equipment (for example, an electronic colorimeter) can differentiate among the subspecies by subtle differences in color and morphology (for example, Unitt, 1987; Paxton, 2008). Despite the subtle level of differences, the taxonomic status of *E. t. extimus* has been critically reviewed and confirmed multiple times based on morphological, genetic, and song data (Hubbard, 1987; Unitt, 1987; Browning, 1993; Paxton, 2000; Sedgwick, 2001).

The Southwestern Willow Flycatcher was described by Phillips (1948) from a specimen collected along the San Pedro River in southeastern Arizona. The Southwestern Willow Flycatcher generally is paler than other Willow Flycatcher subspecies, although this difference is indistinguishable without considerable experience and training, and study skins as comparative reference material. The southwestern subspecies differs in morphology (primarily wing formula) but not overall size. The plumage and color differences between the Willow Flycatcher subspecies are so subtle that they should not be used to characterize birds observed in the field (Unitt, 1987; Hubbard, 1999; U.S. Fish and Wildlife Service, 2002).

Migration and Winter Range, Habitat, and Ecology

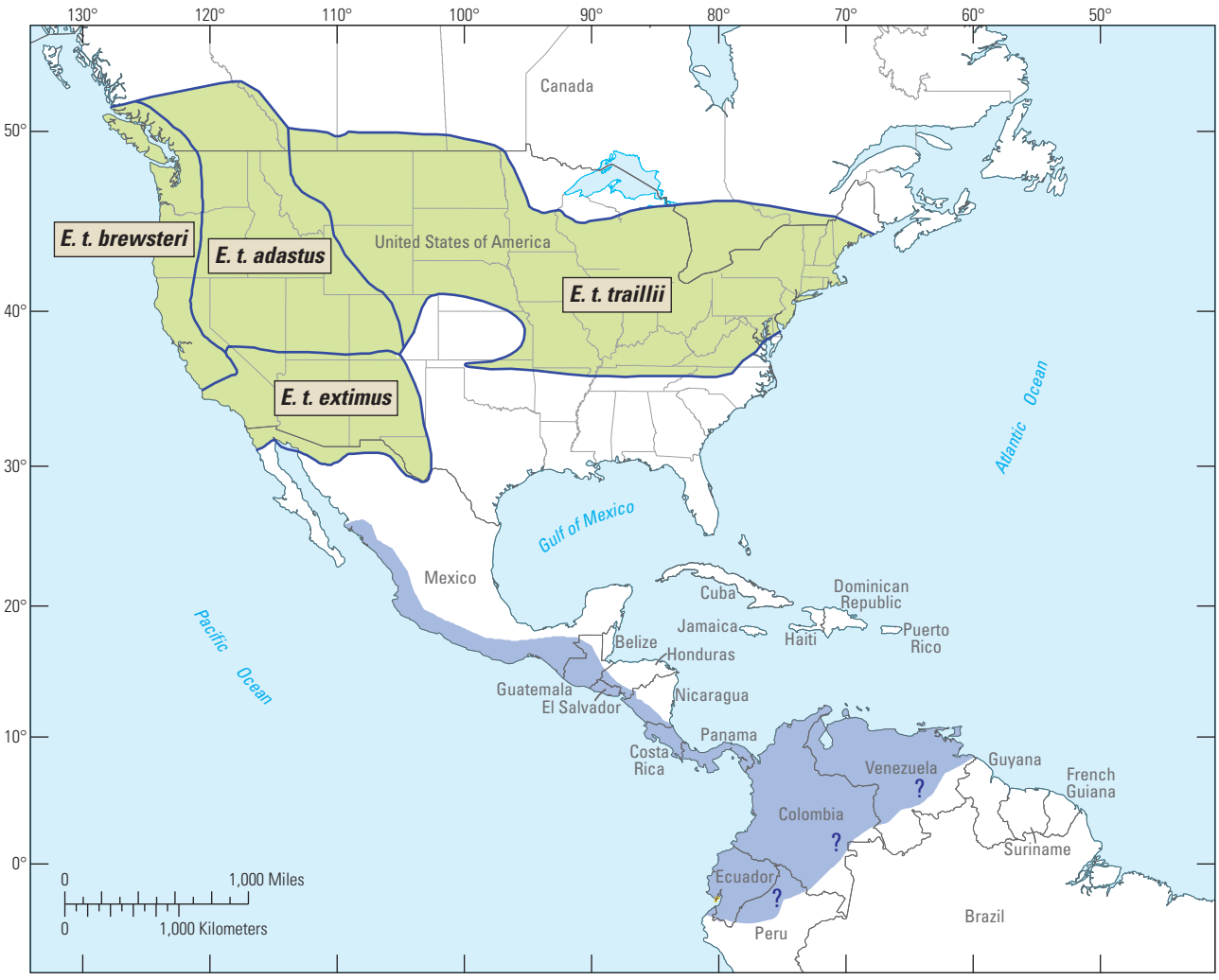
All Willow Flycatcher subspecies breed in North America but winter in the subtropical and tropical regions of southern Mexico, Central America, and northern South America (Sedgwick, 2000; Koronkiewicz, 2002; fig. 1). Most wintering birds are found in the Pacific slope lowlands in Mexico and Central America, and Caribbean slope lowlands in Mexico and Guatemala.

Because all Willow Flycatcher subspecies look very similar, determining specific wintering sites for the southwestern race has been challenging. However, recent genetic analysis of wintering birds (Paxton, 2008) suggests that the four subspecies occupy finite areas of the wintering grounds, but with overlapping ranges. The Southwestern Willow Flycatcher appears to be largely restricted to the center of the winter range (in the vicinity of Costa Rica), although Paxton (2008) suggests more research is needed to address this question.

On the wintering grounds, flycatchers primarily are found in habitats that have four main components: (1) standing or slow moving water and/or saturated soils, (2) patches or stringers of trees, (3) woody shrubs, and (4) open areas (Koronkiewicz and Whitfield, 1999; Koronkiewicz and Sogge, 2000; Lynn and others, 2003; Nishida and Whitfield, 2007; Schuetz and others, 2007). Based on surveys to date, the presence of water or saturated soils is almost universal, although tree heights and configurations, the presence of woody shrubs, and the amount of open space surrounding winter territories can vary considerably (Schuetz and others, 2007).

Male and female flycatchers hold separate, individual non-breeding territories, and defend those territories throughout the winter by using song, calls, and aggression displays. Fidelity to wintering territories and sites is high, as is survivorship over the wintering period (Koronkiewicz and others, 2006b; Sogge and others, 2007).

Willow Flycatchers travel approximately 1,500–8,000 km each way between wintering and breeding areas. During migration, flycatchers use a wider array of forest and shrub habitats than they do for breeding, although riparian vegetation may still be a preferred migration habitat type (Finch and others, 2000). Migration requires high energy expenditures, exposure to predators, and successful foraging in unfamiliar areas. Therefore, migration is the period of highest mortality within the annual cycle of the flycatcher (Paxton and others, 2007). Willow Flycatchers of all subspecies sing during northward migration, perhaps to establish temporary territories for short-term defense of food resources.



Basemap modified from U.S. Geological Survey and other agency digital data, various scales. Projection Mercator, World Geodetic System1984 datum.

EXPLANATION

Approximate range distribution of the Willow Flycatcher (*Empidonax traillii*)—Adapted from Unitt (1987), Browning (1993), and Paxton (2008)

Breeding range, including boundaries of the Willow Flycatcher subspecies

? Wintering range—Question marks reflect uncertainty of the location of the eastern boundary of the winter range

Figure 1. Approximate ranges of the Willow Flycatcher (*Empidonax traillii*) during breeding and non-breeding seasons.

Southwestern Willow Flycatchers typically arrive on breeding grounds between early May and early June (Ellis and others, 2008; Moore and Ahlers, 2009). Because arrival dates vary annually and geographically, northbound migrant Willow Flycatchers of multiple subspecies pass through areas where Southwestern Willow Flycatchers have already begun nesting. Similarly, southbound migrants in late July and August may occur where Southwestern Willow Flycatchers are still breeding (Unitt, 1987). This can make it challenging for an observer to differentiate local breeders from migrants. Other than timing, we still know relatively little about Southwestern Willow Flycatcher migratory behavior, pathways, or habitat use.

Breeding Habitat

Breeding Southwestern Willow Flycatchers are riparian obligates, typically nesting in relatively dense riparian vegetation where surface water is present or soil moisture is high enough to maintain the appropriate vegetation characteristics (Sogge and Marshall, 2000; U.S. Fish and Wildlife Service, 2002; Ahlers and Moore, 2009). However, hydrological conditions in the Southwest can be highly variable within a season and between years, so water availability at a site may range from flooded to dry over the course of a breeding season or from year to year.

The Southwestern Willow Flycatcher breeds in dense riparian habitats across a wide elevational range, from near sea level in California to more than 2,600 m in Arizona and southwestern Colorado (Durst and others, 2008a). Vegetation characteristics of Southwestern Willow Flycatcher breeding habitat generally include dense tree or shrub cover that is ≥ 3 m tall (with or without a higher overstory layer), dense twig structure, and high levels of live green foliage (Allison and others, 2003); many patches with tall canopy vegetation also include dense midstory vegetation in the 2–5 m range. Beyond these generalities, the flycatcher shows adaptability in habitat selection, as demonstrated by variability in dominant plant species (both native and exotic), size and shape of breeding patch, and canopy height and structure (U.S. Fish and Wildlife Service, 2002).

Southwestern Willow Flycatcher breeding habitat can be quantified and characterized in a number of ways, depending on the level of detail needed and habitat traits of interest. For many sites, detailed floristic composition, plant structure, patch size, and even characteristics such as Normalized Difference Vegetation Index (NDVI) have been described in agency reports and scientific journal articles (Allison and others, 2003; Hatten and Paradzick, 2003; Koronkiewicz and others, 2006a; Hatten and Sogge, 2007; Moore, 2007; Schuetz and Whitfield, 2007; Ellis and others, 2008). For purposes of this survey protocol, we take a relatively simple approach and broadly describe and classify breeding sites based on plant species composition and habitat structure. Clearly, these are not the only important components, but they are conspicuous to human perception and easily observed and recorded. Thus, they have proven useful in conceptualizing, selecting and evaluating suitable survey habitat, and in predicting where breeding flycatchers are likely to be found.

Breeding habitat types commonly used by Southwestern Willow Flycatchers are described below. The general categories are based on the composition of the tree/shrub vegetation at the site—native broadleaf, exotic, and mixed native/exotic. In the field, breeding habitats occur along a continuum of plant species composition (from nearly monotypic to mixed species) and vegetation structure (from simple, single stratum patches to complex, multiple strata patches). The images in figures 2–7 illustrate some of the variation in flycatcher breeding habitat, and other examples can be found in numerous publications and agency reports, and on the USGS photo gallery web site (http://sbsc.wr.usgs.gov/SBSCgallery/). The intent of the descriptions and photographs is to provide a general guide for identifying suitable habitat in which to conduct surveys.

Native broadleaf.—Southwestern Willow Flycatchers breed across a great elevational range, and the characteristics of their native broadleaf breeding sites varies between high elevation sites and those at low and mid-elevation sites.

High elevation sites (fig. 2) range from nearly monotypic dense stands of willow to mixed stands of native broadleaf trees and shrubs, 2–7 m in height with no distinct overstory layer; often associated with sedges, rushes, nettles, and other herbaceous wetland plants; usually very dense structure in lower 2 m; live foliage density is high from the ground to the canopy. Vegetation surrounding the patch can range from open meadow, to agricultural lands, to pines or upland shrub.

At low and mid-elevations (fig. 3), flycatcher breeding sites can be composed of single species (often Goodding's willow (*Salix gooddingii*), *S. exigua*, or other willow species) or mixtures of native broadleaf trees and shrubs including (but not limited to) cottonwood, willows, boxelder (*Acer negundo*), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus* spp.), height from 3 to 15 m; characterized by trees of different size classes; often a distinct overstory of cottonwood, willow or other broadleaf tree, with recognizable subcanopy layers and a dense understory of mixed species; exotic/introduced species may be a rare component, particularly in the understory.

Monotypic exotic.—(fig. 4) Breeding sites also can include nearly monotypic, dense stands of exotics such as saltcedar (*Tamarix* spp.) or Russian olive (*Elaeagnus angustifolia*), 4–10 m in height forming a nearly continuous, closed canopy (with no distinct overstory layer); lower 2 m commonly very difficult to penetrate due to dense branches, however, live foliage density may be relatively low 1–2 m above ground, but increases higher in the canopy; canopy density uniformly high.

Aerial view of Little Colorado River near Greer, Arizona. Photograph by USGS, 1995.

Little Colorado River near Greer, Arizona. Photograph courtesy of Arizona Game and Fish Department, 1996.

Parkview Fish Hatchery, New Mexico. Photograph by USGS, 2000.

Rio Grande State Wildlife Area, Colorado. Photograph by USGS, 2002.

Tierra Azul, New Mexico. Photograph by USGS, 2005.

McIntyre Springs, Colorado. Photograph by USGS, 2002.

Figure 2. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at high-elevation sites.

Hassayampa River, Arizona. Photograph by USGS, 2003.

Santa Ynez River, California, Photograph by USGS, 1996.

San Luis Rey River, California. Photograph by USGS, 2005.

Kern River, California. Photograph by USGS, 1995.

Bosque del Apache, Rio Grande, New Mexico. Photograph courtesy of Bureau of Reclamation, 2008.

Kern River, California. Photograph by USGS, 1995.

Figure 3. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at low and mid-elevation sites.

Aerial view of Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Salt River, Arizona. Photograph courtesy of Bureau of Reclamation, 1996.

Orrilla Verde, Rio Grande, New Mexico. Photograph by USGS, 2006.

Aerial view of Salt River, Arizona. Photograph by USGS, 1996.

Figure 4. Examples of Southwestern Willow Flycatcher breeding habitat in exotic vegetation.

Mixed native/exotic—(fig. 5) These sites include dense mixtures of native broadleaf trees and shrubs (such as those listed above) mixed with exotic/introduced species, such as saltcedar or Russian olive; exotics are often primarily in the understory, but may be a component of overstory; the native and exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat; overall, a particular site may be dominated primarily by natives or exotics, or be a more-or-less equal mixture.

Regardless of the plant species composition or height, occupied sites almost always have dense vegetation in the patch interior (fig. 6). These dense patches are often interspersed with small openings, open water, or shorter/sparser vegetation, creating a mosaic that is not uniformly dense.

Gila River, Arizona. Photograph by USGS, 2002.

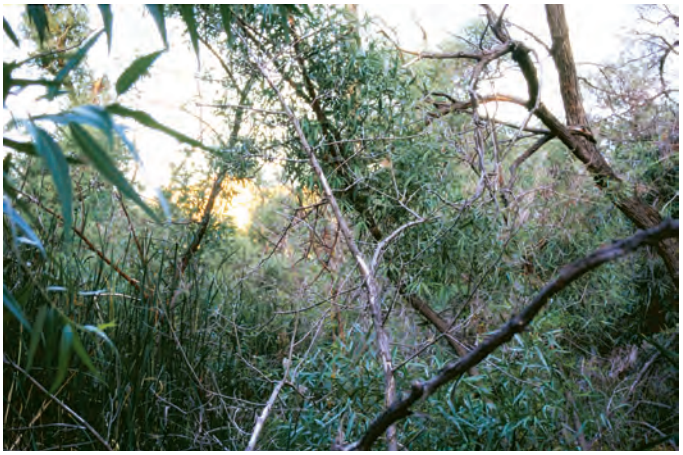
Roosevelt Lake, Arizona. Photograph by USGS, 1999.

Verde River River, Arizona. Photograph by USGS, 2002.

Virgin River, Utah. Photograph by USGS, 1997.

Figure 5. Examples of Southwestern Willow Flycatcher breeding habitat in mixed native/exotic vegetation.


Gila River, Arizona. Photograph by USGS, 2002.


Kern River, California. Photograph by USGS, 1999.


Rio Grande, New Mexico. Photograph by USGS, 2007.


Salt River, Arizona. Photograph by USGS, 1999.


Rio Grande, New Mexico. Photograph by USGS, 2007.


Rio Grande, New Mexico. Photograph by USGS, 2005.

Figure 6. Examples of dense vegetation structure within breeding habitats of Southwestern Willow Flycatcher.

Riparian patches used by breeding flycatchers vary in size and shape, ranging from a relatively contiguous stand of uniform vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Southwestern Willow Flycatchers have nested in patches as small as 0.8 ha (for example, in the Grand Canyon) and as large as several hundred hectares (for example, at Roosevelt Lake, Ariz., or Elephant Butte Reservoir, New Mex.). They have only rarely been found nesting in isolated, narrow, linear riparian habitats that are less than 10 m wide, although they will use such linear habitats during migration.

Flycatcher territories and nests typically are adjacent to open water, cienegas, marshy seeps, or saturated soil, and within riparian areas rooted in standing water. However, in the Southwest, hydrological conditions at a site can vary remarkably within a season, between years, and among nearby sites (fig. 7). Surface water or saturated soil may only be present early in the breeding season (that is, May and part of June), especially in dry years. Similarly, vegetation at a patch may be immersed in standing water during a wet year, but be hundreds of meters from surface water in dry years (Ahlers and Moore, 2009). This is particularly true of reservoir sites, such as the Kern River at Lake Isabella, Calif., Tonto Creek and Salt River at Roosevelt Lake, and the Rio Grande near Elephant Butte Reservoir. Natural or human-caused river channel modifications and altered subsurface flows (for example, from agricultural runoff), can lead to a total absence of water or visibly saturated soil at a site for several years.

Other potentially important aspects of Southwestern Willow Flycatcher habitat include distribution and isolation of vegetation patches, hydrology, food base (arthropods), parasites, predators, environmental factors (for example temperature, humidity), and interspecific competition (U.S. Fish and Wildlife Service, 2002). Population dynamics

Rio Grande at San Marcial, New Mexico, with dry substrate. Photograph by USGS, 2007.

Rio Grande at San Marcial, New Mexico, with flowing water beneath the territories. Photograph by USGS, 2007.

Tonto Creek inflow to Roosevelt Lake, Arizona, during a dry year. Photograph by USGS, 2004.

Tonto Creek inflow to Roosevelt Lake, Arizona, during high-water year. Photograph by USGS, 2005.

Figure 7. Examples of the variable hydrologic conditions at breeding habitats of Southwestern Willow Flycatcher.

factors, such as demography (for example, survivorship rates, fecundity), distribution of breeding groups across the landscape, flycatcher dispersal patterns, migration routes, the tendency for adults and surviving young to return to their previous year breeding site, and conspecific sociality also influence where flycatchers are found and what habitats they use (U.S. Fish and Wildlife Service, 2002).

It is critically important to recognize that the ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high to poor to unsuitable; the best habitats are those in which flycatcher reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam, 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Furthermore, productivity and survival rates can vary widely among years (Paxton and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009), so conclusions based on short-term datasets or data extrapolated from one area to another may be erroneous. It also is important to note that not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding flycatchers. There also may simply not be enough flycatchers in a given area to fill all available habitat in particular locations (U.S. Fish and Wildlife Service, 2002). A better understanding of which habitats or sites are sinks or sources can be especially helpful in site conservation and restoration planning.

As described earlier, migrant Willow Flycatchers may occur in riparian habitats that are structurally unsuitable for breeding (for example, too sparse, smaller patch size, etc.), and in non-riparian habitats. Such migration stopover areas, even though not used for breeding, may be critically important resources affecting local and regional flycatcher productivity and survival (U.S. Fish and Wildlife Service, 2002, 2005).

Breeding Chronology and Biology

Unless otherwise noted, the information that follows and upon which the generalized breeding season chronology (fig. 8) is based comes from Unitt (1987), Whitfield (1990), Maynard (1995), Sogge and others (2003b), Paxton and others (2007), Schuetz and Whitfield (2007), and Ellis and others (2008). Extreme or record dates for any stage of the breeding cycle may vary by 1–2 weeks from the dates presented, depending on the geographic area, extreme weather events, yearly variation and other factors. Higher elevation areas, in particular, have delayed chronology (Ahlers and White, 2000).

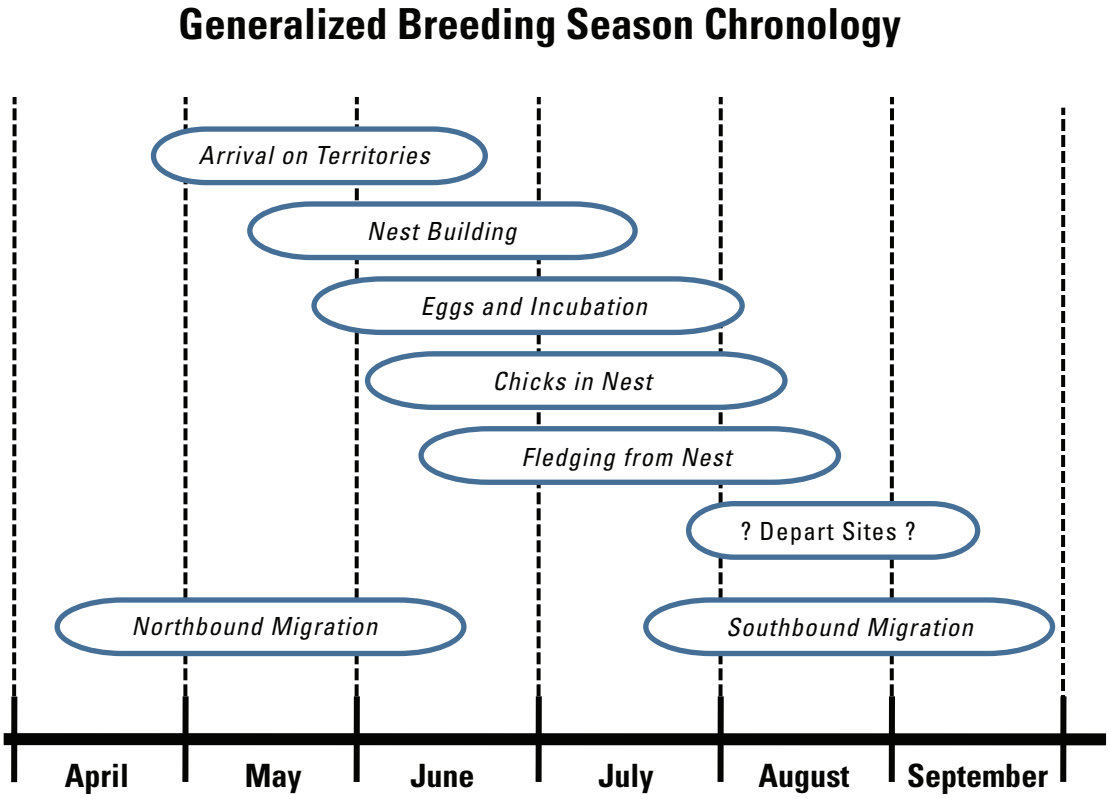


Figure 8. Generalized migration and breeding chronology for the Willow Flycatcher in the Southwest. Extreme or record dates may occur slightly earlier or later than indicated.

Both sexes can breed beginning in their second year. Male Southwestern Willow Flycatchers generally arrive at breeding areas first; older males typically arrive before younger ones. Although females usually arrive a few weeks after males, some older females are present at sites before late-arriving males. Adult flycatchers will sometimes wander extensively through large riparian sites before and after breeding, possibly as a way to evaluate potential breeding habitat (Cardinal and others, 2006).

Males establish and defend their territories through singing and aggressive interactions. Females settle on established territories, and may choose a territory more for its habitat characteristics than for the traits of its territorial male. Territory size tends to be larger when a male first arrives, then gets smaller after a female pairs with the male (Cardinal and others, 2006). Similarly, male song rate is very high early in the season, then declines after pairing (Yard and Brown, 2003). Not all males are successful in attracting mates in a given year, and as a result unpaired territorial males occur at many breeding sites. Unpaired males are usually a small percentage of any local population, but can comprise as much as 15–25 percent of the territories in some populations (Munzer and others, 2005; Ahlers and Moore, 2009).

Although the Willow Flycatcher as a species is considered predominantly monogamous during the breeding season (Sedgwick, 2000), some Southwestern Willow Flycatcher populations have a relatively high degree of polygyny whereby one male can have more than one breeding female in its territory. Polygynous males generally have two females in their territory, but up to four have been recorded (Davidson and Allison, 2003; Pearson and others, 2006). Polygyny rates can vary between sites, and among years at a given site. At some sites, polygynous males have much higher productivity than monogamous males (Paxton and others, 2007).

Nest building within the territory usually begins within a week or two after pair formation. Egg laying begins as early as mid-May, but more often starts in late May to mid-June. Chicks can be present in nests from late May through early August. Young typically fledge from nests from mid-June through mid-August; later fledglings are often products of re-nesting attempts. Breeding adults generally depart from their territories in early to mid-August, but may stay later if they fledged young late in the season. Males that fail to attract or retain mates, and males or pairs that are subject to significant disturbance, such as repeated nest parasitism or predation may leave territories by early July. Fledglings probably leave the breeding areas a week or two after adults, but few details are known.

Southwestern Willow Flycatcher territory size varies widely, probably due to differences in population density, habitat quality (including vegetation density and food availability), and nesting stage. Studies have reported estimated territory sizes ranging from 0.06 to 2.3 ha (Sogge and others, 1995; Whitfield and Enos, 1996; Bureau of Reclamation, 2009). At Roosevelt Lake, Ariz., measurements of home ranges, which include the defended territory and sometimes adjacent use areas, averaged 0.4 ha for actively breeding males; home range can be much larger for pre- and post-breeding males (Paxton and others, 2007). During incubation and nestling phases territory size, or at least the activity centers of pairs, can be very small. Flycatchers may increase their activity area after young are fledged, and use non-riparian habitats adjacent to the breeding area (Cardinal and others, 2006). This variability among sites, individual territories, and over time illustrates the challenge of defining a minimum habitat patch size for breeding flycatchers, or estimating the number of territories based simply on the size of a given breeding site.

At some breeding sites, non-territorial adult "floaters" will be present among the territorial population. Floaters are quieter and less aggressive than territorial adults, and therefore are harder to detect and frequently overlooked. Most floaters are young males, and float for only a single year. At Roosevelt Lake, floaters typically accounted for 3–8 percent of the known adult population, although the rate was much higher in drought years when habitat quality was lower (Paxton and others, 2007). The presence of floaters in a population may indicate that there is not enough high quality habitat to support all potentially territorial individuals present in a given breeding season.

Nests and Eggs

Historically, 75–80 percent of reported Southwestern Willow Flycatcher nests were placed in willows (Phillips, 1948; Phillips and others, 1964; Hubbard, 1987; Unitt, 1987). Southwestern Willow Flycatchers still commonly place their nests in native plants, but will often build nests in exotics, such as saltcedar and Russian olive (Sogge and Marshall, 2000; Stoleson and Finch, 2003; Durst and others, 2008a). In Arizona, most nests are in saltcedar or willows (Paradzick and Woodward, 2003; McLeod and others, 2007). In a unique situation in San Diego County, Calif., the flycatcher nests in coast live oak (*Quercus agrifolia*) along the San Luis Rey River (Haas, 2003), where oak became the dominant plant species adjacent to the river following willow removal in the 1950s. In another unusual situation, flycatchers in the Cliff-Gila Valley in New Mex. nest in tall boxelder (Stoleson and Finch, 2003). Southwestern Willow Flycatcher nests also have been found in buttonbush, black twinberry (*Lonicera involucrata*), Fremont cottonwood (*Populus fremontii*), alder (*Alnus* spp.), blackberry (*Rubus ursinus*), baccharis (*Baccharis* spp.), and stinging nettle (*Urtica* spp.). Overall, flycatcher nest site selection appears to be driven more by plant structure than by species composition.

Southwestern Willow Flycatchers build open cup nests approximately 8 cm high and 8 cm wide (outside dimensions), exclusive of any dangling material at the bottom. Females build the nest with little or no assistance from the males. Nests typically are placed in the fork of a branch with the nest cup supported by several small-diameter vertical stems. Nest height is highly variable and depends on the available plant structure within the territory; nests have been found from 0.6 m to approximately 20 m above ground. In any given habitat type or nest substrate, nests can be placed wherever suitable twig structure and vegetative cover are present.

Egg laying generally begins from mid-May through mid-June, depending on the geographic area and elevation. Willow Flycatcher eggs are buffy or light tan, approximately 18 mm long and 14 mm wide, with brown markings in a wreath at the blunt end. Clutch size is usually three or four eggs for first nests. Only the female develops a brood patch and incubates the eggs. Incubation lasts 12–13 days from the date the last egg is laid, and all eggs typically hatch within 24–48 hours of each other.

Flycatcher chicks are altricial and weigh only about 1–2 g at hatching, but grow rapidly and are ready to leave the nest at 12–15 days of age (Sedgwick, 2000; Paxton and Owen, 2002). The female provides most or all initial care of the young, although the role of the male increases with the age and size of nestlings. After Willow Flycatchers fledge at 12–15 days of age, they stay close to the nest and each other for 3–5 days, and adults continue feeding the fledged young for approximately 2 weeks. Recently fledged birds may repeatedly return to and leave the nest during this period (Spencer and others, 1996). Both male and female adults feed the fledged young, which give frequent, loud "*peep*" calls.

Southwestern Willow Flycatchers readily re-nest following an unsuccessful nesting attempt, although rarely more than once (Ellis and others, 2008). They also will sometimes nest again (double brood) following a successful nesting attempt, although this is more uncommon than re-nesting and varies between sites and years. From 2002 to 2008 at Elephant Butte Reservoir, approximately 13 percent of the pairs produced two successful nests per year (Ahlers and Moore, 2009). The productivity gains from pairs having successful second nests are important drivers of positive population growth (Paxton and others, 2007; Moore and Ahlers, 2009).

Replacement nests are built in the same territory, either in the same plant or at a distance of as much as 20 m from the previous nest. Reuse of old nests is uncommon, but does occur (Yard and Brown, 1999; Darrell Ahlers, Bureau of Reclamation, unpub. data, 2009). Replacement nest building and egg laying can occur (uncommonly) as late as the end of July or early August. Pairs may attempt a third nest if the second fails. However, clutch size, and therefore potential productivity, decreases with each nest attempt (Whitfield and Strong, 1995; Ellis and others, 2008).

Food and Foraging

The breeding season diet of Southwestern Willow Flycatchers is relatively well documented (DeLay and others, 2002; Drost and others, 2003; Durst, 2004; Wiesenborn and Heydon, 2007; Durst and others, 2008b). Breeding flycatchers are exclusively insectivorous, and consume a wide range of prey taxa ranging in size from small leafhoppers (Homoptera) to large dragonflies (Odonata). Major prey taxa include bugs (Hemiptera), bees and wasps (Hymenoptera), flies (Diptera), and leafhoppers; however, diet can vary widely between years and among different habitat types. There is no known differences in diet by sex, but there are differences between adult and nestling diet in the proportions of some arthropod groups. Differences in the composition of arthropods in flycatcher diet have been documented between native and exotic habitats, and between years within particular breeding sites; however, flycatchers appear able to tolerate substantial variation in relative prey abundance, except in extreme situations such as severe droughts (Durst and others, 2008b).

Willow Flycatchers of all subspecies forage primarily by sallying from a perch to perform aerial hawking and gleaning (Sedgwick, 2000; Durst, 2004). Males and females forage with similar maneuvers, although males may forage higher in the tree canopy than females. Foraging frequently takes place at external edges or internal openings within a habitat patch, or at the top of the upper canopy.

Site Fidelity and Survivorship

Based on studies of banded birds, most adult Southwestern Willow Flycatchers that survive from one year to the next will return to the same river drainage, often in proximity to the same breeding site (U.S. Fish and Wildlife Service, 2002; McLeod and others, 2007; Paxton and others, 2007). However, it is common for individual flycatchers to return to different sites within a breeding area, and even to move between breeding areas, from one year to the next. Some of this movement may be related to breeding success and habitat quality. At Roosevelt Lake, those birds that moved to different sites within a breeding area had on average higher productivity in the year following the move than in the year before the move (Paxton and others, 2007). At Roosevelt Lake and on the San Pedro and Gila Rivers, movement out of breeding patches also increased with the relative age of a patch, which may indicate a preference for younger riparian vegetation structure.

In addition to movements within a breeding site, long-distance movements within and between drainages have been observed (Paxton and others, 2007), at distances up to approximately 450 km. Dispersal of first-year flycatchers is more extensive than adult birds, as typical for most bird species.

Survivorship within the breeding season can be very high, averaging 97 percent at Roosevelt Lake (Paxton and others, 2007). Between-year survivorship of adults can be highly variable, but appears to be similar to that of most small passerine birds studied, with estimates generally ranging from approximately 55 to 65 percent (Stoleson and others, 2000; McLeod and others, 2007; Paxton and others, 2007; Schuetz and Whitfield, 2007). Males and females have similar survivorship rates.

Estimated survivorship of young birds (from hatching to the next breeding season) is highly variable, depending in part on how the estimates are generated (Stoleson and others, 2000). Generally reported as between 15 and 40 percent, juvenile survivorship typically is lower than adult survivorship (Whitfield and Strong, 1995; Stoleson and others, 2000; McLeod and others, 2007). Early fledging young have higher survivorship than those that leave the nest later in the season (Whitfield and Strong, 1995; Paxton and others, 2007). Most flycatchers survive for only 1–2 adult years, and mean life expectancy in Arizona was estimated to be 1.9 years following fledging. However, some individuals live much longer. The maximum reported ages of banded Southwestern Willow Flycatchers are 9–11 years (Sedgwick, 2000; Paxton and others, 2007).

Overall, the Southwestern Willow Flycatcher population appears to persist as one or more widely dispersed metapopulations (Busch and others, 2000; U.S. Fish and Wildlife Service, 2002), with movement of individuals, and thus genetic exchange, occurring across the landscape. However, the amount of movement and interchange is lower among sites that are farther apart or more isolated. Some sites serve as population sources while others may be sinks; some sites will be ephemeral over periods of years or decades. Flycatcher movement and dispersal among sites is important for initial site colonization and subsequent recolonization.

There are few general predictors for the persistence of breeding sites. Relatively large populations, such as the Kern River Preserve, San Pedro River, Elephant Butte Reservoir, and the Gila River have persisted for 10 or more years. However, such large sites can be subject to major changes in population numbers, and even potential extirpation, due to changes in local hydrology, site inundation, drought, etc. (Moore, 2005; Paxton and others, 2007). Although some small populations may be ephemeral and last only a few years (Durst and others, 2008a), others have remained occupied for much longer periods (Kus and others, 2003). Breeding populations also may reappear at unoccupied sites following 1–5 year absences. Suitable flycatcher habitat also can develop—and poor quality habitat can improve—relatively quickly in some sites, under favorable hydrological conditions. For example, at Roosevelt Lake and the San Pedro River (AZ), the age of riparian vegetation when first colonized was as young as 3 years (Paxton and others, 2007). In the same study, flycatchers moved back into older habitat patches when nearby younger, occupied habitat was inundated or scoured away.

Overall, the vegetation and flycatcher occupancy of a habitat patch or river drainage are often dynamic; few if any sites remain static over time. The amount of suitable flycatcher habitat can substantially increase or decrease in just a few years, at local and regional scales. Flycatchers can respond quickly to habitat changes, colonizing new sites if available and abandoning others. Therefore, one cannot assume that local, regional, or rangewide flycatcher population numbers will remain stable over time.

Threats to the Flycatcher and Habitat

The greatest historical factor in the decline of the Southwestern Willow Flycatcher is the extensive loss, fragmentation, and modification of riparian breeding habitat (U.S. Fish and Wildlife Service, 2002). Large-scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats historically used by the Southwestern Willow Flycatcher (Unitt, 1987; General Accounting Office, 1988; Dahl, 1990; State of Arizona, 1990). Changes in the riparian plant community have frequently reduced, degraded, and eliminated nesting habitat for the flycatcher, curtailing its distribution and abundance.

Habitat losses and changes have occurred and continue to occur because of urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, and replacement of native habitats by introduced plant species (Marshall and Stoleson, 2000; U.S. Fish and Wildlife Service, 2002). Hydrological changes, natural or man-made, can greatly reduce the quality and extent of flycatcher habitat. Although riparian areas are often not considered as fire-prone, several Southwestern Willow Flycatcher breeding sites were destroyed by fire over the past decade (U.S. Fish and Wildlife Service, 2002), and others are at risk to similar catastrophic loss. Fire danger in these riparian systems may be exacerbated by increases in exotic vegetation, such as saltcedar, diversions or reductions of surface water, increased recreational activity, and drawdown of local water tables.

Although the degradation of many river systems and associated riparian habitat is a key cause of their absence, Southwestern Willow Flycatchers do not require free-running rivers or “pristine” riparian habitats. Most of the largest

Southwestern Willow Flycatcher populations in the last decade were found in reservoir drawdown zones, such as at Roosevelt Lake and Elephant Butte Reservoir. Many breeding populations are found on regulated rivers (Graf and others, 2002). In addition, the vegetation at many smaller flycatcher breeding sites is supported by artificial water sources such as irrigation canals, sewage outflow, or agricultural drainages (U.S. Fish and Wildlife Service, 2002). Although rising water levels could be detrimental to breeding flycatchers within a reservoir drawdown zone, reservoir fluctuations can simulate river dynamics with cycles of destruction and establishment of riparian vegetation, depositing rich sediments and flushing salt accumulations in the soil (Paxton and others, 2007). Therefore, managed and manipulated rivers and reservoirs have the potential to play a positive role by providing flycatcher breeding habitat. However, because rivers and reservoirs are not managed solely to create and maintain flycatcher habitat, the persistence of riparian vegetation in these systems—and any flycatchers breeding therein—is not assured.

Although the historic degradation and loss of native riparian negatively affected the Southwestern Willow Flycatcher, this species does not show an inherent preference for native vegetation. Instead, breeding habitat selection is based primarily on vegetation structure, density, size, and other stand characteristics, and presence of water or saturated soils (U.S. Fish and Wildlife Service, 2002). In fact, approximately 25 percent of known territories are found in habitat composed of 50 percent or greater exotic vegetative component—primarily saltcedar (Durst and others, 2008a). Saltcedar also can be an important habitat component in sites dominated by native vegetation (U.S. Fish and Wildlife Service, 2002, 2005). Despite suggestions that flycatchers breeding in saltcedar are suffering negative consequences and that removal of saltcedar is therefore a benefit (DeLoach and others, 2000; Dudley and DeLoach, 2004), there is increasing and substantial evidence that this is not the case. For example, Paxton and others (2007) found that flycatchers did not suffer any detectable negative consequences from breeding in saltcedar. This is consistent with the findings of Owen and others (2005) and Sogge and others (2006). Therefore, the rapid or large-scale loss of saltcedar in occupied flycatcher habitats, without rapid replacement of suitable native vegetation, could result in reduction or degradation of flycatcher habitat (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2008).

In evaluating Southwestern Willow Flycatcher use of either native or exotic habitat, it is important to recognize that throughout the Southwest, there are many saltcedar-dominated and native-dominated habitats in which flycatchers do not breed (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2006). Therefore, the use of any riparian patch—native or exotic—as breeding habitat will be site specific and will depend on the spatial, structural, and ecological characteristics of that particular patch and the potential for flycatchers to colonize and maintain populations within it.

Drought can have substantial negative effects on breeding flycatchers and their breeding habitat by reducing riparian vegetation vigor and density, and reducing prey availability (Durst, 2004; Paxton and others, 2007; Bureau of Reclamation, 2009). For example, the extreme drought of 2002 caused near complete reproductive failure of the large flycatcher population at Roosevelt Lake; among approximately 150 breeding territories, only two nests successfully fledged young in that year (Ellis and others, 2008). If future climate change produces more frequent or more sustained droughts, as predicted by many climate change models (for example, Seager and others, 2007), southwestern riparian habitats could be reduced in extent or quality. This scenario would present a challenge to the long-term sustainability of Southwestern Willow Flycatcher populations.

Brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) was initially considered another significant threat to the Southwestern Willow Flycatcher (Whitfield, 1990; Harris, 1991; U.S. Fish and Wildlife Service, 1993, 1995; Whitfield and Strong, 1995; Sferra and others, 1997). Cowbirds lay their eggs in the nest of other species (the "hosts"), which raise the young cowbirds—often at the expense of reduced survivorship of their own young. Southwestern Willow Flycatchers seldom fledge any flycatcher young from nests that are parasitized by cowbirds (Whitfield and Sogge, 1999). Although parasitism negatively impacts some Southwestern Willow Flycatcher populations, especially at small and isolated breeding sites, it is highly variable and no longer considered among the primary rangewide threats to flycatcher conservation (U.S. Fish and Wildlife Service, 2002). Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, not specific to the flycatcher. Therefore, large-scale cowbirds control may not always be warranted unless certain impact thresholds are met (U.S. Fish and Wildlife Service, 2002; Rothstein and others, 2003; Siegle and Ahlers, 2004).

Section 2. Survey Protocol

The fundamental principles of the methodology described in this version have remained the same since the original Tibbitts and others (1994) and subsequent Sogge and others (1997a) protocols: the use of vocalization play-back, repeated site visits, and confirmation of flycatcher identity via the species-characteristic song. This newest protocol incorporates guidelines of the 2000 USFWS addendum, and includes changes based on our improved understanding of Willow Flycatcher biology and the significance of potential threats, and the availability of new survey technologies.

Several factors work together to make Southwestern Willow Flycatcher surveys challenging. Difficulties include the flycatcher's physical similarities with other species and subspecies; accessing the dense habitat they occupy; time constraints based on their breeding period; and vocalization patterns. Given these challenges, no methodology can assure 100-percent detection rates. However, the survey protocol described herein has proven to be an effective tool for locating flycatchers, and flycatchers generally are detectable when the protocol is carefully followed. Since 1995, hundreds of sites have been surveyed and thousands of flycatchers detected using the two previous versions of the survey protocol.

The Willow Flycatcher is 1 of 10 regularly occurring *Empidonax* flycatchers found in North America, all of which look very much alike. Like all *Empidonax*, Willow Flycatchers are nondescript in appearance, making them difficult to see in dense breeding habitat. Although the Willow Flycatcher has a characteristic *fitz-bew* song that distinguishes it from other birds (including other *Empidonax*), Willow Flycatchers are not equally vocal at all times of the day or during all parts of the breeding season. Because Southwestern Willow Flycatchers are rare and require relatively dense riparian habitat, they may occur only in a small area within a larger riparian system, thus decreasing detectability during general bird surveys. Migrating Willow Flycatchers (of all subspecies) often sing during their migration through the Southwest, and could therefore be confused with local breeders. In addition, Southwestern Willow Flycatchers are in breeding areas for only 3–4 months of the year. Surveys conducted too early or late in the year would fail to find flycatchers even at sites where they breed.

These life history characteristics and demographic factors influence how Southwestern Willow Flycatcher surveys should be conducted and form the basis upon which this protocol was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding their absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for rare species (Bibby and others, 1992).

The primary objective of this protocol is to provide a standardized survey technique to detect Southwestern Willow Flycatchers, determine breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence or absence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with *Empidonax* flycatchers or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to distinguish the Willow Flycatcher from other non-*Empidonax* species, and be able to recognize the Willow Flycatcher's primary song. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and their ability to remain alert and aware of important cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and between sites, and between years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on flycatcher status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

The earlier versions of this protocol (Tibbitts and others, 1994; Sogge and others, 1997a) were used extensively and successfully for many years. Hundreds of flycatcher surveys conducted throughout the Southwest since 1994 revealed much about the usefulness and application of this survey technique. Three important lessons were: (1) the call-playback technique works and detects flycatchers that would have otherwise been overlooked; (2) multiple surveys at each site are important; and (3) with appropriate effort, general biologists without extensive experience with *Empidonax* can find and verify Willow Flycatcher breeding sites.

This revised protocol is still based on call-playback techniques and detection of singing individuals. However, it includes changes in the timing and number of surveys to increase the probability of detecting flycatchers and to help determine if they are breeders or migrants. It also incorporates the basic premise of the USFWS 2000 addendum to the 1997 protocol by requiring a minimum of five surveys in all "project-related" sites. A detailed description of surveys and

timing is discussed in section, "Timing and Number of Visits." Changes in the survey data sheets make them easier to use and submit, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that the data on the respective forms can be easily incorporated into the flycatcher range-wide database.

This protocol is intended to determine if a habitat patch contains territorial Southwestern Willow Flycatchers, and is not designed establish the exact distribution and abundance of flycatchers at a site. Determining precise flycatcher numbers and locations requires many more visits and additional time observing the behavior of individual birds. This survey protocol also does not address issues and techniques associated with nest monitoring or other flycatcher research activities. Those efforts are beyond the scope usually needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to the flycatcher. If nest monitoring is a required component of your study, refer to Rourke and others (1999) for appropriate nest monitoring techniques (available for download at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/reports.asp).

Biologists who are not expert birders or specialists with regard to *Empidonax* flycatchers can effectively use this protocol. However, users should attend a U.S. Fish and Wildlife Service-approved Southwestern Willow Flycatcher survey training workshop, and have knowledge and experience with bird identification, surveys, and ecology sufficient to effectively apply this protocol.

Permits

Federal endangered species recovery permits are required for surveys in all USFWS regions where the Southwestern Willow Flycatcher breeds (application forms can be downloaded at http://www.fws.gov/forms/3-200-55.pdf). State permits also may be required before you can survey within any of the States throughout the Southwestern Willow Flycatcher's range: be certain to check with the appropriate State wildlife agency in your area. It usually takes several months to receive permits, so apply early to avoid delays in starting your surveys. You also must obtain permission from government agencies and private landowners prior to conducting any surveys on their lands.

Pre-Survey Preparation

The degree of effort invested in pre-survey preparation will have a direct effect on the quality and efficiency of the surveys conducted. Pre-survey preparation is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results.

Surveyors should study calls, songs, drawings, photographs, and videos of Willow Flycatchers. Several web sites describe life history requirements, and provide photographs and vocalizations. It is especially critical for surveyors to be familiar with Willow Flycatcher vocalizations before going in the field. Although the *fitz-bew* song is the basis of verifying detections using this protocol, Willow Flycatchers use many other vocalizations that are valuable in locating birds and breeding sites. We strongly encourage that all surveyors learn as many vocalizations as possible and refer to the on-line "Willow Flycatcher Vocalizations; a Guide for Surveyors" (available at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/wiflvocl.asp). Several commercial bird song recordings include Willow Flycatcher vocalizations, but these recordings typically have only a few vocalizations and the dialects may differ from those heard in the Southwest.

If possible, visit known Willow Flycatcher breeding sites to become familiar with flycatcher appearance, behavior, vocalizations, and habitat. Such visits are usually part of the standardized flycatcher survey workshops. All visits should be coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to territorial flycatchers. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Surveyors must be able to identify, by sight and vocalizations, other species likely to be found in survey areas that may be confused with Southwestern Willow Flycatchers. These include Bell's Vireo (*Vireo bellii*), Western Wood-pewee (*Contopus sordidulus*), young or female Vermillion Flycatchers (*Pyrocephalus rubinus*), and other *Empidonax* flycatchers. At a distance, partial song or call notes of Bell's Vireo, Ash-throated Flycatchers (*Myiarchus cinerascens*) and some swallows can sound considerably like a *fitz-bew*. Surveyors also should be able to identify Brown-headed Cowbirds by sight and vocalizations. It is worthwhile to make one or more pre-survey trips to the survey sites or other similar areas to become familiar with the local bird fauna. You might consider obtaining a species list relative to your area and become familiar with those species by site and sound.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective flycatcher coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if flycatchers have been previously detected in the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where flycatchers have previously been detected.

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant water, muddy or swampy conditions, crawling through dense thickets (often on hands and knees), and exposure to snakes, skunks, and biting insects.

It is imperative that all surveyors exercise the adage "safety first." Be aware of safety hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

The following equipment is necessary to conduct the surveys:

1. **USGS topographic maps of the area**: A marked copy is required to be attached to survey data sheets submitted at the end of the season. Be sure to always delineate the survey area and clearly mark any flycatcher detections. If the survey area differed between visits; delineate each survey individually.
2. **Standardized survey form**: Always bring more copies than you think you need.
3. **Lightweight audio player**: Be sure the player has adequate volume to carry well; use portable speakers if necessary. Several digital devices, such as CD players and MP3 players, are currently available and can be connected to external amplified speakers for broadcasting the flycatcher vocalizations. However, not all are equally functional or effective in field conditions; durability, reliability, and ease of use are particularly important. Talk to experienced surveyors for recommendations on particular models and useful features.
4. **Extra player and batteries**: In the field, dirt, water, dust, and heat often cause equipment failure, and having backup equipment helps avoid aborting a survey due to equipment loss or failure.
5. **Clipboard and permanent (waterproof) ink pen**: We recommend recording survey results directly on the survey data form, to assure that you collect and record all required data and any field notes of interest.
6. **Aerial photographs**: Aerial photographs can significantly improve your surveys by allowing you to accurately target your efforts, thus saving time and energy in the field. Previously, aerial images were often expensive and difficult to obtain. However, it is now easy to get free or low-cost images from sources, such as Google© Earth. Even moderate resolution images generally are better than none. For higher resolution aerial photographs, check with local planning offices and/or State/Federal land-management agencies for availability. Take color photocopies, not the original aerial photographs, with you in the field. Aerial photographs also are very useful when submitting your survey results but cannot be substituted in lieu of the required topographic map.
7. **Binoculars and bird field guide**: Although this protocol relies primarily on song detections to verify flycatcher presence, good quality binoculars are still a crucial field tool to help distinguish between possible Southwestern Willow Flycatchers and other species. Use a pair with 7–10 power magnification that can provide crisp images in poor lighting conditions. A good field guide also is essential for the same reason.
8. **GPS unit**: A GPS unit is needed for determining survey coordinates and verifying the location of survey plots on topographic maps. All flycatcher detections should be stored as waypoints and coordinates recorded on the survey form. A wide variety of fairly inexpensive GPS units are currently available. Most commercially available units will provide accuracy within 10 m, which is sufficient for navigating and marking locations.
9. **Compass**: Surveyors should carry a compass to help them while navigating larger habitat patches. This is an important safety back-up device, because GPS units can fail or lose power. Most GPS units have a feature to provide an accurate bearing to stored waypoints (for example, previous flycatcher detections, your parked vehicle, etc.); however, many units do not accurately display the direction in which the surveyor is traveling slowly through dense vegetation. A compass set to the proper bearing provides a more reliable method to navigate the survey site and relocate previously marked locations.

The following equipment also is recommended:

10. **Camera:** These are very helpful for habitat photographs, especially at sites where flycatchers are found. Small digital cameras are easily portable and relatively inexpensive.
11. **Survey flagging:** Used for marking survey sites or areas where flycatcher are detected. Check with the local land owner or management agency before flagging sites. Use flagging conservatively so as to not attract people or predators.
12. **Field vest:** A multi-pocket field vest can be very useful for carrying field equipment and personal items. We recommend muted earth-tone colors.

13. **Cell phone and/or portable radio**: In addition to providing an increased level of safety, cell phones or portable radios may be used by surveyors to assist each other in identifying territories and pairs in dense habitats, or where birds are difficult to hear.

In addition to the necessary equipment mentioned above, personal items, such as food, extra water or electrolyte drink, sunscreen, insect repellent, mosquito net, first-aid kit, whistle, and a light jacket, also should be considered. Being prepared for unforeseen difficulties, and remaining as comfortable as conditions allow while surveying are important factors to conducting thorough and effective surveys.

All survey results (both negative and positive) should be recorded directly on data forms when possible. These data forms have been designed to prompt surveyors to record key information that is crucial to interpretation of survey results and characterization of study sites. Even if no flycatchers are detected or habitat appears unsuitable, this is valuable information and should be recorded. Knowing where flycatchers are not breeding can be as important as knowing where they are; therefore, negative data are important. Standardized data forms are provided in appendix 1, or can be downloaded online. Always check for updated forms prior to each year's surveys.

Willow Flycatcher surveys are targeted at this species and require a great deal of focused effort. Surveyors must be constantly alert and concentrate on detecting a variety of flycatcher cues and responses. Therefore, field work, such as generalized bird surveys (for example, point counts or walking transects) or other distracting tasks, should not be conducted in conjunction with Willow Flycatcher surveys. Avoid bringing pets or additional people who are not needed for the survey. Dress in muted earth-tone colors, and avoid wearing bright clothing.

Willow Flycatcher Identification

The Southwestern Willow Flycatcher is a small bird, approximately 15 cm long and weighing about 11–12 g. Sexes look alike and cannot be distinguished by plumage. 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 (juveniles have buffy wing bars) and the eye ring is faint or absent. The upper mandible is dark and the lower mandible light. The tail is not strongly forked. When perched, the Willow Flycatcher often flicks its tail upward. As a group, the *Empidonax* flycatchers are very difficult to distinguish from one another by appearance. The Willow Flycatcher also looks very similar to several other passerine species you may encounter in the field.

Given that Willow Flycatchers look similar to other *Empidonax* flycatchers that may be present at survey sites, the most certain way to verify Willow Flycatchers in the field is by their vocalization. For the purpose of this protocol, identification of Willow Flycatchers cannot be made by sight alone; vocalizations are a critical identification criterion, and specifically the primary song *fitz-bew*. Willow Flycatchers have a variety of vocalizations (see Stein, 1963; Sedgwick, 2000), but two are most commonly heard during surveys or in response to call-playback:

1. ***Fitz-bew***. This is the Willow Flycatcher's characteristic primary song. Note that *fitz-bews* are not unique to the southwestern subspecies; all Willow Flycatchers sing this characteristics song. Male Willow Flycatchers may sing almost continuously for hours, with song rates as high as one song every few seconds. Song volume, pitch, and frequency may change as the season progresses. During prolonged singing bouts, *fitz-bews* are often separated by short *britt* notes. *Fitz-bews* are most often given by a male, but studies have shown female Willow Flycatchers also sing, sometimes quite loudly and persistently (although generally less than males). Flycatchers often sing from the top of vegetation, but also will vocalize while perched or moving about in dense vegetation.
2. ***Whitt***. This is a call often used by nesting pairs on their territory, and commonly is heard even during periods when the flycatchers are not singing (*fitz-bewing*). The *whitt* call appears to be a contact call between sexes, as well as an alarm call, particularly when responding to disturbance near the nest. *Whitt* calls can be extremely useful for locating Willow Flycatchers later in the season when *fitz-bewing* may be infrequent, but are easily overlooked by inexperienced surveyors. When flycatcher pairs have active nests and particularly once young have hatched, *whitts* may be the most noticeable vocalization. However, many species of birds *whitt*, and a *whitt* is not a diagnostic characteristic for Willow Flycatchers. For example, the "*whitt*" of the Black-headed Grosbeak (*Pheucticus melanocephalus*) and Yellow-breasted Chat (*Icteria virens*) are often confused with that of the flycatcher.

The *fitz-bew* and *whitt* calls are the primary vocalizations used to locate Willow Flycatchers. However, other less common Willow Flycatcher vocalizations can be very useful in alerting surveyors to the presence of flycatchers. These include twittering vocalizations typically given during interactions between flycatchers and sometimes between flycatchers and other birds, bill snapping, *britt*'s, and *wheeo*'s. Because these sounds can be valuable in locating territories (Shook and others, 2003), they should be studied prior to going in the field. Willow Flycatcher vocalization recordings are available from Federal and State agency contacts and online at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/. Standardized recordings of Southwestern Willow Flycatchers also are available online at http://www.naturesongs.com/tyrrcert.html#tyrr. Specifically, only *fitz-bews* and *britts* should be used for conducting surveys, to provide more robust comparative results among sites and years.

Willow Flycatcher song rates are highest early in the breeding season (late May–early June), and typically decline after eggs hatch. However, in areas with many territorial flycatchers or where an unpaired flycatcher is still trying to attract a mate, or where re-nesting occurs, singing rates may remain high well into July. Isolated pairs can be much quieter and harder to detect than pairs with adjacent territorial flycatchers. At some sites, pre-dawn singing (0330–0500 hours) appears to continue strongly at least through mid-July (Sogge and others, 1995). Singing rates may increase again later in the season, possibly coinciding with re-nesting attempts (Yard and Brown, 2003). The social dynamics of adjacent territories can strongly influence vocalization rates. A single "*fitz-bew*" from one flycatcher may elicit multiple responses from adjacent territories. When these interactions occur, it is a good opportunity to distinguish among territories and provides the surveyor with an estimate of territory numbers in the immediate area.

There are some periods during which Willow Flycatchers do not sing and even the use of call-playback sometimes fails to elicit any response. This can be particularly true late in the breeding season. Early and repeated surveys are the best way to maximize the odds of detecting a singing flycatcher and determining its breeding status.

Timing and Number of Visits

No survey protocol can guarantee that a Southwestern Willow Flycatcher, if present, will be detected on any single visit. However, performing repeated surveys during the early to mid-nesting season increases the likelihood of detecting flycatchers and aids in determining their breeding status. A single survey, or surveys conducted too early or late in the breeding cycle, do not provide definitive data and are of limited value.

For purposes of this survey protocol, we have divided the Southwestern Willow Flycatcher breeding season into three basic survey periods, and specified a minimum number of survey visits for each period (fig. 9). Although the Sogge and others (1997a) protocol recommended a minimum of one survey in each period, we now recommend a differing number of visits for general surveys versus project-related studies.

General surveys are conducted for the sole purpose of determining whether Willow Flycatchers are present or absent from a respective site, when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. In such cases, a minimum of one survey visit is required in each of the three survey periods.

Project-related surveys are conducted to determine the presence or absence of Willow Flycatchers within a site when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management. Additional surveys are required for project-related studies in order to derive a greater degree of confidence regarding the presence or absence of Willow Flycatchers.

All successive surveys must be at least 5 days apart; surveys conducted more closely are not considered to be separate surveys. Although a minimum of three or five surveys are required for general and project-related purposes, respectively, if the habitat patches are large, contiguous and extremely dense, additional surveys are strongly encouraged to ensure full coverage of the site.

If you are uncertain whether three general surveys or five project-related surveys are required for your respective study, contact your USFWS flycatcher coordinator. As noted earlier, this survey protocol will help determine if territorial flycatchers are present and their approximate locations; if your project requires fine-scale estimates of flycatcher numbers or distribution at a site, you may need to conduct more intensive efforts that include additional surveys, nest searches, and nest monitoring.

Survey Period 1: May 15–31.—For both general and project-related surveys: a minimum of one survey is required. The timing of this survey is intended to coincide with the period of high singing rates in newly arrived males, which tends to begin in early to mid-May. This is one of the most reliable times to detect flycatchers that have established their territories, so there is substantial value to conducting period 1 surveys even though not all territorial males may yet have arrived. Migrant Willow Flycatchers of multiple subspecies will likely be present and singing during this period. Because both migrant and resident Willow Flycatchers are present during this period, and relatively more abundant then in subsequent surveys, it is an excellent opportunity to hone your survey and detection skills and gain confidence in your abilities. Detections of flycatchers during period 1 also provide insight on areas to pay particular attention to during the next survey period.

Survey Period 2: June 1–24.—For general surveys: a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Note that this differs from the minimum of one survey that was recommended in this period under the previous protocol (Sogge and others, 1997a). During this period, the earliest arriving males may already be paired and singing less, but later arriving males should still be singing strongly. Period 2 surveys can provide insight about the status of any flycatchers detected during survey period 1. For example, if a flycatcher is detected during survey period 1 but not survey period 2, the first detection may have been a migrant. Conversely, detecting a flycatcher at the same site during periods 1 and 2 increases the likelihood that the bird is not a migrant, although it does not necessarily confirm it. Survey period 2 also is the earliest time during which you are likely to find nesting activity by resident birds at most sites. Special care should be taken during this period to watch for activity that will verify whether the flycatchers that are present are attempting to breed. A little extra time and diligence should be spent at all locations where flycatchers were detected during survey period 1.

Survey Visit Timing, Numbers, and Detection Interpretation

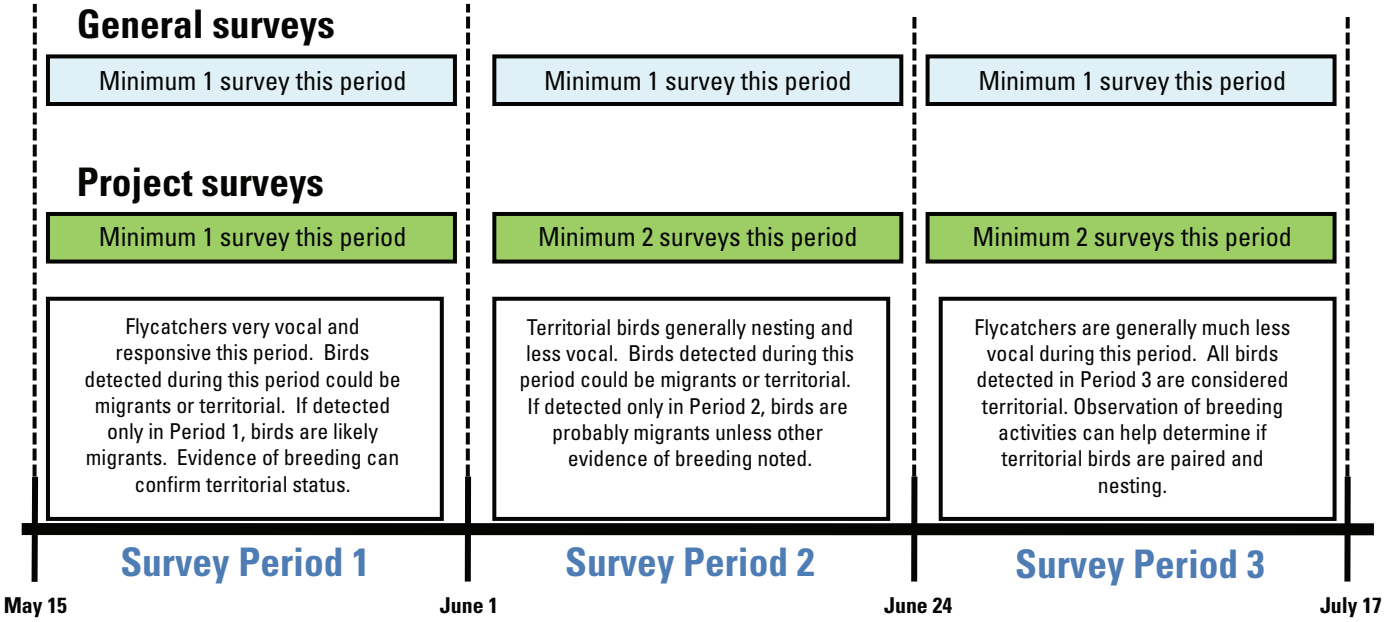


Figure 9. Recommended numbers and timing of visits during each survey period for general surveys and project surveys. General surveys are those conducted when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. Project-related surveys are conducted when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management.

Survey Period 3: June 25–July 17.—For general surveys, a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Virtually all Southwestern Willow Flycatchers should have arrived on their territories by this time. Flycatcher singing rates probably have lessened, and most paired flycatchers will have initiated or even completed their first round of nesting activity. Migrant Willow Flycatchers should no longer be passing through the Southwest; therefore, any flycatchers that you detect are likely to be either territorial or nonbreeding floaters. Surveyors should determine if flycatchers detected during surveys in periods 1 or 2 are still present, and watch closely for nesting activity. Flycatchers that have completed a first nesting attempt may resume vigorous singing during this period. Extra time and diligence should be spent at all locations where flycatchers were detected during survey periods 1 or 2.

At high elevation sites (above 2,000 m), Southwestern Willow Flycatcher arrival and initiation of breeding activities may occur in early June, and possibly later in some years due to weather or migration patterns. Therefore, flycatcher breeding chronology may be delayed by 1 or 2 weeks at such sites, and surveys should be conducted in the latter part of each period.

It may not require multiple surveys to verify Southwestern Willow Flycatcher presence or breeding status. If, for example, Willow Flycatchers are observed carrying nest material during survey periods 1 or 2, this is conclusive verification they are breeders as opposed to migrants, regardless of what is found during period 3. However, it requires a minimum of three surveys for general studies and five surveys for project-related studies to determine with relative confidence that Southwestern Willow Flycatchers probably are not breeding at a site in that year, based on lack of detections.

We strongly encourage additional follow-up surveys to sites where territorial Southwestern Willow Flycatchers are verified or suspected. Extra surveys provide greater confidence about presence or absence of flycatchers at a site, as well as help in estimating the number of breeding territories or pairs, and determining breeding status and the outcome of breeding efforts. Pre-survey visits the evening before the survey or post-survey follow-up later in the morning can help confirm breeding status when surveyors are not under time constraints. However, avoid returning to a site so often as to damage the habitat, establish or enlarge trails, or cause undue disturbance to the flycatchers.

Survey Methods

The survey methods described below fulfill the primary objectives of documenting the presence or absence of Willow Flycatchers, and determining their status as territorial versus migrant. This protocol primarily is a call-playback technique, a proven method for eliciting response from nearby Willow Flycatchers (Seutin, 1987; Craig and others, 1992), both territorial and migrants. The premise of the call-playback technique is to simulate a territorial intrusion by another Willow Flycatcher, which generally will elicit a defensive response by the territorial bird, increasing its detectability. At each site, surveyors should broadcast a series of recorded Willow Flycatcher *fitz-bews* and *britts*, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby flycatchers, this method also allows for positive identification by comparing the responding bird's vocalizations to the known Willow Flycatcher recording.

Documenting Presence/Absence—Begin surveys as soon as there is enough light to safely walk (about 1 hour before sunrise) and end by about 0900–1030 hours, depending on the temperature, wind, rain, background noise, and other environmental factors. Use your best professional judgment whether to conduct surveys that day based on local field conditions. If the detectability of flycatchers is being reduced by environmental factors, surveys planned for that day should be postponed until conditions improve. If observers are camped in or near potential Willow Flycatcher habitat, afternoons and evenings can be spent doing site reconnaissance and planning a survey strategy for the following morning. If camped immediately adjacent to survey sites, surveyors can awaken early and listen for flycatchers singing during the predawn period (0330–0500 hours), when territorial males often sing loudly.

Conduct surveys from within rather than from the perimeter of the sites, while limiting the breaking of vegetation or damaging the habitat. If surveys cannot be conducted from within the habitat, walk along the perimeter and enter the patch at intervals to broadcast the vocalizations and listen for responses. Flycatchers often respond most strongly if the recording is played from within the habitat and territory, rather than from the periphery. In addition, it can be surprisingly difficult to hear singing Willow Flycatchers that are even a short distance away amidst the noise generated by other singing and calling birds, roads, noisy streams, and other extraneous sounds. Therefore, it is preferable to survey from within the habitat, but always move carefully to avoid disturbing habitat or nests. Surveying from the periphery should not be conducted only for the sake of convenience, but is allowable for narrow linear reaches or when absolutely necessary due to safety considerations.

Because flycatchers may be clustered within only a portion of a habitat patch, it is critical to survey all suitable habitat within the patch. Small linear sites may be thoroughly covered by a single transect through the patch. For larger sites, choose a systematic survey path that assures complete patch coverage throughout the length and breadth of the site. This may require multiple straight transects, serpentine, zig-zag, or criss-cross routes. Aerial photographs and previous survey forms are valuable tools to help plan and conduct surveys, and to assure complete coverage. Always move carefully through the habitat to avoid disturbing vegetation or nests.

Initially approach each site and stand quietly for 1–2 minutes or longer, listening for spontaneously singing flycatchers. A period of quiet listening is important because it helps acclimate surveyors to background noises that can be quite loud due to roads, aircraft, machinery, waterways, and other sounds. It also allows surveyors to recognize and shift attention away from the songs and calls of other bird species, letting them focus on listening for flycatchers. Although it happens rarely, some singing Willow Flycatchers will actually stop vocalizing and approach quietly in response to a broadcast song, perhaps in an effort to locate what they perceive as an intruding male. Therefore, playing a recording before listening for singing individuals has at least some potential of reducing detectability.

If you do not hear singing flycatchers during the initial listening period, broadcast the Willow Flycatcher song recording for 10–15 seconds; then listen for approximately 1 minute for a response. Repeat this procedure (including a 10-second quiet pre-broadcast listening period) every 20–30 m throughout each survey site, more often if background noise is loud. The recording should be played at about the volume of natural bird calls, and not so loud as to cause distortion of the broadcast. We recommend that the playback recording include a series of *fitz-bews* interspersed with several *britts*.

Response to the broadcast call could take several forms. Early in the breeding season (approximately May–mid-June), a responding Willow Flycatcher will usually move toward the observer and *fitz-bew* or *whitt* from within or at the top of vegetation. Territorial Willow Flycatchers almost always vocalize strongly when a recording is played in their territory early in the season. If there are several flycatchers present in an area, some or all may start singing after hearing the recording or the first responding individual. Flycatchers can often hear the recording from far away but will not usually move outside of their territory, so listen for distant responses. Also, stay alert and listen for flycatchers vocalizing behind you that may not have responded when you were first in their territory. Another common flycatcher response is alarm calls (*whitts*) or interaction twitters from within nearby vegetation, particularly once nesting has begun. Willow Flycatchers will often sing after a period of *whitting* in response to a recording, so surveyors hearing *whitts* should remain in the area and quietly listen for *fitz-bews* for several minutes. Because some flycatchers may initially respond by approaching quietly, particularly during periods 2 and 3, it is critical to watch carefully for responding birds.

If you detect flycatchers that appear particularly agitated, it is possible that you are in close proximity to their nest. Agitated flycatchers may swoop down at the surveyor, snap their beaks, and otherwise appear distressed. Exercise extreme caution so as to not accidently disturb the nest, and move slowly away from the immediate area.

For the purpose of this protocol, detection of a *fitz-bew* song is essential to identify a bird as a Willow Flycatcher. Similar appearing species (including other *Empidonax* flycatchers) occur as migrants, and even breeders, at potential Willow Flycatcher sites. A few of these other species may even approach a broadcast Willow Flycatcher song and respond with vocalizations. In order to standardize interpretation of survey results and assure a high degree of confidence in surveys conducted by biologists of varying experience and skill, positive identification must be based on detection of the Willow Flycatcher's most unique characteristic—its song. It is important to remember that the *whitt* call is not unique to Willow Flycatchers, and therefore cannot serve as the basis of a positive identification. However, *whitts* are extremely useful for locating flycatchers and identifying areas needing follow-up visits. Loud, strong *whitting* may indicate a nearby nest, dictating that surveyors exercise extra caution moving through the area.

Whenever a verified or suspected Willow Flycatcher is detected, be careful not to overplay the song recording. Excessive playing could divert the bird from normal breeding activities or attract the attention of predators and brood parasites. Wildlife management agencies may consider overplaying the recording as "harassment" of the flycatcher, and this is not needed to verify species identification. Although flycatchers usually sing repeatedly once prompted, even a single *fitz-bew* is sufficient for verification. If you have played a recording several times and a bird has approached but has not *fitz-bewed*, do not continue playing the recording. If a potential Willow Flycatcher responds, approaches or *whitts* but does not sing, it is best to carefully back away and wait quietly. If it is a Willow Flycatcher, it probably will sing within a short time (5–10 minutes). Another option is to return to the same site early the following morning to listen for or attempt to elicit singing again. If you are still uncertain, record the location with your GPS, record comments on the survey form, and follow-up on the detection during subsequent surveys. If possible, request the assistance of an experienced surveyor to determine positive identification.

If more habitat remains to be surveyed, continue onward once a flycatcher is detected and verified. In doing so, move 30–40 m past the current detection before again playing the recording, and try to avoid double-counting flycatchers that have already responded. Willow Flycatchers, particularly unpaired males, may follow the broadcast song for 50 m or more.

Looking For and Recording Color Bands.—Several research projects have involved the capture and banding of Willow Flycatchers at breeding sites across the Southwest. In such projects, flycatchers are banded with one or more small colored leg bands, including a federal numbered band. As a result, surveyors may find color-banded individuals at their survey sites, and identification and reporting of the band combination can provide important data on flycatcher movements, survivorship, and site fidelity.

To look for bands, move to get a good view of the flycatcher's legs. This may be difficult in dense vegetation, but flycatchers commonly perch on more exposed branches at the edges of their territory or habitat patch. If bands are seen, carefully note the band colors. If there is more than one band on a leg, differentiate the top (farthest up the leg) from the bottom (closest to the foot), and those on the bird's left leg versus the right leg. If you are unsure of the color, do not guess. Instead, record the color as unknown. Incorrect color-band data are worse than incomplete data, so only record colors of which you are certain. The fact that a banded bird was seen, even without being certain of its color combination, is very important information. Record the color-band information on the survey form, and report the sighting to the appropriate State or Federal contact as soon as you return from the survey that day.

Determining the Number of Territories and Pairs.—Accurately determining the number of breeding territories and pairs can be more difficult than determining simple presence or absence. Flycatcher habitat is usually so dense that visual detections are difficult, and seeing more than one bird at a time is often impossible. Flycatchers sing from multiple song perches within their territories, and may be mistaken for more than one flycatcher. A flycatcher responding to or following a surveyor playing a recording may move considerable distances in a patch and thus be counted more than once. Territorial male flycatchers often sing strongly, but so do many migrants and some females, particularly in response to call-playback (Seutin, 1987; Unitt, 1987; Sogge and others, 1997b). Rangewide, many territorial male flycatchers are unmated, particularly those in small breeding groups. For these reasons, each singing flycatcher may not represent a territory or a mated pair. Following the established survey protocol and carefully observing flycatcher behavior can help determine if you have detected migrants, territorial birds, breeders, unmated birds, or pairs.

Given sufficient time, effort and observation, it is usually possible to approximate the number of territories and pairs. First, listen carefully for simultaneously singing flycatchers. Note the general location of each bird—especially concurrently singing individuals—on aerial photographs, map, or a site sketch. Spend some time watching each flycatcher to determine approximate boundaries of its territory, and how it interacts with other flycatchers. If one or more singing

birds stay primarily in mutually exclusive areas, they can be considered as separate territories. To determine if a flycatcher is paired, watch for interactions within a territory. Refer to the section, "Determining Breeding Status" for signs of pairing and breeding activity. Do not report a territorial male as a pair unless you observe one or more of the signs listed below. In some cases, it may be possible only to estimate the number of singing individuals. In other cases, it may take multiple site visits to differentiate territories or pairs.

Determining Breeding Status.—One way to determine if the flycatchers found at a particular site are migrants or territorial is to find out if they are still present during the "non-migrant" period, which generally is from about June 15 to July 20 (Unitt, 1987). A Willow Flycatcher found during this time probably is a territorial bird, although there is a small chance it could be a non-territorial floater (Paxton and others, 2007). If the management question is simply whether the site is a potential breeding area, documenting the presence of a territorial flycatcher during the non-migrant period may meet all survey objectives, and the site may not need to be resurveyed during the remainder of that breeding season.

However, in some cases, surveyors will be interested in knowing not only if territorial Southwestern Willow Flycatchers are present at a site, but also whether breeding or nesting efforts are taking place. Some males maintain territories well into July yet never succeed in attracting a mate, so unpaired males are not uncommon (McLeod and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009). Thus, an assumption that each singing male represents a breeding pair may not be well founded, especially in small populations. If it is important to determine whether a pair is present and breeding in that territory, move a short distance away from where the bird was sighted, find a good vantage point, and sit or lie quietly to watch for evidence of breeding. Signs of breeding activity include:

a. observation of another unchallenged Willow Flycatcher in the immediate vicinity (indicates possible pair);
b. *whitt* calls between nearby flycatchers (indicates possible pair);
c. interaction twitter calls between nearby flycatchers (indicates possible pair);
d. countersinging or physical aggression against another flycatcher or bird species (suggests territorial defense);
e. physical aggression against cowbirds (suggests nest defense);
f. observation of Willow Flycatchers copulating (verifies attempted breeding);
g. flycatcher carrying nest material (verifies nesting attempt, but not nest outcome);
h. flycatcher carrying food or fecal sac (verifies nest with young, but not nest outcome);
i. locating an active nest (verifies nesting). Recall that general survey permits do not authorize nest searching or monitoring, and see section, "Special Considerations";
j. observation of adult flycatchers feeding fledged young (verifies successful nesting).

You may be able to detect flycatcher nesting activity, especially once the chicks are being fed. Adults feed chicks at rates of as many as 30 times per hour, and the repeated trips to the nest tree or bush are often quite evident. Be sure to note on the flycatcher survey form any breeding activity that is observed, including detailed descriptions of the number of birds, and specific activities observed. Also note the location of breeding activities on an aerial photograph, map, or sketch of the area.

The number of flycatchers found at a site also can provide a clue as to whether they are migrants or territorial birds. Early season detections of single, isolated Willow Flycatchers often turn out to be migrants. However, discovery of a number of Willow Flycatchers at one site usually leads to verification that at least some of them remain as local breeders. This underscores the importance of completing a thorough survey of each site to be confident of the approximate number of flycatchers present.

In some cases, regardless of the time and diligence of your efforts, it will be difficult to determine the actual breeding status of a territorial male. In these instances, use your best professional judgment, or request the assistance of an experienced surveyor or an agency flycatcher coordinator to interpret your observations regarding breeding status.

Reporting Results.—There is little value in conducting formal surveys if the data are not recorded and submitted. Fill in all appropriate information on the Willow Flycatcher survey form while still in the field, and mark the location of detections on a copy of the USGS topographic map. Make a habit of reviewing the form before you leave any site—trying to remember specific information and recording it later can lead to missing and inaccurate data. Note the location of the sighting on an aerial photograph or sketch of the site. Attaching photographs of the habitat also is useful. Whenever a Willow Flycatcher territory or nest site is confirmed, notify the USFWS or appropriate State wildlife agency as soon as you return from the field. The immediate reporting of flycatcher detections or nests may differ among USFWS regions and States—discuss these reporting procedures with your respective State and USFWS flycatcher coordinators.

Complete a survey form (appendix 1) for each site surveyed, whether or not flycatchers are detected. "Negative data" (that is, a lack of detections) are important to document the absence of Willow Flycatchers and help determine what areas have already been surveyed. Make and retain a copy of each survey form, and submit the original or a legible copy. Electronic copies of the survey forms also are acceptable and are available online (http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/). All survey forms must be submitted to the USFWS and the appropriate State wildlife agency by the specified deadline identified in your permits. Timely submission of survey data is a permit requirement, and will ensure the information is included in annual statewide and regional reports.

Special Considerations

To avoid adverse impacts to Willow Flycatchers, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.
2. Do not play the recording more than necessary or needlessly elicit vocal responses once Willow Flycatchers have been located and verified. This may distract territorial birds from caring for eggs or young, or defending their territory. If flycatchers are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators or brood parasites. Stop playing the survey recording as soon as you have confirmed the presence of a Willow Flycatcher, and do not play the recording again until you have moved 30–40 m to the next survey location.
3. Proceed cautiously while moving through Willow Flycatcher habitat. Continuously check the area around you to avoid disturbance to nests of Willow Flycatchers and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.
4. Do not approach known or suspected nests. Nest searches and monitoring require specific State and Federal permits, have their own specialized methodologies (Rourke and others, 1999), and are not intended to be a part of this survey protocol.
5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a “dead end” trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix flagging to a nearby tree at least 10 m away, and record the compass bearing to the nest on the flagging. Report your findings to an agency flycatcher coordinator or a biologist who is permitted to monitor nests.
6. If you use flagging to mark an area where flycatchers are found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized/permitted nest monitoring, flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.
7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, and magpies. If such predators are in the immediate vicinity, wait for them to leave before playing the recording.
8. Although cowbird parasitism is no longer considered among the primary threats to flycatcher conservation it remains useful to note high concentrations of cowbirds in the comment section of the survey form. While conducting surveys, avoid broadcasting the flycatcher vocalizations if cowbirds are nearby, especially if you believe you may be close to an active flycatcher territory. The intent of not broadcasting flycatcher vocalizations is to reduce the potential for attracting cowbirds to a flycatcher territory or making flycatcher nests more detectable to cowbirds.
9. Non-indigenous plants and animals can pose a significant threat to flycatcher habitat and may be unintentionally spread by field personnel, including those conducting flycatcher surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). One species of particular interest is the tamarisk leaf-beetle (*Diorhabda* spp.). If you observe defoliation of saltcedar while conducting flycatcher surveys and believe that *Diorhabda* beetles may be responsible, notify your USFWS coordinator immediately. Other non-native species of concern in survey locations are the quagga mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot’s feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

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References Cited

Ahlers, D., and White, L., 2000, 1999 Willow Flycatcher survey results: Fish Creek and Gooseberry Creek drainages, Utah: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Ahlers, D., and Moore, D., 2009, A review of vegetation and hydrologic parameters associated with the Southwestern Willow Flycatcher – 2002-2008, Elephant Butte Reservoir Delta, NM: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Allison, L.J., Paradzick, C.E., Rourke, J.W., and McCarthey, T.C., 2003, A characterization of vegetation in nesting and non-nesting plots for Southwestern Willow Flycatchers in central Arizona: Studies in Avian Biology, v. 26, p. 81–90.

Arizona Game and Fish Department, 2006, DRAFT, Arizona's Comprehensive Wildlife Conservation Strategy–2005-2015: Arizona Game and Fish Department, Phoenix, Arizona. (Also available at http://www.azgfd.gov/pdfs/w_c/cwcs/downloads/CWCS_Final_May2006.pdf.)

Bibby, C.J., Burgess, N.D., and Hill, D.A., 1992, Bird census techniques: Academic Press, London, U.K.

Browning, M.R., 1993, Comments on the taxonomy of *Empidonax traillii* (Willow Flycatcher): Western Birds, v. 24, p. 241–257.

Busch, J.D., Miller, M.P., Paxton, E.H., Sogge, M.K., and Keim, P., 2000, Genetic variation in the endangered Southwestern Willow Flycatcher: Auk, v. 117, p. 586–595.

California Department of Fish and Game, 1991, Endangered and threatened animals of California: State of California, The Resources Agency, Department of Fish and Game, Sacramento, California, 5 p.

Cardinal, S.N., Paxton, E.H., and Durst, S.L., 2006, Home range, movement, and habitat use of the Southwestern Willow Flycatcher, Roosevelt Lake, AZ—2005: U.S. Geological Survey report to the Bureau of Reclamation, Phoenix, AZ, 21 p.

Craig, D., Schlorff, R.W., Valentine, B.E., and Pelles, C., 1992, Survey protocol for Willow Flycatchers (*Empidonax traillii*) on National Forest Service lands in the Pacific Southwest region: U.S. Forest Service Region 5, Vallejo, CA.

Dahl, T.E., 1990, Wetlands losses in the United States, 1780s to 1980s: U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 13 p.

Davidson, R.F., and Allison, L.J., 2003, Effects of monogamy and polygyny on reproductive success in Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in Arizona: Studies in Avian Biology, v. 26, p. 118–124.

DeLay, L.S., Stoleson, S.H., and Farnsworth M., 2002, A quantitative analysis of the diet of Southwestern Willow Flycatchers in the Gila Valley, New Mexico: Final report to T&E Inc., accessed July 28, 2008, at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/Reports/NM_SWWF_Diet_Report_2002.pdf.

DeLoach, C.J., Carruthers, R.I., Lovich, J., Dudley, T.L., and Smith, S.D., 2000, Ecological interactions in the biological control of saltcedar (*Tamarix* spp.) in the U.S.: Toward a new understanding, *in* Spencer, N.R., ed., Proceedings of X International Symposium on Biological Control, July 1999, Montana State University, Bozeman, p. 819–874.

Drost, C.A., Paxton, E.H., Sogge, M.K., and Whitfield, M.J., 2003, Food habits of the Southwestern Willow Flycatcher at the Kern River, California: Studies in Avian Biology, v. 26, p. 96-103.

Dudley, T.L., and DeLoach, C.J., 2004, Saltcedar (*Tamarix* spp.), endangered species, and biological weed control—can they mix?: Weed Technology, v. 18, p. 1542–1551.

Durst, S.L., 2004, Southwestern Willow Flycatcher potential prey base and diet in native and exotic habitats: Flagstaff, Arizona, Northern Arizona University, M.S. Thesis, 86 p.

Durst, S.L., Theimer, T.C., Paxton, E.H., and Sogge, M.K., 2008a, Age, habitat, and yearly variation in the diet of a generalist insectivore, the Southwestern Willow Flycatcher: Condor, v. 110, p. 514-525.

Durst, S.L., Sogge, M.K., Stump, S.D., Walker, H.A., Kus, B.E., and Sferra S.J., 2008b, Southwestern Willow Flycatcher breeding sites and territory summary—2007: U.S. Geological Survey Open-File Report 2008-1303, 31 p. (Also available at http://pubs.usgs.gov/of/2008/1303.)

Ellis, L.A., Weddle, D.M., Stump, S.D., English, H.C., and Graber, A.E., 2008, Southwestern Willow Flycatcher final survey and monitoring report: Arizona Game and Fish Department, Research Technical Guidance Bulletin #10, Phoenix, Arizona, USA.

Finch, D.M., Kelly, J.F., and Cartron, J.E., 2000, Chapter 7: Migration and Winter Ecology, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 71-82.

General Accounting Office, 1988, Public rangelands: Some riparian areas restored but widespread improvement will be slow: General Accounting Office, U.S. Government, Washington, D.C.

Graf, W.L., Stromberg, J., and Valentine, B., 2002, Rivers, dams, and Willow Flycatchers: A summary of their science and policy connections: Geomorphology, v. 47, p. 169–188.

Haas, W.E., 2003, Southwestern Willow Flycatcher field season 2002 data summary: Varanus Biological Services, Inc., San Diego, CA.

Harris, J.H., 1991, Effects of brood parasitism by Brown-headed Cowbirds on Willow Flycatcher nesting success along the Kern River, California: Western Birds, v. 22, no. 1, p. 13-26.

Hatten, J.R., and Paradzick, C.E., 2003, A multiscaled model of Southwestern Willow Flycatcher breeding habitat: Journal of Wildlife Management, v. 67, p. 774–788.

Hatten, J.R., and Sogge, M.K., 2007, Using a remote sensing/GIS model to predict Southwestern Willow Flycatcher breeding habitat along the Rio Grande, New Mexico: U.S. Geological Survey Open-File Report 2007-1207, 27 p. (Also available at http://pubs.usgs.gov/of/2007/1207.)

Hubbard, J.P., 1987, The status of the Willow Flycatcher in New Mexico: Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, New Mexico, 29 p.

Hubbard, J.P., 1999, A critique of Wang Yong and Finch's field-identifications of Willow Flycatcher subspecies in New Mexico: Wilson Bulletin, v. 11, p. 585-588.

Koronkiewicz, T.J., 2002, Intraspecific territoriality and site fidelity of wintering Willow Flycatchers (*Empidonax traillii*) in Costa Rica: Flagstaff, Arizona, Northern Arizona University, M.S. thesis, 73 p.

Koronkiewicz, T.J., and Sogge, M.K., 2000, Willow Flycatcher (*Empidonax traillii*) winter ecology study–Costa Rica 1999/2000: U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center/Colorado Plateau Research Station report.

Koronkiewicz, T.J., McLeod, M.A., Brown, B.T., and Carothers, S.W., 2006a, Southwestern Willow Flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2005: Annual report submitted to Bureau of Reclamation, Boulder City, NV by SWCA Environmental Consultants, Flagstaff, AZ.

Koronkiewicz, T.J., Sogge, M.K., van Riper, C., and Paxton, E.H., 2006b, Territoriality, site fidelity, and survivorship of Willow Flycatchers Wintering in Costa Rica: Condor, v. 108, p. 558-570.

Koronkiewicz, T.J., and Whitfield, M.J., 1999, Winter ecology of the Southwestern Willow Flycatcher: San Diego Natural History Museum and Kern River Research Center report.

Kus, B.E., Beck, P.P., and Wells, J.M., 2003, Southwestern Willow Flycatcher populations in California: distribution, abundance, and potential for conservation: Studies in Avian Biology, v. 26, p. 12-21.

Lynn, J.C., Koronkiewicz, T.J., Whitfield M.J., and Sogge, M.K., 2003, Willow Flycatcher winter habitat in El Salvador, Costa Rica, and Panama—Characteristics and threats: Studies in Avian Biology, v. 26, p. 41-51.

Marshall, R.M., and Stoleson, S.H., 2000—Chapter 3: Threats, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 13–24.

Maynard, W.R., 1995, Summary of 1994 survey efforts in New Mexico for Southwestern Willow Flycatcher (*Empidonax traillii extimus*): New Mexico Department of Game and Fish, Santa Fe, NM, Contract #94-516-69, 48 p.

McLeod, M.A., Koronkiewicz, T.J., Brown, B.T., and Carothers, S.W., 2007, Southwestern Willow Flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2006: Annual report submitted to Bureau of Reclamation, Boulder City, Nevada by SWCA Environmental Consultants, Flagstaff, AZ, 194 p.

Moore, D., 2005, Status and monitoring of Southwestern Willow Flycatchers within Elephant Butte Reservoir, New Mexico: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Moore, D., 2007, Vegetation quantification of Southwestern Willow Flycatcher nest sites: Rio Grande from La Joya to Elephant Butte Reservoir Delta, New Mexico, 2004-2006: Bureau of Reclamation, Technical Service Center, Denver, CO.

Moore, D., and Ahlers, D., 2009, 2008 Southwestern Willow Flycatcher study results: selected sites along the Rio Grande from Velarde to Elephant Butte Reservoir, New Mexico: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Munzer, O.M., English, H.C., Smith, A.B., and Tudor A.A., 2005, Southwestern Willow Flycatcher 2004 survey and nest monitoring report: Nongame and Endangered Wildlife Program Technical Report 244, Arizona Game and Fish Department, Phoenix, Arizona, 73 p.

New Mexico Department of Game and Fish, 1996, List of threatened and endangered: Amendment No. 1, NMAC 33.1; 31 January 1996: New Mexico Department of Game and Fish, Santa Fe, New Mexico.

Nishida, C., and Whitfield, M.J., 2007, Winter distribution of the Willow Flycatcher (*Empidonax traillii*) in Ecuador and Northern Mexico: Report to the Bureau of Reclamation, Boulder City, NV.

Owen, J.C., Sogge, M.K., and Kern, M.D., 2005, Habitat and gender differences in the physiological condition of breeding Southwestern Willow Flycatchers: Auk, v. 122, no. 4, p. 1261-1270.

Paradzick, C.E., and Woodward, A.A., 2003, Distribution, abundance, and habitat characteristics of Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in Arizona, 1993–2000: Studies in Avian Biology, v. 26, p. 22–29.

Paxton, E.H., 2000, Molecular genetic structuring and demographic history of the Willow Flycatcher: Flagstaff, Arizona, Northern Arizona University, MS thesis, 43 p.

Paxton, E.H., 2008, Geographic variation and migratory connectivity of Willow Flycatcher subspecies: Flagstaff, Arizona, Northern Arizona University, Ph.D. dissertation, 100 p.

Paxton, E.H., and Owen, J.C., 2002, An aging guide for Willow Flycatcher nestlings: Flagstaff, Arizona, Colorado Plateau Field Station, Northern Arizona University, 18 p.

Paxton, E.H., Sogge, M.K., Durst, S.L., Theimer, T.C., and Hatten, J.R., 2007, The ecology of the Southwestern Willow Flycatcher in central Arizona—a 10-year synthesis report: U.S. Geological Survey Open-File Report 2007-1381, 143 p.

Pearson, T., Whitfield, M.J., Theimer, T.C., and Keim P., 2006, Polygyny and extra-pair paternity in a population of Southwestern Willow Flycatchers: Condor, v. 108, p. 571–578.

Phillips, A.R., 1948, Geographic variation in *Empidonax traillii*: Auk, v. 65, p. 507-514.

Phillips, A.R., Marshall, J., and Monson, G., 1964, The birds of Arizona: Tucson, Arizona, University of Arizona Press, 212 p.

Pulliam, H.R., 1988, Sources, sinks, and population regulation: American Naturalist, v. 132, p. 652-661.

Bureau of Reclamation, 2009, Elephant Butte Reservoir five-year operational plan—Biological Assessment: Bureau of Reclamation, Albuquerque Area Office, Albuquerque, NM.

Rourke, J.W., McCarthey, T.D., Davidson, R.F., and Santaniello, A.M., 1999, Southwestern Willow Flycatcher nest monitoring protocol: Nongame and Endangered Wildlife Program Technical Report 144, Arizona Game and Fish Department, Phoenix, Arizona.

Rothstein, S.I., Kus, B.E., Whitfield, M.J., and Sferra S.J., 2003, Recommendations for cowbird management in recovery efforts for the Southwestern Willow Flycatcher: Studies in Avian Biology, v. 26, p. 157–167.

Schuetz, J.G., and Whitfield, M.J., 2007, Southwestern Willow Flycatcher monitoring and removal of Brown-headed Cowbirds on the South Fork Kern River in 2006: Report to the U.S. Army Corps of Engineers, Sacramento, CA.

Schuetz, J.G., Whitfield, M.J., and Steen V.A., 2007, Winter distribution of the Willow Flycatcher (*Empidonax traillii*) in Guatemala and Mexico: Report by the Southern Sierra Research Station, Weldon, California.

Seager, R., Ting, M., Held, I., Kushnir, Y., Lu, J., Vecchi, G., Huang, H., Harnik, N., Leetma, A., Lau, N., Li, C., Velez, J., and Naik N., 2007, Model projections of an imminent transition to a more arid climate in southwestern North America: Science Express, April 5, 2007.

Sedgwick, J.A., 2000, Willow Flycatcher (*Empidonax traillii*), *in* Poole, A., and Gill, F., eds., The Birds of North America, No. 533: The Birds of North America, Inc., Philadelphia, Pennsylvania.

Sedgwick, J.A., 2001, Geographic variation in the song of Willow Flycatchers—Differentiation between *Empidonax traillii adastus* and *E.t. extimus*: Auk, v. 118, p. 366-379.

Seutin, G., 1987, Female song in Willow Flycatchers (*Empidonax traillii*): Auk, v. 104, p. 329-330.

Sferra, S.J., Corman, T.E., Paradzick, C.E., Rourke, J.W., Spencer, J.A., and Sumner, M.W., 1997, Arizona Partners in Flight Southwestern Willow Flycatcher survey—1993–1996 summary report: Nongame and Endangered Wildlife Program Technical Report 113, Arizona Game and Fish Department, Phoenix, Arizona, 46 p.

Shook, R.S., Stoleson, S.H., and Boucher, P., 2003, A field evaluation of the Southwestern Willow Flycatcher survey protocol: Studies in Avian Biology, v. 26, p. 177-179.

Siegle, R., and Ahlers, D., 2004, Brown-headed Cowbird management techniques manual: Techniques Manual by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Sogge, M.K., Koronkiewicz, T.J.; van Riper, C., and Durst, S.L., 2007a, Willow Flycatcher nonbreeding territory defense behavior in Costa Rica: Condor, v. 109, p. 475-480.

Sogge, M.K., Kus, B.E., Sferra, S.J., and Whitfield, M.J., 2003b, Ecology and conservation of the Willow Flycatcher—Studies in Avian Biology 26: Cooper Ornithological Society, Camarillo, CA, 210 p.

Sogge, M.K., and Marshall, R.M., 2000, Chapter 5: A survey of current breeding habitats, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 43-56.

Sogge, M.K., Marshall, R.M., Tibbitts, T.J., and Sferra, S.J. 1997a, A Southwestern Willow Flycatcher natural history summary and survey protocol: National Park Service Technical Report NPS/NAUCPRS/NRTR-97/12, 37 p.

Sogge, M.K., Paxton, E.H., and Tudor, A.A., 2006, Saltcedar and Southwestern Willow Flycatchers: lessons from long-term studies in central Arizona, *in* Aguirre-Bravo, C., Pellicane, P.J., Burns, D.P., and Draggan, S., eds., Monitoring science and technology symposium: unifying knowledge for sustainability in the Western hemisphere: September 20-24, 2004, Denver, Colorado: Proceedings RMRS-P-42CD, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado, p. 238–241.

Sogge, M.K., Sferra, S.J., McCarthey, T.D., Williams, S.O., and Kus, B.E., 2003a, Distribution and characteristics of Southwestern Willow Flycatcher breeding sites and territories: Studies in Avian Biology, v. 26, p. 5-11.

Sogge, M.K., Sferra, S.J., and Paxton, E.H., 2008, Saltcedar as habitat for birds—Implications to riparian restoration in the Southwest: Restoration Ecology, v. 16, p. 146-154.

Sogge, M.K., Tibbitts, T.J., and Petterson, J., 1997a, Status and breeding ecology of the Southwestern Willow Flycatcher in the Grand Canyon: Western Birds, v. 28, p. 142-157.

Sogge, M.K., Tibbitts, T.J., van Riper, C., and May, T., 1995, Status of the Southwestern Willow Flycatcher along the Colorado River in Grand Canyon National Park—1995, Summary report: National Biological Service Colorado Plateau Research Station/Northern Arizona University, 26 p.

Spencer, J.A., Sferra, S.J., Corman, T.E., Rourke, J.W., and Sumner, M.W., 1996, Arizona Partners in Flight 1995 Southwestern Willow Flycatcher survey: Nongame and Endangered Wildlife Program Technical Report 79, Arizona Game and Fish Department, Phoenix, Arizona, 46 p.

State of Arizona, 1990, Final report and recommendations of the Governor's riparian habitat task force, Executive Order 89-16: Streams and riparian resources, Phoenix, Arizona, October 1990, 28 p.

Stein, R.C., 1963, Isolating mechanisms between populations of Traill's Flycatchers: Proceedings of the American Philosophical Society, v. 107, no. 1, p. 21-50.

Stoleson, S.H., and Finch, D.M., 2003, Microhabitat use by breeding Southwestern Willow Flycatchers on the Gila River, NM: Studies in Avian Biology, v. 26, p. 91-95.

Stoleson, S.H., Whitfield, M.J., and Sogge, M.K., 2000, Chapter 8: Demographic characteristics and population modeling, *in* Finch D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 84-94.

Tibbitts, T.J., Sogge, M.K., and Sferra, S.J., 1994, A survey protocol for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*): National Park Service Technical Report NPS/NAUCPRS/NRTR-94/04.

Unitt, P., 1987, *Empidonax traillii extimus*: an endangered subspecies: Western Birds, v. 18, no. 3, p. 137-162.

U.S. Fish and Wildlife Service, 1991, Notice of review: animal candidate review for listing as endangered or threatened species, November 21, 1991: Federal Register 56:58804-58836.

U.S. Fish and Wildlife Service, 1993, Proposal to list the Southwestern Willow Flycatcher as an endangered species and to designate critical habitat, July 23, 1993: Federal Register 58:39495-39522.

U.S. Fish and Wildlife Service, 1995, Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher: Federal Register 60:10694 (February 27, 1995).

U.S. Fish and Wildlife Service, 1997, Final determination of critical habitat for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*): Federal Register 62(140):39129-39147.

U.S. Fish and Wildlife Service, 2002, Southwestern Willow Flycatcher (*Empidonax traillii extimus*) final recovery plan: U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service, 2005, Designation of critical habitat for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*), Final Rule: Federal Register 70:60886–61009 (October 19, 2005).

Utah Division of Wildlife Resources, 1997, Utah Sensitive Species List – March 1997: Utah Division of Wildlife Resources, Salt Lake City, Utah, 28 p.

Whitfield, M.J., 1990, Willow Flycatcher reproductive response to brown-headed cowbird parasitism: Chico, California, California State University, Masters theses, 25 p.

Whitfield, M.J., and Enos, K., 1996, A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California, 1996: Report to the U.S. Army Corps of Engineers, Sacramento District and the California Department of Fish and Game.

Whitfield, M.J., and Sogge, M.K., 1999, Range-wide impacts of Brown-headed Cowbird parasitism on the Southwestern Willow Flycatcher (*Empidonax traillii extimus*), 1999: Studies in Avian Biology, v. 18, p. 182-190.

Whitfield, M.J., and Strong, C.M., 1995, A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California: California Department of Fish and Game, Bird and Mammal Conservation Program Report 95-4, Sacramento, California, 17 p.

Wiesenborn, W.D., and Heydon, S.L., 2007, Diet of Southwestern Willow Flycatcher compared among breeding populations in different habitats: Wilson Journal of Ornithology, v. 119, p. 547–557.

Wilbur, S.R., 1987, Birds of Baja California: Berkeley, California, University of California Press.

Yard, H.K., and Brown, B.T., 1999, Willow Flycatcher nest resuse in Arizona: Journal of Field Ornithology, v. 70, p. 211–213.

Yard, H.K., and Brown, B.T., 2003, Singing behavior of the Southwestern Willow Flycatchers in Arizona: Studies in Avian Biology, v. 26, p. 125–130.

Appendix 1. Willow Flycatcher Survey and Detection Form

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher (WIFL) Survey and Detection Form (revised April 2010)

Site Name_____ State_____ County _____
USGS Quad Name _____ Elevation _____ (meters)
Creek, River, Wetland, or Lake Name_____
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? Yes___ No____

Survey Coordinates: Start: E_____ N_____ UTM Datum_____(See instructions)
Stop: E_____ N_____ UTM Zone _____
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

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

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N / If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding; potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 2 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 3 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 4 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 5 Observer(s)	Date Start Stop Total hrs ___						# Birds	Sex	UTM E	UTM N
Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total Survey Hrs_____	Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any Willow Flycatchers color-banded? Yes___ No ___ If yes, report color combination(s) in the comments section on back of form and report to USFWS.					

Reporting Individual _____ Date Report Completed_____ _____
US Fish and Wildlife Service Permit #_____State Wildlife Agency Permit #_____
Submit form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.

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

Reporting Individual _____Phone # _____
Affiliation _____ E-mail _____
Site Name_____Date Report Completed _____

Did you verify that this site name is consistent with that used in previous years? Yes ____ No _____ Not Applicable ___
If site name is different, what name(s) was used in the past?_____
If site was surveyed last year, did you survey the same general area this year? Yes ____ No ____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes ____ No ____ If no, summarize below.

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

Length of area surveyed: _____ (meters)

Vegetation Characteristics: Mark the category that best describes the predominant tree/shrub foliar layer at this site (check one):

_____ Native broadleaf plants (entirely or almost entirely, > 90% native, includes high-elevation willow)

_____ Mixed native and exotic plants (mostly native, 50 - 90% native)

_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
_____

Average height of canopy (Do not include a range): _____ (meters)

Attach copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections.
Attach sketch or aerial photo showing site location, patch shape, survey route, location of any WIFLs or WIFL nests detected.
Attach photos of the interior of the patch, exterior of the patch, and overall site; describe any unique habitat features.

Comments (attach additional sheets if necessary)
_____
_____
_____
_____
_____
_____

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM N	UTM E	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Attach additional sheets if necessary

Appendix 2. Willow Flycatcher Survey Continuation Sheet / Territory Summary Table

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher Survey Continuation Sheet

(For reporting additional detections and territories; append to Survey and Detection form)

Reporting Individual _____Phone # _____
Affiliation _____ E-mail _____
Site Name_____Date Report Completed _____

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Comments_____

Appendix 3. Instructions for Completing the Willow Flycatcher Survey and Detection Form and the Survey Continuation Sheet

These instructions are provided as guidance for completing the standard survey form. It is particularly important to provide the correct type and format of information for each field. Complete and submit your survey forms to both the appropriate State Willow Flycatcher coordinator and the U.S. Fish and Wildlife Service (USFWS) by September 1 of the survey year. You also may complete forms digitally (Microsoft© Word or Excel) and submit them via email with attached or embedded topographic maps and photographs.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the flycatcher survey coordinators for each State and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your State or USFWS flycatcher coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the State or USFWS flycatcher coordinator). If you are uncertain if the site was previously surveyed, contact your State or USFWS flycatcher coordinator.

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Survey Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). California surveyors only: provide latitude/longitude geographic coordinates instead of UTMs in the UTM fields and identify them as such. If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Datum. Indicate the datum in which the coordinates are expressed: NAD27, WGS84, or NAD83. The datum can be found in the settings of most GPS units. Note that Arizona prefers NAD27 and New Mexico prefers NAD83.

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units. Zones for California are 10, 11, or 12. The zone for Arizona is 12. Zones for New Mexico are 12 or 13.

Survey #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. **Note:** A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple subsites and use separate survey forms for each. Casual site visits, pre-season or supplemental visits, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the Comments section on page 2 or in the survey continuation sheet.

Date. Indicate the date that the survey was conducted, using the format mm/dd/yyyy.

Start and **Stop.** Start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hours. The duration of time (in hours) spent surveying the site, rounded to the nearest tenth (0.1) hour. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed sections of the site concurrently and independently, sum the number of hours each observer spent surveying the site.

Number of Adult WIFLs. The total number of individual adult Willow Flycatchers detected during this particular survey. Do not count nestlings or recently fledged birds.

Number of Pairs. The number of breeding pairs. Do not assume that any bird is paired; designation of birds as paired should be based only on direct evidence of breeding behaviors described in the protocol. If there is strong evidence that the detected bird is unpaired, enter "0". If it is unknown whether a territorial bird is paired, enter "–". Note that the estimated number of pairs can change over the course of a season.

Number of Territories. Provide your best estimate of the number of territories, defined as a discrete area defended by a resident single bird or pair. This is usually evidenced by the presence of a singing male, and possibly one or more mates. Note that the estimated number of territories may change over the course of a season.

Nest(s) Found? Yes or No. If yes, indicate the number of nests. Renests are included in this total.

Comments about this survey. Describe bird behavior, evidence of pairs or breeding, evidence of nest building, evidence of nestlings/fledglings, nesting, vocalizations (e.g., interaction twitter calls, *whitts*, *britts*, *wheeos*, *fitz-bews*/countersinging), potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.). If *Diorhabda* beetles are observed, contact your USFWS and State flycatcher coordinator immediately. Please be aware that permits are needed for nest monitoring.

GPS Coordinates for WIFL Detections. Provide the number of birds (e.g., unpaired, paired, or groups of birds) and corresponding UTMs. If known, provide the sex of individuals.

Overall Site Summary. For each of these columns, provide your best estimate of the overall total for the season. Do not simply total the numbers in each column. In some cases where consistent numbers were detected on each survey, the overall summary is easy to determine. In cases where numbers varied substantially among the different surveys, use professional judgment and logic to estimate the most likely number of adults, pairs, and territories that were consistently present. Be careful not to double count individuals. Record only territorial adult Southwestern Willow Flycatchers, do not include migrants, nestlings, or fledglings in the overall summary. In complex cases, consult with your State or USFWS flycatcher coordinator.

Total Survey Hours. The sum of all hours spent surveying the site.

Were any WIFLs color-banded? Circle or highlight "Yes" or "No". If yes, report the sighting and color combination (if known) in the comments section on back of form, and contact your USFWS coordinator within 48 hours after returning from the survey. Note that identifying colors of bands is difficult and might require follow-up visits by experienced surveyors.

Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

U.S. Fish and Wildlife Service Permit #. List the full number of the required federal permit under which the survey was completed.

State Wildlife Agency Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State permit. State permits are required for Arizona and California. State permits are recommended for New Mexico.

Page 2 of Survey Form

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Self-explanatory; include the area code.

E-mail. Self-explanatory.

Was this site surveyed in a previous year? Indicate "Yes", "No", or "Unknown."

Did you verify that this site name is consistent with that used in previous years? Indicate "Yes" or "No". This can be determined by checking survey forms from previous years or consulting with agency flycatcher coordinators.

If site name is different, what name(s) was used in the past? Enter the full site name that was used in previous years.

If site was surveyed last year, did you survey the same general area this year? Indicate "Yes" or "No". If no, indicate the reason and how the survey varied in the Comments section.

Did you survey the same general area during each visit to this site this year? If no, indicate the reason in the Comments section and delineate the differing route of each survey on the topographical map.

Management Authority for Survey Area. Mark the appropriate management authority.

Name of Management Entity or Owner (e.g., Tonto National Forest). Provide the name of the organization or person(s) responsible for management of the survey site.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Vegetation Characteristics: Mark only one of the categories that best describes the predominant tree/shrub foliar layer at the site.

Native broadleaf habitat is composed of entirely or almost entirely (i.e., > 90%) native broadleaf plants.

Mostly native habitat is composed of 50–90% native plants with some (i.e., 10–50%) non-native plants.

Mostly exotic habitat is composed of 50–90% non-native plants with some (i.e., 10–50%) native plants.

Exotic/introduced habitat is composed entirely or almost entirely (i.e., > 90%) of non-native plants.

Identify the 2–3 predominant tree/shrub species in order of dominance. Identify by scientific name.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Attach the following: (1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests; (3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments. Include the flycatcher territory number and GPS location. You also may include a compact disc of photographs.

Comments. Include any information that supports estimates of total territory numbers and breeding status. You may provide additional information on bird behavior, banded birds, evidence of pairs or breeding, nesting, potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.), and changes in survey length and route throughout the season. Attach additional pages or use the continuation sheet if needed.

Table. If Willow Flycatchers are detected, complete the table at the bottom of the form. Identify flycatchers by territory number and include the dates detected, UTMs, whether or not pairs were detected, and whether or not nests were located. Also describe the observation. For example, the surveyor might have observed and heard a bird *fitz-bew* from an exposed perch, heard and observed two birds interacting and eliciting a twitter call, heard a bird *fitz-bew* while observing another carrying nesting material, heard birds from territory 1 and 2 countersinging, etc. This information provides supporting information for territory and breeding status. Use the continuation sheet if needed.

Appendix 4. Example of a Completed Willow Flycatcher Survey and Detection Form (with map)

Willow Flycatcher (WIFL) Survey and Detection Form (revised April, 2010)

Site Name: **DL-08** State: **New Mexico** County: **Socorro**
USGS Quad Name: **Paraje Well** Elevation: **1,356** (meters)
Creek, River, or Lake Name: **Rio Grande**
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ***Yes*** **X** ***No*** ____
Survey Coordinates: Start: E **306,009** N **3,715,506** UTM Datum: **NAD 83** (See instructions)
Stop: E **304,339** N **3,711,922** UTM Zone: **13**
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.
*****Fill in additional site information on back of this page*****

Survey # Observer(s) (Full Name)	Date (m/d/y) Survey Time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding;-potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator.	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	5/24/2009						1	M	305,276	3,714,926
D. Savage	Start:						1	M	305,131	3,714,628
	5:45	5	0	5	N	Suitable breeding habitat dispersed throughout site. WIFLs were very vocal, and covering large areas. No obvious signs of pairing were observed. Approximately 10 head of cattle were found within this site.	1	M	305,191	3,714,778
	Stop:						1	M	305,394	3,715,009
	10:15						1	M	305,084	3,714,732
	Total hrs:									
	4.5									
Survey # 2	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/10/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	6:00	11	4	7	Y (3)	Portions of site are flooded, 1-2 ft deep. Two males found during 1st survey appear unpaired. Three pairs confirmed based on nesting, and another pair suspected based on vocal interactions and nonaggressive behavior with another flycatcher. Two additional territories (1 pair and 1 unpaired male) found during this survey.	2	M/F	305,191	714,778
	Stop:						2	M/F	305,394	3,715,009
	10:15						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.3						1	M	305,010	3,714,524
Survey # 3	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/21/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	5:30	12	5	7	Y (4)	Portions of site still flooded. All territories found in Survey 2 are still active. The two males found during Surveys #1 and #2, still believed to be unpaired. All other territories are believed to be paired. Several cows observed in vicinity of active territories.	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.5						2	M/F	305,010	3,714,524
Survey # 4	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/1/2009						1	M	305,276	3,714,926
D. Moore	Start:						1	M	305,131	3,714,628
	6:00	12	5	7	Y (4)	Site is no longer flooded, but saturated soils persist throughout most of site. No change in territory numbers or status. All SWFL pairs very quiet - only a few whits and fitz-bews. Light rain over night, vegetation was saturated early in the morning. Lots of mosquitos!	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.0						2	M/F	305,010	3,714,524
Survey # 5	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/10/2009						1	M	305,131	3,714,628
D. Moore	Start:						2	M/F	305,191	3,714,778
	5:30	11	5	6	Y (4)	Site beginning to dry out, some portions still muddy. One of the unpaired males could not be detected. It was hard to hear SWFLs due to breezy conditions early in the morning.	2	M/F	305,394	3,715,009
	Stop:						2	M/F	305,084	3,714,732
	10:00						2	M/F	305,001	3,714,640
	Total hrs:						2	M/F	305,010	3,714,524
	4.5									
Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total survey hrs: 21.8		Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any WIFLs color-banded? Yes ____ No **X** If yes, report color combination(s) in the comments section on back of form and report to USFWS.				
		12	5	7	4					

Reporting Individual: **Darrell Ahlers** Date Report Completed: **8/20/2009**
US Fish & Wildlife Service Permit #: **TE819475-2** State Wildlife Agency Permit #: **N/A**

Submit ***form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.***

Fill in the following information completely. Submit form by September 1 st. Retain a copy for your records.

Reporting Individual **Darrell Ahlers** Phone # **(303) 445-2233**
Affiliation **Bureau of Reclamation** E-mail dahlers@usbr.gov
Site Name **DL-08** Date report Completed **8/20/2009**
Was this site surveyed in a previous year? Yes__**x**__ No____ Unknown____
Did you verify that this site name is consistent with that used in previous yrs? Yes **x** No _____ Not Applicable _____
If name is different, what name(s) was used in the past? **Not applicable**
If site was surveyed last year, did you survey the same general area this year? Yes **x** No _____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes **x** No _____ If no, summarize below.

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

Length of area surveyed: **2.5** (km)

Vegetation Characteristics: Check (only one) category that best describes the predominant tree/shrub foliar layer at this site:

_____ Native broadleaf plants (entirely or almost entirely, > 90% native)
X Mixed native and exotic plants (mostly native, 50 - 90% native)
_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)
_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
Salix Gooddingii, Populus spp., Tamarix spp.

Average height of canopy (Do not include a range): **6** (meters)

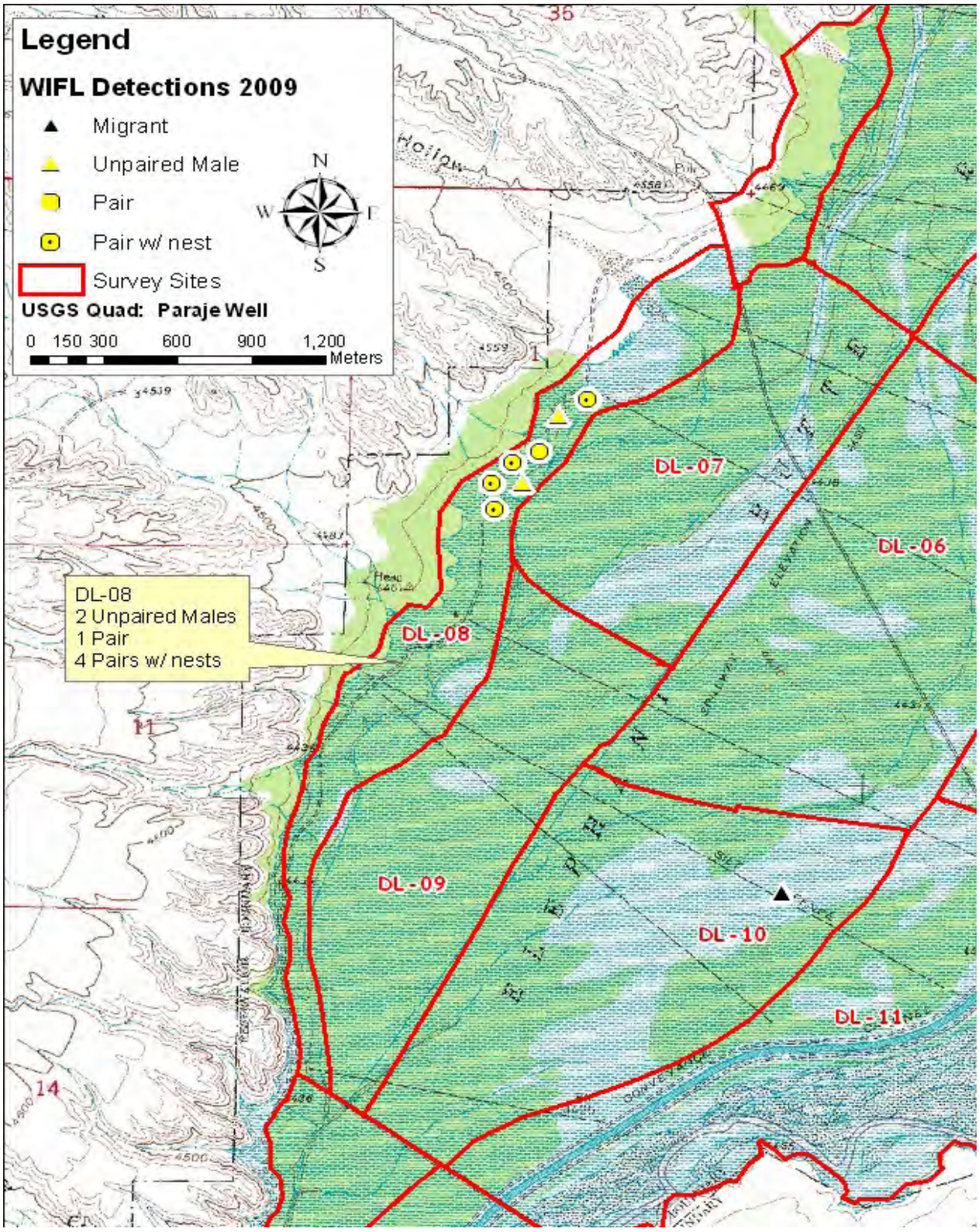
Attach the following: 1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections;
2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests;
3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments.

Comments (such as start and end coordinates of survey area if changed among surveys, supplemental visits to sites, unique habitat features. Attach additional sheets if necessary.
Great habitat with saturated or flooded soils throughout most of the site on 1st survey. Site began to dry by the end of the breeding season. SWFL territories are dominated by Gooddings willow, however Tamarix spp. tends to be increasing in density compared to previous years. Site is supported by flows from the Low Flow Conveyance Channel.

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)
1 (Unpaired male)	5/24, 6/10,6/21,7/1	305,276	3,714,926	N	N	extended presence at site from 5/24 through 7/1, no evidence of pairing
2 (Unpaired male)	5/24, 6/10,6/21,7/1, 7/10	305,131	3,714,628	N	N	extended presence at site from 5/24 through 7/10, no evidence of pairing
3 (Pair)	5/24, 6/10,6/21,7/1, 7/10	305,191	3,714,778	Y	Y	Pair confirmed based on vocalizations and observation of unchallenged WIFL
4 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,394	3,715,009	Y	Y	Confirmed breeding status with nest
5 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,084	3,714,732	Y	Y	Confirmed breeding status with nest
6 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,001	3,714,640	Y	Y	Confirmed breeding status with nest
7 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,010	3,714,524	Y	N	Confirmed breeding status with nest

Attach additional sheets if necessary


Legend
WIFL Detections 2009
Migrant
Unpaired Male
Pair
Pair w/ nest
Survey Sites
USGS Quad: Paraje Well
0 150 300 600 900 1,200
Meters
N
W
E
S
DL-08
2 Unpaired Males
1 Pair
4 Pairs w/ nests
DL-07
DL-06
DL-08
DL-09
DL-10
DL-11
35
1
11
14

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Prepared in cooperation with the Bureau of Reclamation and the U.S. Fish and Wildlife Service

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

Chapter 10 of
Section A, Biological Science
Book 2, Collection of Environmental Data

Techniques and Methods 2A-10

U.S. Department of the Interior
U.S. Geological Survey

Cover: Southwestern Willow Flycatcher. Photograph taken by Susan Sferra, U.S. Fish and Wildlife Service.

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U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2010

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Figures

Conversion Factors

Multiply	By	To obtain
centimeter (cm)	0.3937	inch (in.)
gram (g)	0.03527	ounce, avoirdupois (oz)
hectare (ha)	2.471	acre
kilometer (km)	0.6214	mile (mi)
meter (m)	3.281	foot (ft)
millimeter (mm)	0.03937	inch (in.)

Abbreviations and Acronyms

GPS	Global Positioning System
NDVI	Normalized Difference Vegetation Index
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher

By Mark K. Sogge, U.S. Geological Survey; Darrell Ahlers, Bureau of Reclamation; and Susan J. Sferra, U.S. Fish and Wildlife Service

Background

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*) has been the subject of substantial research, monitoring, and management activity since it was listed as an endangered species in 1995. When proposed for listing in 1993, relatively little was known about the flycatcher's natural history, and there were only 30 known breeding sites supporting an estimated 111 territories rangewide (Sogge and others, 2003a). Since that time, thousands of presence/absences surveys have been conducted throughout the historical range of the flycatcher, and many studies of its natural history and ecology have been completed. As a result, the ecology of the flycatcher is much better understood than it was just over a decade ago. In addition, we have learned that the current status of the flycatcher is better than originally thought: as of 2007, the population was estimated at approximately 1,300 territories distributed among approximately 280 breeding sites (Durst and others, 2008a).

Concern about the Southwestern Willow Flycatcher on a rangewide scale was brought to focus by Unitt (1987), who described declines in flycatcher abundance and distribution throughout the Southwest. *E. t. extimus* populations declined during the 20th century, primarily because of habitat loss and modification from activities, such as dam construction and operation, groundwater pumping, water diversions, and flood control. In 1991, the U.S. Fish and Wildlife Service (USFWS) designated the Southwestern Willow Flycatcher as a candidate category 1 species (U.S. Fish and Wildlife Service, 1991). In July 1993, the USFWS proposed to list *E. t. extimus* as an endangered species and to designate critical habitat under the Act (U.S. Fish and Wildlife Service, 1993). A final rule listing *E. t. extimus* as endangered was published in February 1995 (U.S. Fish and Wildlife Service, 1995); critical habitat was designated in 1997 (U.S. Fish and Wildlife Service, 1997). The USFWS Service released a Recovery Plan for the Southwestern Willow Flycatcher in 2002 (U.S. Fish and Wildlife Service, 2002), and re-designated critical habitat in 2005 (U.S. Fish and Wildlife Service, 2005).

In addition to its federal status, the Southwestern Willow Flycatcher is listed as an endangered species or species of concern in Arizona (Arizona Game and Fish Department, 2006), New Mexico (New Mexico Department of Game and Fish, 1996), California (California Department of Fish and Game, 1991), and Utah (Utah Division of Wildlife Resources, 1997).

Sound management and conservation of an endangered species like the Southwestern Willow Flycatcher requires current, detailed information on its abundance and distribution. This requires, among other things, identifying where flycatchers are and are not breeding, and annual monitoring of as many breeding areas as possible. Such efforts require effective, standardized survey protocols and consistent reporting, at both local and regional levels. However, the Willow Flycatcher is a difficult species to identify and survey for. Moreover, inconsistent or ineffective surveys are of limited value, can produce misleading information (including "false positives" and "false negatives"), hinder regional and rangewide analyses, and waste limited resources.

We developed this document to provide a standardized survey protocol and a source of basic ecological and status information on the flycatcher. The first section summarizes the current state of knowledge regarding Southwestern Willow Flycatcher natural history, based on a wide array of published and unpublished literature. Emphasis is given to information relevant to flycatcher conservation and management, and to conducting and interpreting surveys. The second section details a standard survey protocol that provides for consistent data collection, reporting, and interpretation. This protocol document builds on and supersedes previous versions, the most recent of which was Sogge and others (1997a). In this update, we incorporate over a decade of new science and survey results, and refine the survey methodology to clarify key points. Further, we update the standard survey data sheets and provide guidelines on how to fill in the requested information. Amidst these revisions, the basic approach of the survey protocol has remained unchanged—multiple surveys at each survey area within the same breeding season, the use of the call-playback technique using flycatcher vocalizations to increase the probability of detection, and verification of species identity through its diagnostic song.

Section 1. Natural History

Breeding Range and Taxonomy

The Willow Flycatcher is a widespread species that breeds across much of the conterminous United States (Sedgwick, 2000). Four subspecies commonly are recognized in North America, with each occupying a distinct breeding range (fig. 1): *E. t. adastus*, ranging across the northern Rocky Mountains and Great Basin; *E. t. brewsteri*, found west of the Sierra Nevada and Cascade Mountains along the Pacific Slope; *E. t. extimus*, the Southwestern Willow Flycatcher, which breeds across the Southwest; and *E. t. traillii*, ranging east of the northern Rocky Mountains. Although the overall subspecies' ranges are distinct, Sedgwick (2001) and Paxton (2008) noted interbreeding/gradation zones in the boundary area between *E. t. extimus* and *E. t. adastus*.

The breeding range of the Southwestern Willow Flycatcher includes southern California, Arizona, New Mexico, southwestern Colorado, and extreme southern portions of Nevada and Utah: specific range boundaries are delineated in the subspecies' recovery plan (U.S. Fish and Wildlife Service, 2002). Unitt (1987) included western Texas in the subspecies' range, but recent breeding records from western Texas are lacking. Records of probable breeding Southwestern Willow Flycatchers in Mexico are few and restricted to extreme northern Baja California and Sonora (Unitt, 1987; Wilbur, 1987). Although recent data are lacking, the USFWS does include parts of northern Mexico in its description of *E. t. extimus* breeding range (U.S. Fish and Wildlife Service, 2002).

Although they appear very similar to most observers, experienced taxonomist or those using specialized equipment (for example, an electronic colorimeter) can differentiate among the subspecies by subtle differences in color and morphology (for example, Unitt, 1987; Paxton, 2008). Despite the subtle level of differences, the taxonomic status of *E. t. extimus* has been critically reviewed and confirmed multiple times based on morphological, genetic, and song data (Hubbard, 1987; Unitt, 1987; Browning, 1993; Paxton, 2000; Sedgwick, 2001).

The Southwestern Willow Flycatcher was described by Phillips (1948) from a specimen collected along the San Pedro River in southeastern Arizona. The Southwestern Willow Flycatcher generally is paler than other Willow Flycatcher subspecies, although this difference is indistinguishable without considerable experience and training, and study skins as comparative reference material. The southwestern subspecies differs in morphology (primarily wing formula) but not overall size. The plumage and color differences between the Willow Flycatcher subspecies are so subtle that they should not be used to characterize birds observed in the field (Unitt, 1987; Hubbard, 1999; U.S. Fish and Wildlife Service, 2002).

Migration and Winter Range, Habitat, and Ecology

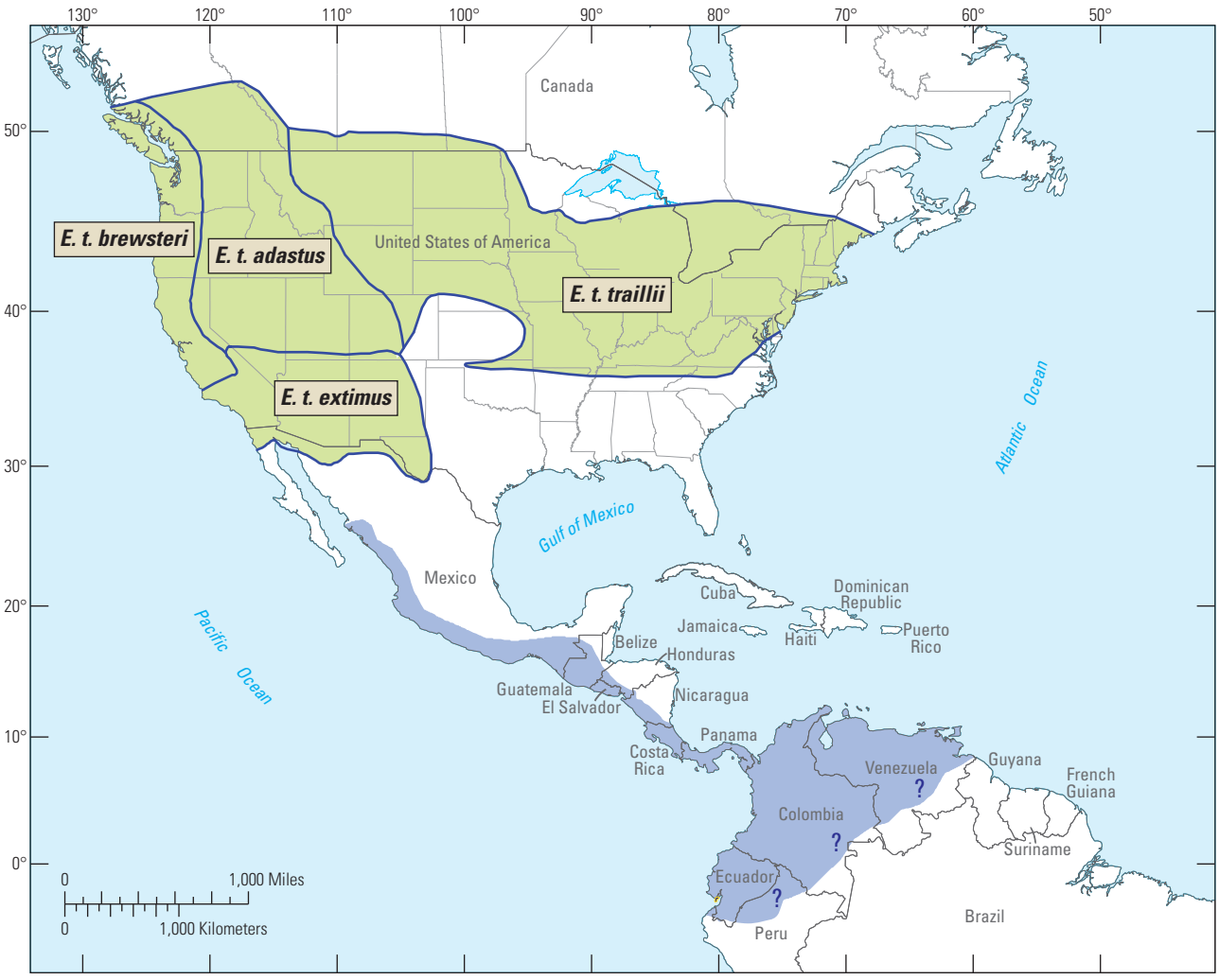
All Willow Flycatcher subspecies breed in North America but winter in the subtropical and tropical regions of southern Mexico, Central America, and northern South America (Sedgwick, 2000; Koronkiewicz, 2002; fig. 1). Most wintering birds are found in the Pacific slope lowlands in Mexico and Central America, and Caribbean slope lowlands in Mexico and Guatemala.

Because all Willow Flycatcher subspecies look very similar, determining specific wintering sites for the southwestern race has been challenging. However, recent genetic analysis of wintering birds (Paxton, 2008) suggests that the four subspecies occupy finite areas of the wintering grounds, but with overlapping ranges. The Southwestern Willow Flycatcher appears to be largely restricted to the center of the winter range (in the vicinity of Costa Rica), although Paxton (2008) suggests more research is needed to address this question.

On the wintering grounds, flycatchers primarily are found in habitats that have four main components: (1) standing or slow moving water and/or saturated soils, (2) patches or stringers of trees, (3) woody shrubs, and (4) open areas (Koronkiewicz and Whitfield, 1999; Koronkiewicz and Sogge, 2000; Lynn and others, 2003; Nishida and Whitfield, 2007; Schuetz and others, 2007). Based on surveys to date, the presence of water or saturated soils is almost universal, although tree heights and configurations, the presence of woody shrubs, and the amount of open space surrounding winter territories can vary considerably (Schuetz and others, 2007).

Male and female flycatchers hold separate, individual non-breeding territories, and defend those territories throughout the winter by using song, calls, and aggression displays. Fidelity to wintering territories and sites is high, as is survivorship over the wintering period (Koronkiewicz and others, 2006b; Sogge and others, 2007).

Willow Flycatchers travel approximately 1,500–8,000 km each way between wintering and breeding areas. During migration, flycatchers use a wider array of forest and shrub habitats than they do for breeding, although riparian vegetation may still be a preferred migration habitat type (Finch and others, 2000). Migration requires high energy expenditures, exposure to predators, and successful foraging in unfamiliar areas. Therefore, migration is the period of highest mortality within the annual cycle of the flycatcher (Paxton and others, 2007). Willow Flycatchers of all subspecies sing during northward migration, perhaps to establish temporary territories for short-term defense of food resources.



Basemap modified from U.S. Geological Survey and other agency digital data, various scales. Projection Mercator, World Geodetic System1984 datum.

EXPLANATION

Approximate range distribution of the Willow Flycatcher (*Empidonax traillii*)—Adapted from Unitt (1987), Browning (1993), and Paxton (2008)

Breeding range, including boundaries of the Willow Flycatcher subspecies

? Wintering range—Question marks reflect uncertainty of the location of the eastern boundary of the winter range

Figure 1. Approximate ranges of the Willow Flycatcher (*Empidonax traillii*) during breeding and non-breeding seasons.

Southwestern Willow Flycatchers typically arrive on breeding grounds between early May and early June (Ellis and others, 2008; Moore and Ahlers, 2009). Because arrival dates vary annually and geographically, northbound migrant Willow Flycatchers of multiple subspecies pass through areas where Southwestern Willow Flycatchers have already begun nesting. Similarly, southbound migrants in late July and August may occur where Southwestern Willow Flycatchers are still breeding (Unitt, 1987). This can make it challenging for an observer to differentiate local breeders from migrants. Other than timing, we still know relatively little about Southwestern Willow Flycatcher migratory behavior, pathways, or habitat use.

Breeding Habitat

Breeding Southwestern Willow Flycatchers are riparian obligates, typically nesting in relatively dense riparian vegetation where surface water is present or soil moisture is high enough to maintain the appropriate vegetation characteristics (Sogge and Marshall, 2000; U.S. Fish and Wildlife Service, 2002; Ahlers and Moore, 2009). However, hydrological conditions in the Southwest can be highly variable within a season and between years, so water availability at a site may range from flooded to dry over the course of a breeding season or from year to year.

The Southwestern Willow Flycatcher breeds in dense riparian habitats across a wide elevational range, from near sea level in California to more than 2,600 m in Arizona and southwestern Colorado (Durst and others, 2008a). Vegetation characteristics of Southwestern Willow Flycatcher breeding habitat generally include dense tree or shrub cover that is ≥ 3 m tall (with or without a higher overstory layer), dense twig structure, and high levels of live green foliage (Allison and others, 2003); many patches with tall canopy vegetation also include dense midstory vegetation in the 2–5 m range. Beyond these generalities, the flycatcher shows adaptability in habitat selection, as demonstrated by variability in dominant plant species (both native and exotic), size and shape of breeding patch, and canopy height and structure (U.S. Fish and Wildlife Service, 2002).

Southwestern Willow Flycatcher breeding habitat can be quantified and characterized in a number of ways, depending on the level of detail needed and habitat traits of interest. For many sites, detailed floristic composition, plant structure, patch size, and even characteristics such as Normalized Difference Vegetation Index (NDVI) have been described in agency reports and scientific journal articles (Allison and others, 2003; Hatten and Paradzick, 2003; Koronkiewicz and others, 2006a; Hatten and Sogge, 2007; Moore, 2007; Schuetz and Whitfield, 2007; Ellis and others, 2008). For purposes of this survey protocol, we take a relatively simple approach and broadly describe and classify breeding sites based on plant species composition and habitat structure. Clearly, these are not the only important components, but they are conspicuous to human perception and easily observed and recorded. Thus, they have proven useful in conceptualizing, selecting and evaluating suitable survey habitat, and in predicting where breeding flycatchers are likely to be found.

Breeding habitat types commonly used by Southwestern Willow Flycatchers are described below. The general categories are based on the composition of the tree/shrub vegetation at the site—native broadleaf, exotic, and mixed native/exotic. In the field, breeding habitats occur along a continuum of plant species composition (from nearly monotypic to mixed species) and vegetation structure (from simple, single stratum patches to complex, multiple strata patches). The images in figures 2–7 illustrate some of the variation in flycatcher breeding habitat, and other examples can be found in numerous publications and agency reports, and on the USGS photo gallery web site (http://sbsc.wr.usgs.gov/SBSCgallery/). The intent of the descriptions and photographs is to provide a general guide for identifying suitable habitat in which to conduct surveys.

Native broadleaf.—Southwestern Willow Flycatchers breed across a great elevational range, and the characteristics of their native broadleaf breeding sites varies between high elevation sites and those at low and mid-elevation sites.

High elevation sites (fig. 2) range from nearly monotypic dense stands of willow to mixed stands of native broadleaf trees and shrubs, 2–7 m in height with no distinct overstory layer; often associated with sedges, rushes, nettles, and other herbaceous wetland plants; usually very dense structure in lower 2 m; live foliage density is high from the ground to the canopy. Vegetation surrounding the patch can range from open meadow, to agricultural lands, to pines or upland shrub.

At low and mid-elevations (fig. 3), flycatcher breeding sites can be composed of single species (often Goodding's willow (*Salix gooddingii*), *S. exigua*, or other willow species) or mixtures of native broadleaf trees and shrubs including (but not limited to) cottonwood, willows, boxelder (*Acer negundo*), ash (*Fraxinus* spp.), alder (*Alnus* spp.), and buttonbush (*Cephalanthus* spp.), height from 3 to 15 m; characterized by trees of different size classes; often a distinct overstory of cottonwood, willow or other broadleaf tree, with recognizable subcanopy layers and a dense understory of mixed species; exotic/introduced species may be a rare component, particularly in the understory.

Monotypic exotic.—(fig. 4) Breeding sites also can include nearly monotypic, dense stands of exotics such as saltcedar (*Tamarix* spp.) or Russian olive (*Elaeagnus angustifolia*), 4–10 m in height forming a nearly continuous, closed canopy (with no distinct overstory layer); lower 2 m commonly very difficult to penetrate due to dense branches, however, live foliage density may be relatively low 1–2 m above ground, but increases higher in the canopy; canopy density uniformly high.

Aerial view of Little Colorado River near Greer, Arizona. Photograph by USGS, 1995.

Little Colorado River near Greer, Arizona. Photograph courtesy of Arizona Game and Fish Department, 1996.

Parkview Fish Hatchery, New Mexico. Photograph by USGS, 2000.

Rio Grande State Wildlife Area, Colorado. Photograph by USGS, 2002.

Tierra Azul, New Mexico. Photograph by USGS, 2005.

McIntyre Springs, Colorado. Photograph by USGS, 2002.

Figure 2. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at high-elevation sites.

Hassayampa River, Arizona. Photograph by USGS, 2003.

Santa Ynez River, California, Photograph by USGS, 1996.

San Luis Rey River, California. Photograph by USGS, 2005.

Kern River, California. Photograph by USGS, 1995.

Bosque del Apache, Rio Grande, New Mexico. Photograph courtesy of Bureau of Reclamation, 2008.

Kern River, California. Photograph by USGS, 1995.

Figure 3. Examples of Southwestern Willow Flycatcher breeding habitat in native broadleaf vegetation at low and mid-elevation sites.

Aerial view of Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Topock Marsh, Colorado River, Arizona. Photograph by USGS, 1996.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Salt River, Arizona. Photograph courtesy of Bureau of Reclamation, 1996.

Orrilla Verde, Rio Grande, New Mexico. Photograph by USGS, 2006.

Aerial view of Salt River, Arizona. Photograph by USGS, 1996.

Figure 4. Examples of Southwestern Willow Flycatcher breeding habitat in exotic vegetation.

Mixed native/exotic—(fig. 5) These sites include dense mixtures of native broadleaf trees and shrubs (such as those listed above) mixed with exotic/introduced species, such as saltcedar or Russian olive; exotics are often primarily in the understory, but may be a component of overstory; the native and exotic components may be dispersed throughout the habitat or concentrated as a distinct patch within a larger matrix of habitat; overall, a particular site may be dominated primarily by natives or exotics, or be a more-or-less equal mixture.

Regardless of the plant species composition or height, occupied sites almost always have dense vegetation in the patch interior (fig. 6). These dense patches are often interspersed with small openings, open water, or shorter/sparser vegetation, creating a mosaic that is not uniformly dense.

Gila River, Arizona. Photograph by USGS, 2002.

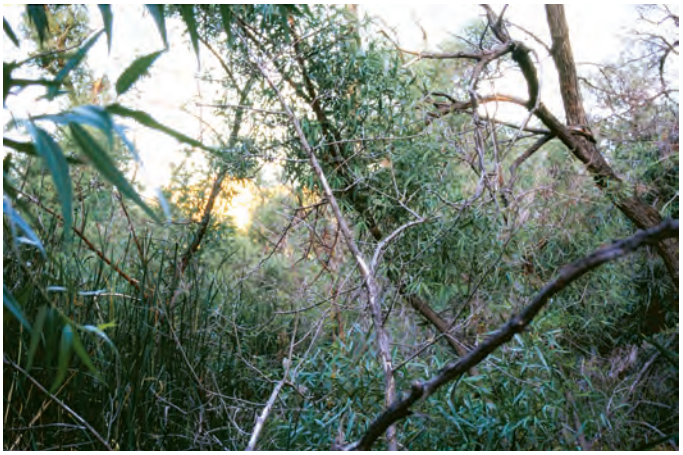
Roosevelt Lake, Arizona. Photograph by USGS, 1999.

Verde River River, Arizona. Photograph by USGS, 2002.

Virgin River, Utah. Photograph by USGS, 1997.

Figure 5. Examples of Southwestern Willow Flycatcher breeding habitat in mixed native/exotic vegetation.

Gila River, Arizona. Photograph by USGS, 2002.



Kern River, California. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Salt River, Arizona. Photograph by USGS, 1999.

Rio Grande, New Mexico. Photograph by USGS, 2007.

Rio Grande, New Mexico. Photograph by USGS, 2005.

Figure 6. Examples of dense vegetation structure within breeding habitats of Southwestern Willow Flycatcher.

Riparian patches used by breeding flycatchers vary in size and shape, ranging from a relatively contiguous stand of uniform vegetation to an irregularly shaped mosaic of dense vegetation with open areas. Southwestern Willow Flycatchers have nested in patches as small as 0.8 ha (for example, in the Grand Canyon) and as large as several hundred hectares (for example, at Roosevelt Lake, Ariz., or Elephant Butte Reservoir, New Mex.). They have only rarely been found nesting in isolated, narrow, linear riparian habitats that are less than 10 m wide, although they will use such linear habitats during migration.

Flycatcher territories and nests typically are adjacent to open water, cienegas, marshy seeps, or saturated soil, and within riparian areas rooted in standing water. However, in the Southwest, hydrological conditions at a site can vary remarkably within a season, between years, and among nearby sites (fig. 7). Surface water or saturated soil may only be present early in the breeding season (that is, May and part of June), especially in dry years. Similarly, vegetation at a patch may be immersed in standing water during a wet year, but be hundreds of meters from surface water in dry years (Ahlers and Moore, 2009). This is particularly true of reservoir sites, such as the Kern River at Lake Isabella, Calif., Tonto Creek and Salt River at Roosevelt Lake, and the Rio Grande near Elephant Butte Reservoir. Natural or human-caused river channel modifications and altered subsurface flows (for example, from agricultural runoff), can lead to a total absence of water or visibly saturated soil at a site for several years.

Other potentially important aspects of Southwestern Willow Flycatcher habitat include distribution and isolation of vegetation patches, hydrology, food base (arthropods), parasites, predators, environmental factors (for example temperature, humidity), and interspecific competition (U.S. Fish and Wildlife Service, 2002). Population dynamics

Rio Grande at San Marcial, New Mexico, with dry substrate. Photograph by USGS, 2007.

Rio Grande at San Marcial, New Mexico, with flowing water beneath the territories. Photograph by USGS, 2007.

Tonto Creek inflow to Roosevelt Lake, Arizona, during a dry year. Photograph by USGS, 2004.

Tonto Creek inflow to Roosevelt Lake, Arizona, during high-water year. Photograph by USGS, 2005.

Figure 7. Examples of the variable hydrologic conditions at breeding habitats of Southwestern Willow Flycatcher.

factors, such as demography (for example, survivorship rates, fecundity), distribution of breeding groups across the landscape, flycatcher dispersal patterns, migration routes, the tendency for adults and surviving young to return to their previous year breeding site, and conspecific sociality also influence where flycatchers are found and what habitats they use (U.S. Fish and Wildlife Service, 2002).

It is critically important to recognize that the ultimate measure of habitat suitability is not simply whether or not a site is occupied. Habitat suitability occurs along a gradient from high to poor to unsuitable; the best habitats are those in which flycatcher reproductive success and survivorship result in a stable or growing population. Some occupied habitats may be acting as population sources, while others may be functioning as population sinks (Pulliam, 1988). Therefore, it can take extensive research to determine the quality of any given habitat patch. Furthermore, productivity and survival rates can vary widely among years (Paxton and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009), so conclusions based on short-term datasets or data extrapolated from one area to another may be erroneous. It also is important to note that not all unoccupied habitat is unsuitable; some sites with suitable habitat may be geographically isolated or newly established, such that they are not yet colonized by breeding flycatchers. There also may simply not be enough flycatchers in a given area to fill all available habitat in particular locations (U.S. Fish and Wildlife Service, 2002). A better understanding of which habitats or sites are sinks or sources can be especially helpful in site conservation and restoration planning.

As described earlier, migrant Willow Flycatchers may occur in riparian habitats that are structurally unsuitable for breeding (for example, too sparse, smaller patch size, etc.), and in non-riparian habitats. Such migration stopover areas, even though not used for breeding, may be critically important resources affecting local and regional flycatcher productivity and survival (U.S. Fish and Wildlife Service, 2002, 2005).

Breeding Chronology and Biology

Unless otherwise noted, the information that follows and upon which the generalized breeding season chronology (fig. 8) is based comes from Unitt (1987), Whitfield (1990), Maynard (1995), Sogge and others (2003b), Paxton and others (2007), Schuetz and Whitfield (2007), and Ellis and others (2008). Extreme or record dates for any stage of the breeding cycle may vary by 1–2 weeks from the dates presented, depending on the geographic area, extreme weather events, yearly variation and other factors. Higher elevation areas, in particular, have delayed chronology (Ahlers and White, 2000).

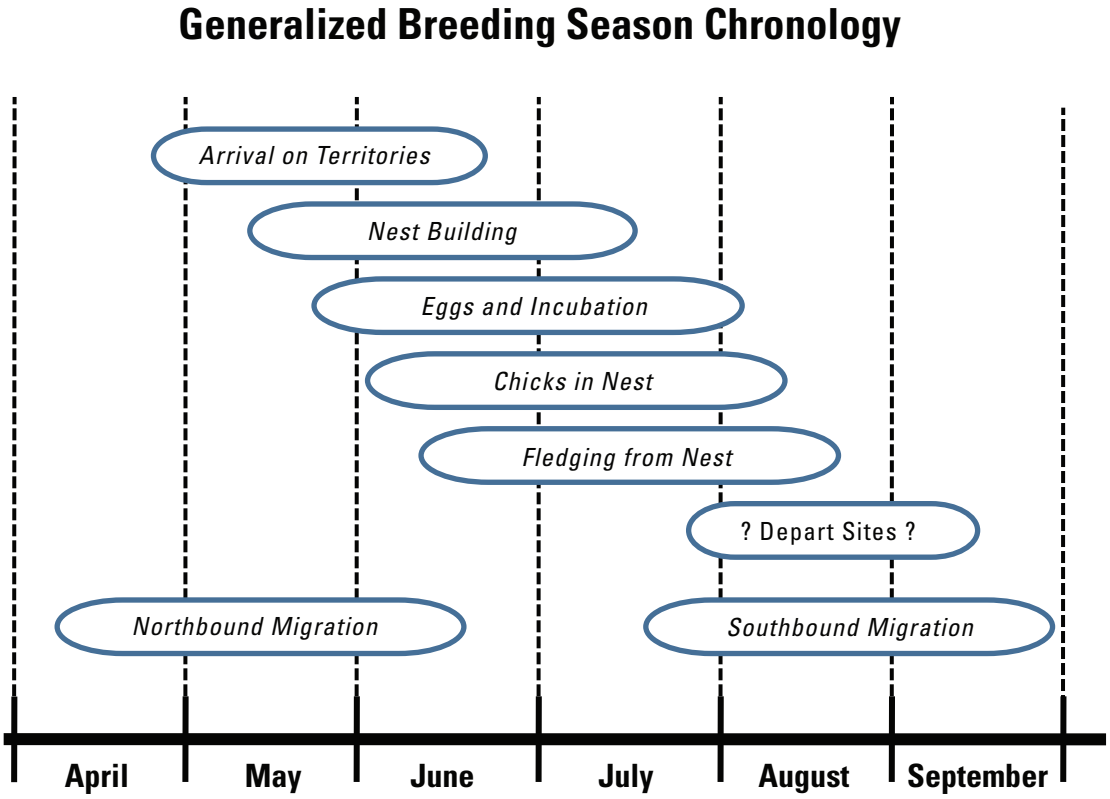


Figure 8. Generalized migration and breeding chronology for the Willow Flycatcher in the Southwest. Extreme or record dates may occur slightly earlier or later than indicated.

Both sexes can breed beginning in their second year. Male Southwestern Willow Flycatchers generally arrive at breeding areas first; older males typically arrive before younger ones. Although females usually arrive a few weeks after males, some older females are present at sites before late-arriving males. Adult flycatchers will sometimes wander extensively through large riparian sites before and after breeding, possibly as a way to evaluate potential breeding habitat (Cardinal and others, 2006).

Males establish and defend their territories through singing and aggressive interactions. Females settle on established territories, and may choose a territory more for its habitat characteristics than for the traits of its territorial male. Territory size tends to be larger when a male first arrives, then gets smaller after a female pairs with the male (Cardinal and others, 2006). Similarly, male song rate is very high early in the season, then declines after pairing (Yard and Brown, 2003). Not all males are successful in attracting mates in a given year, and as a result unpaired territorial males occur at many breeding sites. Unpaired males are usually a small percentage of any local population, but can comprise as much as 15–25 percent of the territories in some populations (Munzer and others, 2005; Ahlers and Moore, 2009).

Although the Willow Flycatcher as a species is considered predominantly monogamous during the breeding season (Sedgwick, 2000), some Southwestern Willow Flycatcher populations have a relatively high degree of polygyny whereby one male can have more than one breeding female in its territory. Polygynous males generally have two females in their territory, but up to four have been recorded (Davidson and Allison, 2003; Pearson and others, 2006). Polygyny rates can vary between sites, and among years at a given site. At some sites, polygynous males have much higher productivity than monogamous males (Paxton and others, 2007).

Nest building within the territory usually begins within a week or two after pair formation. Egg laying begins as early as mid-May, but more often starts in late May to mid-June. Chicks can be present in nests from late May through early August. Young typically fledge from nests from mid-June through mid-August; later fledglings are often products of re-nesting attempts. Breeding adults generally depart from their territories in early to mid-August, but may stay later if they fledged young late in the season. Males that fail to attract or retain mates, and males or pairs that are subject to significant disturbance, such as repeated nest parasitism or predation may leave territories by early July. Fledglings probably leave the breeding areas a week or two after adults, but few details are known.

Southwestern Willow Flycatcher territory size varies widely, probably due to differences in population density, habitat quality (including vegetation density and food availability), and nesting stage. Studies have reported estimated territory sizes ranging from 0.06 to 2.3 ha (Sogge and others, 1995; Whitfield and Enos, 1996; Bureau of Reclamation, 2009). At Roosevelt Lake, Ariz., measurements of home ranges, which include the defended territory and sometimes adjacent use areas, averaged 0.4 ha for actively breeding males; home range can be much larger for pre- and post-breeding males (Paxton and others, 2007). During incubation and nestling phases territory size, or at least the activity centers of pairs, can be very small. Flycatchers may increase their activity area after young are fledged, and use non-riparian habitats adjacent to the breeding area (Cardinal and others, 2006). This variability among sites, individual territories, and over time illustrates the challenge of defining a minimum habitat patch size for breeding flycatchers, or estimating the number of territories based simply on the size of a given breeding site.

At some breeding sites, non-territorial adult "floaters" will be present among the territorial population. Floaters are quieter and less aggressive than territorial adults, and therefore are harder to detect and frequently overlooked. Most floaters are young males, and float for only a single year. At Roosevelt Lake, floaters typically accounted for 3–8 percent of the known adult population, although the rate was much higher in drought years when habitat quality was lower (Paxton and others, 2007). The presence of floaters in a population may indicate that there is not enough high quality habitat to support all potentially territorial individuals present in a given breeding season.

Nests and Eggs

Historically, 75–80 percent of reported Southwestern Willow Flycatcher nests were placed in willows (Phillips, 1948; Phillips and others, 1964; Hubbard, 1987; Unitt, 1987). Southwestern Willow Flycatchers still commonly place their nests in native plants, but will often build nests in exotics, such as saltcedar and Russian olive (Sogge and Marshall, 2000; Stoleson and Finch, 2003; Durst and others, 2008a). In Arizona, most nests are in saltcedar or willows (Paradzick and Woodward, 2003; McLeod and others, 2007). In a unique situation in San Diego County, Calif., the flycatcher nests in coast live oak (*Quercus agrifolia*) along the San Luis Rey River (Haas, 2003), where oak became the dominant plant species adjacent to the river following willow removal in the 1950s. In another unusual situation, flycatchers in the Cliff-Gila Valley in New Mex. nest in tall boxelder (Stoleson and Finch, 2003). Southwestern Willow Flycatcher nests also have been found in buttonbush, black twinberry (*Lonicera involucrata*), Fremont cottonwood (*Populus fremontii*), alder (*Alnus* spp.), blackberry (*Rubus ursinus*), baccharis (*Baccharis* spp.), and stinging nettle (*Urtica* spp.). Overall, flycatcher nest site selection appears to be driven more by plant structure than by species composition.

Southwestern Willow Flycatchers build open cup nests approximately 8 cm high and 8 cm wide (outside dimensions), exclusive of any dangling material at the bottom. Females build the nest with little or no assistance from the males. Nests typically are placed in the fork of a branch with the nest cup supported by several small-diameter vertical stems. Nest height is highly variable and depends on the available plant structure within the territory; nests have been found from 0.6 m to approximately 20 m above ground. In any given habitat type or nest substrate, nests can be placed wherever suitable twig structure and vegetative cover are present.

Egg laying generally begins from mid-May through mid-June, depending on the geographic area and elevation. Willow Flycatcher eggs are buffy or light tan, approximately 18 mm long and 14 mm wide, with brown markings in a wreath at the blunt end. Clutch size is usually three or four eggs for first nests. Only the female develops a brood patch and incubates the eggs. Incubation lasts 12–13 days from the date the last egg is laid, and all eggs typically hatch within 24–48 hours of each other.

Flycatcher chicks are altricial and weigh only about 1–2 g at hatching, but grow rapidly and are ready to leave the nest at 12–15 days of age (Sedgwick, 2000; Paxton and Owen, 2002). The female provides most or all initial care of the young, although the role of the male increases with the age and size of nestlings. After Willow Flycatchers fledge at 12–15 days of age, they stay close to the nest and each other for 3–5 days, and adults continue feeding the fledged young for approximately 2 weeks. Recently fledged birds may repeatedly return to and leave the nest during this period (Spencer and others, 1996). Both male and female adults feed the fledged young, which give frequent, loud "*peep*" calls.

Southwestern Willow Flycatchers readily re-nest following an unsuccessful nesting attempt, although rarely more than once (Ellis and others, 2008). They also will sometimes nest again (double brood) following a successful nesting attempt, although this is more uncommon than re-nesting and varies between sites and years. From 2002 to 2008 at Elephant Butte Reservoir, approximately 13 percent of the pairs produced two successful nests per year (Ahlers and Moore, 2009). The productivity gains from pairs having successful second nests are important drivers of positive population growth (Paxton and others, 2007; Moore and Ahlers, 2009).

Replacement nests are built in the same territory, either in the same plant or at a distance of as much as 20 m from the previous nest. Reuse of old nests is uncommon, but does occur (Yard and Brown, 1999; Darrell Ahlers, Bureau of Reclamation, unpub. data, 2009). Replacement nest building and egg laying can occur (uncommonly) as late as the end of July or early August. Pairs may attempt a third nest if the second fails. However, clutch size, and therefore potential productivity, decreases with each nest attempt (Whitfield and Strong, 1995; Ellis and others, 2008).

Food and Foraging

The breeding season diet of Southwestern Willow Flycatchers is relatively well documented (DeLay and others, 2002; Drost and others, 2003; Durst, 2004; Wiesenborn and Heydon, 2007; Durst and others, 2008b). Breeding flycatchers are exclusively insectivorous, and consume a wide range of prey taxa ranging in size from small leafhoppers (Homoptera) to large dragonflies (Odonata). Major prey taxa include bugs (Hemiptera), bees and wasps (Hymenoptera), flies (Diptera), and leafhoppers; however, diet can vary widely between years and among different habitat types. There is no known differences in diet by sex, but there are differences between adult and nestling diet in the proportions of some arthropod groups. Differences in the composition of arthropods in flycatcher diet have been documented between native and exotic habitats, and between years within particular breeding sites; however, flycatchers appear able to tolerate substantial variation in relative prey abundance, except in extreme situations such as severe droughts (Durst and others, 2008b).

Willow Flycatchers of all subspecies forage primarily by sallying from a perch to perform aerial hawking and gleaning (Sedgwick, 2000; Durst, 2004). Males and females forage with similar maneuvers, although males may forage higher in the tree canopy than females. Foraging frequently takes place at external edges or internal openings within a habitat patch, or at the top of the upper canopy.

Site Fidelity and Survivorship

Based on studies of banded birds, most adult Southwestern Willow Flycatchers that survive from one year to the next will return to the same river drainage, often in proximity to the same breeding site (U.S. Fish and Wildlife Service, 2002; McLeod and others, 2007; Paxton and others, 2007). However, it is common for individual flycatchers to return to different sites within a breeding area, and even to move between breeding areas, from one year to the next. Some of this movement may be related to breeding success and habitat quality. At Roosevelt Lake, those birds that moved to different sites within a breeding area had on average higher productivity in the year following the move than in the year before the move (Paxton and others, 2007). At Roosevelt Lake and on the San Pedro and Gila Rivers, movement out of breeding patches also increased with the relative age of a patch, which may indicate a preference for younger riparian vegetation structure.

In addition to movements within a breeding site, long-distance movements within and between drainages have been observed (Paxton and others, 2007), at distances up to approximately 450 km. Dispersal of first-year flycatchers is more extensive than adult birds, as typical for most bird species.

Survivorship within the breeding season can be very high, averaging 97 percent at Roosevelt Lake (Paxton and others, 2007). Between-year survivorship of adults can be highly variable, but appears to be similar to that of most small passerine birds studied, with estimates generally ranging from approximately 55 to 65 percent (Stoleson and others, 2000; McLeod and others, 2007; Paxton and others, 2007; Schuetz and Whitfield, 2007). Males and females have similar survivorship rates.

Estimated survivorship of young birds (from hatching to the next breeding season) is highly variable, depending in part on how the estimates are generated (Stoleson and others, 2000). Generally reported as between 15 and 40 percent, juvenile survivorship typically is lower than adult survivorship (Whitfield and Strong, 1995; Stoleson and others, 2000; McLeod and others, 2007). Early fledging young have higher survivorship than those that leave the nest later in the season (Whitfield and Strong, 1995; Paxton and others, 2007). Most flycatchers survive for only 1–2 adult years, and mean life expectancy in Arizona was estimated to be 1.9 years following fledging. However, some individuals live much longer. The maximum reported ages of banded Southwestern Willow Flycatchers are 9–11 years (Sedgwick, 2000; Paxton and others, 2007).

Overall, the Southwestern Willow Flycatcher population appears to persist as one or more widely dispersed metapopulations (Busch and others, 2000; U.S. Fish and Wildlife Service, 2002), with movement of individuals, and thus genetic exchange, occurring across the landscape. However, the amount of movement and interchange is lower among sites that are farther apart or more isolated. Some sites serve as population sources while others may be sinks; some sites will be ephemeral over periods of years or decades. Flycatcher movement and dispersal among sites is important for initial site colonization and subsequent recolonization.

There are few general predictors for the persistence of breeding sites. Relatively large populations, such as the Kern River Preserve, San Pedro River, Elephant Butte Reservoir, and the Gila River have persisted for 10 or more years. However, such large sites can be subject to major changes in population numbers, and even potential extirpation, due to changes in local hydrology, site inundation, drought, etc. (Moore, 2005; Paxton and others, 2007). Although some small populations may be ephemeral and last only a few years (Durst and others, 2008a), others have remained occupied for much longer periods (Kus and others, 2003). Breeding populations also may reappear at unoccupied sites following 1–5 year absences. Suitable flycatcher habitat also can develop—and poor quality habitat can improve—relatively quickly in some sites, under favorable hydrological conditions. For example, at Roosevelt Lake and the San Pedro River (AZ), the age of riparian vegetation when first colonized was as young as 3 years (Paxton and others, 2007). In the same study, flycatchers moved back into older habitat patches when nearby younger, occupied habitat was inundated or scoured away.

Overall, the vegetation and flycatcher occupancy of a habitat patch or river drainage are often dynamic; few if any sites remain static over time. The amount of suitable flycatcher habitat can substantially increase or decrease in just a few years, at local and regional scales. Flycatchers can respond quickly to habitat changes, colonizing new sites if available and abandoning others. Therefore, one cannot assume that local, regional, or rangewide flycatcher population numbers will remain stable over time.

Threats to the Flycatcher and Habitat

The greatest historical factor in the decline of the Southwestern Willow Flycatcher is the extensive loss, fragmentation, and modification of riparian breeding habitat (U.S. Fish and Wildlife Service, 2002). Large-scale losses of southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats historically used by the Southwestern Willow Flycatcher (Unitt, 1987; General Accounting Office, 1988; Dahl, 1990; State of Arizona, 1990). Changes in the riparian plant community have frequently reduced, degraded, and eliminated nesting habitat for the flycatcher, curtailing its distribution and abundance.

Habitat losses and changes have occurred and continue to occur because of urban, recreational, and agricultural development, water diversion and impoundment, channelization, livestock grazing, and replacement of native habitats by introduced plant species (Marshall and Stoleson, 2000; U.S. Fish and Wildlife Service, 2002). Hydrological changes, natural or man-made, can greatly reduce the quality and extent of flycatcher habitat. Although riparian areas are often not considered as fire-prone, several Southwestern Willow Flycatcher breeding sites were destroyed by fire over the past decade (U.S. Fish and Wildlife Service, 2002), and others are at risk to similar catastrophic loss. Fire danger in these riparian systems may be exacerbated by increases in exotic vegetation, such as saltcedar, diversions or reductions of surface water, increased recreational activity, and drawdown of local water tables.

Although the degradation of many river systems and associated riparian habitat is a key cause of their absence, Southwestern Willow Flycatchers do not require free-running rivers or “pristine” riparian habitats. Most of the largest

Southwestern Willow Flycatcher populations in the last decade were found in reservoir drawdown zones, such as at Roosevelt Lake and Elephant Butte Reservoir. Many breeding populations are found on regulated rivers (Graf and others, 2002). In addition, the vegetation at many smaller flycatcher breeding sites is supported by artificial water sources such as irrigation canals, sewage outflow, or agricultural drainages (U.S. Fish and Wildlife Service, 2002). Although rising water levels could be detrimental to breeding flycatchers within a reservoir drawdown zone, reservoir fluctuations can simulate river dynamics with cycles of destruction and establishment of riparian vegetation, depositing rich sediments and flushing salt accumulations in the soil (Paxton and others, 2007). Therefore, managed and manipulated rivers and reservoirs have the potential to play a positive role by providing flycatcher breeding habitat. However, because rivers and reservoirs are not managed solely to create and maintain flycatcher habitat, the persistence of riparian vegetation in these systems—and any flycatchers breeding therein—is not assured.

Although the historic degradation and loss of native riparian negatively affected the Southwestern Willow Flycatcher, this species does not show an inherent preference for native vegetation. Instead, breeding habitat selection is based primarily on vegetation structure, density, size, and other stand characteristics, and presence of water or saturated soils (U.S. Fish and Wildlife Service, 2002). In fact, approximately 25 percent of known territories are found in habitat composed of 50 percent or greater exotic vegetative component—primarily saltcedar (Durst and others, 2008a). Saltcedar also can be an important habitat component in sites dominated by native vegetation (U.S. Fish and Wildlife Service, 2002, 2005). Despite suggestions that flycatchers breeding in saltcedar are suffering negative consequences and that removal of saltcedar is therefore a benefit (DeLoach and others, 2000; Dudley and DeLoach, 2004), there is increasing and substantial evidence that this is not the case. For example, Paxton and others (2007) found that flycatchers did not suffer any detectable negative consequences from breeding in saltcedar. This is consistent with the findings of Owen and others (2005) and Sogge and others (2006). Therefore, the rapid or large-scale loss of saltcedar in occupied flycatcher habitats, without rapid replacement of suitable native vegetation, could result in reduction or degradation of flycatcher habitat (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2008).

In evaluating Southwestern Willow Flycatcher use of either native or exotic habitat, it is important to recognize that throughout the Southwest, there are many saltcedar-dominated and native-dominated habitats in which flycatchers do not breed (U.S. Fish and Wildlife Service, 2002; Sogge and others, 2006). Therefore, the use of any riparian patch—native or exotic—as breeding habitat will be site specific and will depend on the spatial, structural, and ecological characteristics of that particular patch and the potential for flycatchers to colonize and maintain populations within it.

Drought can have substantial negative effects on breeding flycatchers and their breeding habitat by reducing riparian vegetation vigor and density, and reducing prey availability (Durst, 2004; Paxton and others, 2007; Bureau of Reclamation, 2009). For example, the extreme drought of 2002 caused near complete reproductive failure of the large flycatcher population at Roosevelt Lake; among approximately 150 breeding territories, only two nests successfully fledged young in that year (Ellis and others, 2008). If future climate change produces more frequent or more sustained droughts, as predicted by many climate change models (for example, Seager and others, 2007), southwestern riparian habitats could be reduced in extent or quality. This scenario would present a challenge to the long-term sustainability of Southwestern Willow Flycatcher populations.

Brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) was initially considered another significant threat to the Southwestern Willow Flycatcher (Whitfield, 1990; Harris, 1991; U.S. Fish and Wildlife Service, 1993, 1995; Whitfield and Strong, 1995; Sferra and others, 1997). Cowbirds lay their eggs in the nest of other species (the "hosts"), which raise the young cowbirds—often at the expense of reduced survivorship of their own young. Southwestern Willow Flycatchers seldom fledge any flycatcher young from nests that are parasitized by cowbirds (Whitfield and Sogge, 1999). Although parasitism negatively impacts some Southwestern Willow Flycatcher populations, especially at small and isolated breeding sites, it is highly variable and no longer considered among the primary rangewide threats to flycatcher conservation (U.S. Fish and Wildlife Service, 2002). Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, not specific to the flycatcher. Therefore, large-scale cowbirds control may not always be warranted unless certain impact thresholds are met (U.S. Fish and Wildlife Service, 2002; Rothstein and others, 2003; Siegle and Ahlers, 2004).

Section 2. Survey Protocol

The fundamental principles of the methodology described in this version have remained the same since the original Tibbitts and others (1994) and subsequent Sogge and others (1997a) protocols: the use of vocalization play-back, repeated site visits, and confirmation of flycatcher identity via the species-characteristic song. This newest protocol incorporates guidelines of the 2000 USFWS addendum, and includes changes based on our improved understanding of Willow Flycatcher biology and the significance of potential threats, and the availability of new survey technologies.

Several factors work together to make Southwestern Willow Flycatcher surveys challenging. Difficulties include the flycatcher's physical similarities with other species and subspecies; accessing the dense habitat they occupy; time constraints based on their breeding period; and vocalization patterns. Given these challenges, no methodology can assure 100-percent detection rates. However, the survey protocol described herein has proven to be an effective tool for locating flycatchers, and flycatchers generally are detectable when the protocol is carefully followed. Since 1995, hundreds of sites have been surveyed and thousands of flycatchers detected using the two previous versions of the survey protocol.

The Willow Flycatcher is 1 of 10 regularly occurring *Empidonax* flycatchers found in North America, all of which look very much alike. Like all *Empidonax*, Willow Flycatchers are nondescript in appearance, making them difficult to see in dense breeding habitat. Although the Willow Flycatcher has a characteristic *fitz-bew* song that distinguishes it from other birds (including other *Empidonax*), Willow Flycatchers are not equally vocal at all times of the day or during all parts of the breeding season. Because Southwestern Willow Flycatchers are rare and require relatively dense riparian habitat, they may occur only in a small area within a larger riparian system, thus decreasing detectability during general bird surveys. Migrating Willow Flycatchers (of all subspecies) often sing during their migration through the Southwest, and could therefore be confused with local breeders. In addition, Southwestern Willow Flycatchers are in breeding areas for only 3–4 months of the year. Surveys conducted too early or late in the year would fail to find flycatchers even at sites where they breed.

These life history characteristics and demographic factors influence how Southwestern Willow Flycatcher surveys should be conducted and form the basis upon which this protocol was developed. This protocol is based on the use of repeated call-playback surveys during pre-determined periods of the breeding season, to confirm presence or to derive a high degree of confidence regarding their absence at a site. Such species-specific survey techniques are necessary to collect reliable presence/absence information for rare species (Bibby and others, 1992).

The primary objective of this protocol is to provide a standardized survey technique to detect Southwestern Willow Flycatchers, determine breeding status, and facilitate consistent and standardized data reporting. The survey technique will, at a minimum, help determine presence or absence of the species in the surveyed habitat for that breeding season. Ultimately, the quality of the survey that is conducted will depend on the preparation, training, and in-the-field diligence of the individual surveyor.

This protocol is designed for use by persons who are non-specialists with *Empidonax* flycatchers or who are not expert birders. However, surveyors must have sufficient knowledge, training, and experience with bird identification and surveys to distinguish the Willow Flycatcher from other non-*Empidonax* species, and be able to recognize the Willow Flycatcher's primary song. A surveyor's dedication and attitude, willingness to work early hours in dense, rugged and wet habitats, and their ability to remain alert and aware of important cues also are important. Surveys conducted improperly or by unqualified, inexperienced, or complacent personnel may lead to inaccurate results and unwarranted conclusions.

Surveys conducted by qualified personnel in a consistent and standardized manner will enable continued monitoring of general population trends at and between sites, and between years. Annual or periodic surveys in cooperation with State and Federal agencies should aid resource managers in gathering basic information on flycatcher status and distribution at various spatial scales. Identifying occupied and unoccupied sites will assist resource managers in assessing potential impacts of proposed projects, avoiding impacts to occupied habitat, identifying suitable habitat characteristics, developing effective restoration management plans, and assessing species recovery.

The earlier versions of this protocol (Tibbitts and others, 1994; Sogge and others, 1997a) were used extensively and successfully for many years. Hundreds of flycatcher surveys conducted throughout the Southwest since 1994 revealed much about the usefulness and application of this survey technique. Three important lessons were: (1) the call-playback technique works and detects flycatchers that would have otherwise been overlooked; (2) multiple surveys at each site are important; and (3) with appropriate effort, general biologists without extensive experience with *Empidonax* can find and verify Willow Flycatcher breeding sites.

This revised protocol is still based on call-playback techniques and detection of singing individuals. However, it includes changes in the timing and number of surveys to increase the probability of detecting flycatchers and to help determine if they are breeders or migrants. It also incorporates the basic premise of the USFWS 2000 addendum to the 1997 protocol by requiring a minimum of five surveys in all "project-related" sites. A detailed description of surveys and

timing is discussed in section, "Timing and Number of Visits." Changes in the survey data sheets make them easier to use and submit, and allow reporting all site visits within a single year on one form. The new survey forms also are formatted such that the data on the respective forms can be easily incorporated into the flycatcher range-wide database.

This protocol is intended to determine if a habitat patch contains territorial Southwestern Willow Flycatchers, and is not designed establish the exact distribution and abundance of flycatchers at a site. Determining precise flycatcher numbers and locations requires many more visits and additional time observing the behavior of individual birds. This survey protocol also does not address issues and techniques associated with nest monitoring or other flycatcher research activities. Those efforts are beyond the scope usually needed for most survey purposes, and require advanced levels of experience and skills to gather useful data and avoid potential negative effects to the flycatcher. If nest monitoring is a required component of your study, refer to Rourke and others (1999) for appropriate nest monitoring techniques (available for download at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/reports.asp).

Biologists who are not expert birders or specialists with regard to *Empidonax* flycatchers can effectively use this protocol. However, users should attend a U.S. Fish and Wildlife Service-approved Southwestern Willow Flycatcher survey training workshop, and have knowledge and experience with bird identification, surveys, and ecology sufficient to effectively apply this protocol.

Permits

Federal endangered species recovery permits are required for surveys in all USFWS regions where the Southwestern Willow Flycatcher breeds (application forms can be downloaded at http://www.fws.gov/forms/3-200-55.pdf). State permits also may be required before you can survey within any of the States throughout the Southwestern Willow Flycatcher's range: be certain to check with the appropriate State wildlife agency in your area. It usually takes several months to receive permits, so apply early to avoid delays in starting your surveys. You also must obtain permission from government agencies and private landowners prior to conducting any surveys on their lands.

Pre-Survey Preparation

The degree of effort invested in pre-survey preparation will have a direct effect on the quality and efficiency of the surveys conducted. Pre-survey preparation is often overlooked, but can prove to be one of the more important aspects in achieving high-quality survey results.

Surveyors should study calls, songs, drawings, photographs, and videos of Willow Flycatchers. Several web sites describe life history requirements, and provide photographs and vocalizations. It is especially critical for surveyors to be familiar with Willow Flycatcher vocalizations before going in the field. Although the *fitz-bew* song is the basis of verifying detections using this protocol, Willow Flycatchers use many other vocalizations that are valuable in locating birds and breeding sites. We strongly encourage that all surveyors learn as many vocalizations as possible and refer to the on-line "Willow Flycatcher Vocalizations; a Guide for Surveyors" (available at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/wiflvocl.asp). Several commercial bird song recordings include Willow Flycatcher vocalizations, but these recordings typically have only a few vocalizations and the dialects may differ from those heard in the Southwest.

If possible, visit known Willow Flycatcher breeding sites to become familiar with flycatcher appearance, behavior, vocalizations, and habitat. Such visits are usually part of the standardized flycatcher survey workshops. All visits should be coordinated with USFWS, State wildlife agencies, and the property manager/owner, and must avoid disturbance to territorial flycatchers. While visiting these sites, carefully observe the habitat characteristics to develop a mental image of the key features of suitable habitat.

Surveyors must be able to identify, by sight and vocalizations, other species likely to be found in survey areas that may be confused with Southwestern Willow Flycatchers. These include Bell's Vireo (*Vireo bellii*), Western Wood-pewee (*Contopus sordidulus*), young or female Vermillion Flycatchers (*Pyrocephalus rubinus*), and other *Empidonax* flycatchers. At a distance, partial song or call notes of Bell's Vireo, Ash-throated Flycatchers (*Myiarchus cinerascens*) and some swallows can sound considerably like a *fitz-bew*. Surveyors also should be able to identify Brown-headed Cowbirds by sight and vocalizations. It is worthwhile to make one or more pre-survey trips to the survey sites or other similar areas to become familiar with the local bird fauna. You might consider obtaining a species list relative to your area and become familiar with those species by site and sound.

Prior to conducting any presence/absence surveys in your respective State or USFWS Region, contact the respective flycatcher coordinators to discuss the proposed survey sites and determine if the sites have been surveyed in prior years. If possible, obtain copies of previous survey forms and maintain consistency with naming conventions and site boundaries. Study the forms to determine if flycatchers have been previously detected in the site, record locations of any previous detections, and read the comments provided by prior surveyors. While surveying, be sure to pay special attention to any patches where flycatchers have previously been detected.

Familiarity with the survey site prior to the first surveys is the best way to be prepared for the conditions you will experience. Determine the best access routes to your sites and always have a back-up plan available in the event of unforeseen conditions (for example, locked gates, weather, etc.). Know the local property boundaries and where the potential hazards may be, including deep water, barbed wire fencing, and difficult terrain. Be prepared to work hard and remain focused and diligent in a wide range of physically demanding conditions. At many sites, these include heat, cold, wading through flowing or stagnant water, muddy or swampy conditions, crawling through dense thickets (often on hands and knees), and exposure to snakes, skunks, and biting insects.

It is imperative that all surveyors exercise the adage "safety first." Be aware of safety hazards and how to avoid them, and do not allow the need to conduct surveys to supersede common sense and safety. Inform your coworkers where you will be surveying and when you anticipate returning. Always take plenty of water and know how to effectively use your equipment, especially compass, Global Positioning System (GPS), and maps.

Equipment

The following equipment is necessary to conduct the surveys:

1. **USGS topographic maps of the area**: A marked copy is required to be attached to survey data sheets submitted at the end of the season. Be sure to always delineate the survey area and clearly mark any flycatcher detections. If the survey area differed between visits; delineate each survey individually.
2. **Standardized survey form**: Always bring more copies than you think you need.
3. **Lightweight audio player**: Be sure the player has adequate volume to carry well; use portable speakers if necessary. Several digital devices, such as CD players and MP3 players, are currently available and can be connected to external amplified speakers for broadcasting the flycatcher vocalizations. However, not all are equally functional or effective in field conditions; durability, reliability, and ease of use are particularly important. Talk to experienced surveyors for recommendations on particular models and useful features.
4. **Extra player and batteries**: In the field, dirt, water, dust, and heat often cause equipment failure, and having backup equipment helps avoid aborting a survey due to equipment loss or failure.
5. **Clipboard and permanent (waterproof) ink pen**: We recommend recording survey results directly on the survey data form, to assure that you collect and record all required data and any field notes of interest.
6. **Aerial photographs**: Aerial photographs can significantly improve your surveys by allowing you to accurately target your efforts, thus saving time and energy in the field. Previously, aerial images were often expensive and difficult to obtain. However, it is now easy to get free or low-cost images from sources, such as Google© Earth. Even moderate resolution images generally are better than none. For higher resolution aerial photographs, check with local planning offices and/or State/Federal land-management agencies for availability. Take color photocopies, not the original aerial photographs, with you in the field. Aerial photographs also are very useful when submitting your survey results but cannot be substituted in lieu of the required topographic map.
7. **Binoculars and bird field guide**: Although this protocol relies primarily on song detections to verify flycatcher presence, good quality binoculars are still a crucial field tool to help distinguish between possible Southwestern Willow Flycatchers and other species. Use a pair with 7–10 power magnification that can provide crisp images in poor lighting conditions. A good field guide also is essential for the same reason.
8. **GPS unit**: A GPS unit is needed for determining survey coordinates and verifying the location of survey plots on topographic maps. All flycatcher detections should be stored as waypoints and coordinates recorded on the survey form. A wide variety of fairly inexpensive GPS units are currently available. Most commercially available units will provide accuracy within 10 m, which is sufficient for navigating and marking locations.
9. **Compass**: Surveyors should carry a compass to help them while navigating larger habitat patches. This is an important safety back-up device, because GPS units can fail or lose power. Most GPS units have a feature to provide an accurate bearing to stored waypoints (for example, previous flycatcher detections, your parked vehicle, etc.); however, many units do not accurately display the direction in which the surveyor is traveling slowly through dense vegetation. A compass set to the proper bearing provides a more reliable method to navigate the survey site and relocate previously marked locations.

The following equipment also is recommended:

10. **Camera:** These are very helpful for habitat photographs, especially at sites where flycatchers are found. Small digital cameras are easily portable and relatively inexpensive.
11. **Survey flagging:** Used for marking survey sites or areas where flycatcher are detected. Check with the local land owner or management agency before flagging sites. Use flagging conservatively so as to not attract people or predators.
12. **Field vest:** A multi-pocket field vest can be very useful for carrying field equipment and personal items. We recommend muted earth-tone colors.

13. **Cell phone and/or portable radio**: In addition to providing an increased level of safety, cell phones or portable radios may be used by surveyors to assist each other in identifying territories and pairs in dense habitats, or where birds are difficult to hear.

In addition to the necessary equipment mentioned above, personal items, such as food, extra water or electrolyte drink, sunscreen, insect repellent, mosquito net, first-aid kit, whistle, and a light jacket, also should be considered. Being prepared for unforeseen difficulties, and remaining as comfortable as conditions allow while surveying are important factors to conducting thorough and effective surveys.

All survey results (both negative and positive) should be recorded directly on data forms when possible. These data forms have been designed to prompt surveyors to record key information that is crucial to interpretation of survey results and characterization of study sites. Even if no flycatchers are detected or habitat appears unsuitable, this is valuable information and should be recorded. Knowing where flycatchers are not breeding can be as important as knowing where they are; therefore, negative data are important. Standardized data forms are provided in appendix 1, or can be downloaded online. Always check for updated forms prior to each year's surveys.

Willow Flycatcher surveys are targeted at this species and require a great deal of focused effort. Surveyors must be constantly alert and concentrate on detecting a variety of flycatcher cues and responses. Therefore, field work, such as generalized bird surveys (for example, point counts or walking transects) or other distracting tasks, should not be conducted in conjunction with Willow Flycatcher surveys. Avoid bringing pets or additional people who are not needed for the survey. Dress in muted earth-tone colors, and avoid wearing bright clothing.

Willow Flycatcher Identification

The Southwestern Willow Flycatcher is a small bird, approximately 15 cm long and weighing about 11–12 g. Sexes look alike and cannot be distinguished by plumage. 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 (juveniles have buffy wing bars) and the eye ring is faint or absent. The upper mandible is dark and the lower mandible light. The tail is not strongly forked. When perched, the Willow Flycatcher often flicks its tail upward. As a group, the *Empidonax* flycatchers are very difficult to distinguish from one another by appearance. The Willow Flycatcher also looks very similar to several other passerine species you may encounter in the field.

Given that Willow Flycatchers look similar to other *Empidonax* flycatchers that may be present at survey sites, the most certain way to verify Willow Flycatchers in the field is by their vocalization. For the purpose of this protocol, identification of Willow Flycatchers cannot be made by sight alone; vocalizations are a critical identification criterion, and specifically the primary song *fitz-bew*. Willow Flycatchers have a variety of vocalizations (see Stein, 1963; Sedgwick, 2000), but two are most commonly heard during surveys or in response to call-playback:

1. ***Fitz-bew***. This is the Willow Flycatcher's characteristic primary song. Note that *fitz-bews* are not unique to the southwestern subspecies; all Willow Flycatchers sing this characteristics song. Male Willow Flycatchers may sing almost continuously for hours, with song rates as high as one song every few seconds. Song volume, pitch, and frequency may change as the season progresses. During prolonged singing bouts, *fitz-bews* are often separated by short *britt* notes. *Fitz-bews* are most often given by a male, but studies have shown female Willow Flycatchers also sing, sometimes quite loudly and persistently (although generally less than males). Flycatchers often sing from the top of vegetation, but also will vocalize while perched or moving about in dense vegetation.
2. ***Whitt***. This is a call often used by nesting pairs on their territory, and commonly is heard even during periods when the flycatchers are not singing (*fitz-bewing*). The *whitt* call appears to be a contact call between sexes, as well as an alarm call, particularly when responding to disturbance near the nest. *Whitt* calls can be extremely useful for locating Willow Flycatchers later in the season when *fitz-bewing* may be infrequent, but are easily overlooked by inexperienced surveyors. When flycatcher pairs have active nests and particularly once young have hatched, *whitts* may be the most noticeable vocalization. However, many species of birds *whitt*, and a *whitt* is not a diagnostic characteristic for Willow Flycatchers. For example, the "*whitt*" of the Black-headed Grosbeak (*Pheucticus melanocephalus*) and Yellow-breasted Chat (*Icteria virens*) are often confused with that of the flycatcher.

The *fitz-bew* and *whitt* calls are the primary vocalizations used to locate Willow Flycatchers. However, other less common Willow Flycatcher vocalizations can be very useful in alerting surveyors to the presence of flycatchers. These include twittering vocalizations typically given during interactions between flycatchers and sometimes between flycatchers and other birds, bill snapping, *britt*'s, and *wheeo*'s. Because these sounds can be valuable in locating territories (Shook and others, 2003), they should be studied prior to going in the field. Willow Flycatcher vocalization recordings are available from Federal and State agency contacts and online at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/. Standardized recordings of Southwestern Willow Flycatchers also are available online at http://www.naturesongs.com/tyrrcert.html#tyrr. Specifically, only *fitz-bews* and *britts* should be used for conducting surveys, to provide more robust comparative results among sites and years.

Willow Flycatcher song rates are highest early in the breeding season (late May–early June), and typically decline after eggs hatch. However, in areas with many territorial flycatchers or where an unpaired flycatcher is still trying to attract a mate, or where re-nesting occurs, singing rates may remain high well into July. Isolated pairs can be much quieter and harder to detect than pairs with adjacent territorial flycatchers. At some sites, pre-dawn singing (0330–0500 hours) appears to continue strongly at least through mid-July (Sogge and others, 1995). Singing rates may increase again later in the season, possibly coinciding with re-nesting attempts (Yard and Brown, 2003). The social dynamics of adjacent territories can strongly influence vocalization rates. A single "*fitz-bew*" from one flycatcher may elicit multiple responses from adjacent territories. When these interactions occur, it is a good opportunity to distinguish among territories and provides the surveyor with an estimate of territory numbers in the immediate area.

There are some periods during which Willow Flycatchers do not sing and even the use of call-playback sometimes fails to elicit any response. This can be particularly true late in the breeding season. Early and repeated surveys are the best way to maximize the odds of detecting a singing flycatcher and determining its breeding status.

Timing and Number of Visits

No survey protocol can guarantee that a Southwestern Willow Flycatcher, if present, will be detected on any single visit. However, performing repeated surveys during the early to mid-nesting season increases the likelihood of detecting flycatchers and aids in determining their breeding status. A single survey, or surveys conducted too early or late in the breeding cycle, do not provide definitive data and are of limited value.

For purposes of this survey protocol, we have divided the Southwestern Willow Flycatcher breeding season into three basic survey periods, and specified a minimum number of survey visits for each period (fig. 9). Although the Sogge and others (1997a) protocol recommended a minimum of one survey in each period, we now recommend a differing number of visits for general surveys versus project-related studies.

General surveys are conducted for the sole purpose of determining whether Willow Flycatchers are present or absent from a respective site, when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. In such cases, a minimum of one survey visit is required in each of the three survey periods.

Project-related surveys are conducted to determine the presence or absence of Willow Flycatchers within a site when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management. Additional surveys are required for project-related studies in order to derive a greater degree of confidence regarding the presence or absence of Willow Flycatchers.

All successive surveys must be at least 5 days apart; surveys conducted more closely are not considered to be separate surveys. Although a minimum of three or five surveys are required for general and project-related purposes, respectively, if the habitat patches are large, contiguous and extremely dense, additional surveys are strongly encouraged to ensure full coverage of the site.

If you are uncertain whether three general surveys or five project-related surveys are required for your respective study, contact your USFWS flycatcher coordinator. As noted earlier, this survey protocol will help determine if territorial flycatchers are present and their approximate locations; if your project requires fine-scale estimates of flycatcher numbers or distribution at a site, you may need to conduct more intensive efforts that include additional surveys, nest searches, and nest monitoring.

Survey Period 1: May 15–31.—For both general and project-related surveys: a minimum of one survey is required. The timing of this survey is intended to coincide with the period of high singing rates in newly arrived males, which tends to begin in early to mid-May. This is one of the most reliable times to detect flycatchers that have established their territories, so there is substantial value to conducting period 1 surveys even though not all territorial males may yet have arrived. Migrant Willow Flycatchers of multiple subspecies will likely be present and singing during this period. Because both migrant and resident Willow Flycatchers are present during this period, and relatively more abundant then in subsequent surveys, it is an excellent opportunity to hone your survey and detection skills and gain confidence in your abilities. Detections of flycatchers during period 1 also provide insight on areas to pay particular attention to during the next survey period.

Survey Period 2: June 1–24.—For general surveys: a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Note that this differs from the minimum of one survey that was recommended in this period under the previous protocol (Sogge and others, 1997a). During this period, the earliest arriving males may already be paired and singing less, but later arriving males should still be singing strongly. Period 2 surveys can provide insight about the status of any flycatchers detected during survey period 1. For example, if a flycatcher is detected during survey period 1 but not survey period 2, the first detection may have been a migrant. Conversely, detecting a flycatcher at the same site during periods 1 and 2 increases the likelihood that the bird is not a migrant, although it does not necessarily confirm it. Survey period 2 also is the earliest time during which you are likely to find nesting activity by resident birds at most sites. Special care should be taken during this period to watch for activity that will verify whether the flycatchers that are present are attempting to breed. A little extra time and diligence should be spent at all locations where flycatchers were detected during survey period 1.

Survey Visit Timing, Numbers, and Detection Interpretation

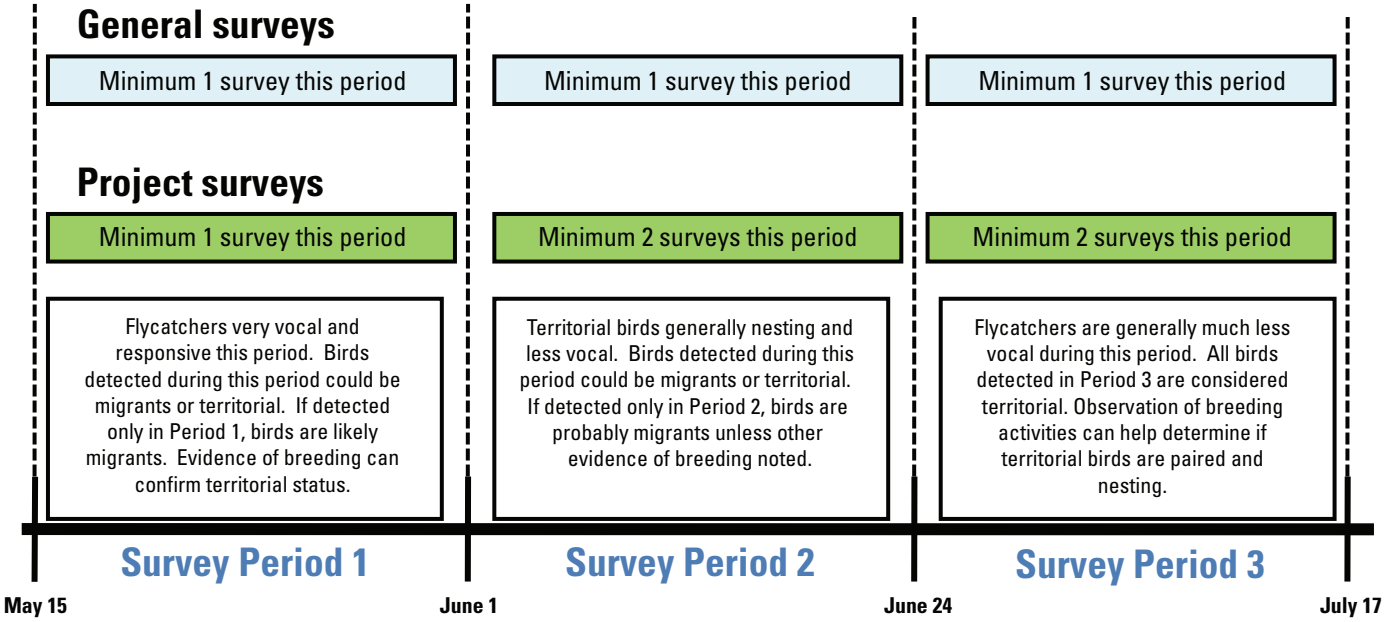


Figure 9. Recommended numbers and timing of visits during each survey period for general surveys and project surveys. General surveys are those conducted when there is no foreseeable direct or indirect impact to their habitat from a known potential project or change in site management. Project-related surveys are conducted when there is a potential or foreseeable impact to their habitat due to a potential project or change in site management.

Survey Period 3: June 25–July 17.—For general surveys, a minimum of one survey is required. For project-related surveys, a minimum of two surveys are required. Virtually all Southwestern Willow Flycatchers should have arrived on their territories by this time. Flycatcher singing rates probably have lessened, and most paired flycatchers will have initiated or even completed their first round of nesting activity. Migrant Willow Flycatchers should no longer be passing through the Southwest; therefore, any flycatchers that you detect are likely to be either territorial or nonbreeding floaters. Surveyors should determine if flycatchers detected during surveys in periods 1 or 2 are still present, and watch closely for nesting activity. Flycatchers that have completed a first nesting attempt may resume vigorous singing during this period. Extra time and diligence should be spent at all locations where flycatchers were detected during survey periods 1 or 2.

At high elevation sites (above 2,000 m), Southwestern Willow Flycatcher arrival and initiation of breeding activities may occur in early June, and possibly later in some years due to weather or migration patterns. Therefore, flycatcher breeding chronology may be delayed by 1 or 2 weeks at such sites, and surveys should be conducted in the latter part of each period.

It may not require multiple surveys to verify Southwestern Willow Flycatcher presence or breeding status. If, for example, Willow Flycatchers are observed carrying nest material during survey periods 1 or 2, this is conclusive verification they are breeders as opposed to migrants, regardless of what is found during period 3. However, it requires a minimum of three surveys for general studies and five surveys for project-related studies to determine with relative confidence that Southwestern Willow Flycatchers probably are not breeding at a site in that year, based on lack of detections.

We strongly encourage additional follow-up surveys to sites where territorial Southwestern Willow Flycatchers are verified or suspected. Extra surveys provide greater confidence about presence or absence of flycatchers at a site, as well as help in estimating the number of breeding territories or pairs, and determining breeding status and the outcome of breeding efforts. Pre-survey visits the evening before the survey or post-survey follow-up later in the morning can help confirm breeding status when surveyors are not under time constraints. However, avoid returning to a site so often as to damage the habitat, establish or enlarge trails, or cause undue disturbance to the flycatchers.

Survey Methods

The survey methods described below fulfill the primary objectives of documenting the presence or absence of Willow Flycatchers, and determining their status as territorial versus migrant. This protocol primarily is a call-playback technique, a proven method for eliciting response from nearby Willow Flycatchers (Seutin, 1987; Craig and others, 1992), both territorial and migrants. The premise of the call-playback technique is to simulate a territorial intrusion by another Willow Flycatcher, which generally will elicit a defensive response by the territorial bird, increasing its detectability. At each site, surveyors should broadcast a series of recorded Willow Flycatcher *fitz-bews* and *britts*, and look and listen for responses. In addition to maximizing the likelihood of detecting nearby flycatchers, this method also allows for positive identification by comparing the responding bird's vocalizations to the known Willow Flycatcher recording.

Documenting Presence/Absence—Begin surveys as soon as there is enough light to safely walk (about 1 hour before sunrise) and end by about 0900–1030 hours, depending on the temperature, wind, rain, background noise, and other environmental factors. Use your best professional judgment whether to conduct surveys that day based on local field conditions. If the detectability of flycatchers is being reduced by environmental factors, surveys planned for that day should be postponed until conditions improve. If observers are camped in or near potential Willow Flycatcher habitat, afternoons and evenings can be spent doing site reconnaissance and planning a survey strategy for the following morning. If camped immediately adjacent to survey sites, surveyors can awaken early and listen for flycatchers singing during the predawn period (0330–0500 hours), when territorial males often sing loudly.

Conduct surveys from within rather than from the perimeter of the sites, while limiting the breaking of vegetation or damaging the habitat. If surveys cannot be conducted from within the habitat, walk along the perimeter and enter the patch at intervals to broadcast the vocalizations and listen for responses. Flycatchers often respond most strongly if the recording is played from within the habitat and territory, rather than from the periphery. In addition, it can be surprisingly difficult to hear singing Willow Flycatchers that are even a short distance away amidst the noise generated by other singing and calling birds, roads, noisy streams, and other extraneous sounds. Therefore, it is preferable to survey from within the habitat, but always move carefully to avoid disturbing habitat or nests. Surveying from the periphery should not be conducted only for the sake of convenience, but is allowable for narrow linear reaches or when absolutely necessary due to safety considerations.

Because flycatchers may be clustered within only a portion of a habitat patch, it is critical to survey all suitable habitat within the patch. Small linear sites may be thoroughly covered by a single transect through the patch. For larger sites, choose a systematic survey path that assures complete patch coverage throughout the length and breadth of the site. This may require multiple straight transects, serpentine, zig-zag, or criss-cross routes. Aerial photographs and previous survey forms are valuable tools to help plan and conduct surveys, and to assure complete coverage. Always move carefully through the habitat to avoid disturbing vegetation or nests.

Initially approach each site and stand quietly for 1–2 minutes or longer, listening for spontaneously singing flycatchers. A period of quiet listening is important because it helps acclimate surveyors to background noises that can be quite loud due to roads, aircraft, machinery, waterways, and other sounds. It also allows surveyors to recognize and shift attention away from the songs and calls of other bird species, letting them focus on listening for flycatchers. Although it happens rarely, some singing Willow Flycatchers will actually stop vocalizing and approach quietly in response to a broadcast song, perhaps in an effort to locate what they perceive as an intruding male. Therefore, playing a recording before listening for singing individuals has at least some potential of reducing detectability.

If you do not hear singing flycatchers during the initial listening period, broadcast the Willow Flycatcher song recording for 10–15 seconds; then listen for approximately 1 minute for a response. Repeat this procedure (including a 10-second quiet pre-broadcast listening period) every 20–30 m throughout each survey site, more often if background noise is loud. The recording should be played at about the volume of natural bird calls, and not so loud as to cause distortion of the broadcast. We recommend that the playback recording include a series of *fitz-bews* interspersed with several *britts*.

Response to the broadcast call could take several forms. Early in the breeding season (approximately May–mid-June), a responding Willow Flycatcher will usually move toward the observer and *fitz-bew* or *whitt* from within or at the top of vegetation. Territorial Willow Flycatchers almost always vocalize strongly when a recording is played in their territory early in the season. If there are several flycatchers present in an area, some or all may start singing after hearing the recording or the first responding individual. Flycatchers can often hear the recording from far away but will not usually move outside of their territory, so listen for distant responses. Also, stay alert and listen for flycatchers vocalizing behind you that may not have responded when you were first in their territory. Another common flycatcher response is alarm calls (*whitts*) or interaction twitters from within nearby vegetation, particularly once nesting has begun. Willow Flycatchers will often sing after a period of *whitting* in response to a recording, so surveyors hearing *whitts* should remain in the area and quietly listen for *fitz-bews* for several minutes. Because some flycatchers may initially respond by approaching quietly, particularly during periods 2 and 3, it is critical to watch carefully for responding birds.

If you detect flycatchers that appear particularly agitated, it is possible that you are in close proximity to their nest. Agitated flycatchers may swoop down at the surveyor, snap their beaks, and otherwise appear distressed. Exercise extreme caution so as to not accidently disturb the nest, and move slowly away from the immediate area.

For the purpose of this protocol, detection of a *fitz-bew* song is essential to identify a bird as a Willow Flycatcher. Similar appearing species (including other *Empidonax* flycatchers) occur as migrants, and even breeders, at potential Willow Flycatcher sites. A few of these other species may even approach a broadcast Willow Flycatcher song and respond with vocalizations. In order to standardize interpretation of survey results and assure a high degree of confidence in surveys conducted by biologists of varying experience and skill, positive identification must be based on detection of the Willow Flycatcher's most unique characteristic—its song. It is important to remember that the *whitt* call is not unique to Willow Flycatchers, and therefore cannot serve as the basis of a positive identification. However, *whitts* are extremely useful for locating flycatchers and identifying areas needing follow-up visits. Loud, strong *whitting* may indicate a nearby nest, dictating that surveyors exercise extra caution moving through the area.

Whenever a verified or suspected Willow Flycatcher is detected, be careful not to overplay the song recording. Excessive playing could divert the bird from normal breeding activities or attract the attention of predators and brood parasites. Wildlife management agencies may consider overplaying the recording as "harassment" of the flycatcher, and this is not needed to verify species identification. Although flycatchers usually sing repeatedly once prompted, even a single *fitz-bew* is sufficient for verification. If you have played a recording several times and a bird has approached but has not *fitz-bewed*, do not continue playing the recording. If a potential Willow Flycatcher responds, approaches or *whitts* but does not sing, it is best to carefully back away and wait quietly. If it is a Willow Flycatcher, it probably will sing within a short time (5–10 minutes). Another option is to return to the same site early the following morning to listen for or attempt to elicit singing again. If you are still uncertain, record the location with your GPS, record comments on the survey form, and follow-up on the detection during subsequent surveys. If possible, request the assistance of an experienced surveyor to determine positive identification.

If more habitat remains to be surveyed, continue onward once a flycatcher is detected and verified. In doing so, move 30–40 m past the current detection before again playing the recording, and try to avoid double-counting flycatchers that have already responded. Willow Flycatchers, particularly unpaired males, may follow the broadcast song for 50 m or more.

Looking For and Recording Color Bands.—Several research projects have involved the capture and banding of Willow Flycatchers at breeding sites across the Southwest. In such projects, flycatchers are banded with one or more small colored leg bands, including a federal numbered band. As a result, surveyors may find color-banded individuals at their survey sites, and identification and reporting of the band combination can provide important data on flycatcher movements, survivorship, and site fidelity.

To look for bands, move to get a good view of the flycatcher's legs. This may be difficult in dense vegetation, but flycatchers commonly perch on more exposed branches at the edges of their territory or habitat patch. If bands are seen, carefully note the band colors. If there is more than one band on a leg, differentiate the top (farthest up the leg) from the bottom (closest to the foot), and those on the bird's left leg versus the right leg. If you are unsure of the color, do not guess. Instead, record the color as unknown. Incorrect color-band data are worse than incomplete data, so only record colors of which you are certain. The fact that a banded bird was seen, even without being certain of its color combination, is very important information. Record the color-band information on the survey form, and report the sighting to the appropriate State or Federal contact as soon as you return from the survey that day.

Determining the Number of Territories and Pairs.—Accurately determining the number of breeding territories and pairs can be more difficult than determining simple presence or absence. Flycatcher habitat is usually so dense that visual detections are difficult, and seeing more than one bird at a time is often impossible. Flycatchers sing from multiple song perches within their territories, and may be mistaken for more than one flycatcher. A flycatcher responding to or following a surveyor playing a recording may move considerable distances in a patch and thus be counted more than once. Territorial male flycatchers often sing strongly, but so do many migrants and some females, particularly in response to call-playback (Seutin, 1987; Unitt, 1987; Sogge and others, 1997b). Rangewide, many territorial male flycatchers are unmated, particularly those in small breeding groups. For these reasons, each singing flycatcher may not represent a territory or a mated pair. Following the established survey protocol and carefully observing flycatcher behavior can help determine if you have detected migrants, territorial birds, breeders, unmated birds, or pairs.

Given sufficient time, effort and observation, it is usually possible to approximate the number of territories and pairs. First, listen carefully for simultaneously singing flycatchers. Note the general location of each bird—especially concurrently singing individuals—on aerial photographs, map, or a site sketch. Spend some time watching each flycatcher to determine approximate boundaries of its territory, and how it interacts with other flycatchers. If one or more singing

birds stay primarily in mutually exclusive areas, they can be considered as separate territories. To determine if a flycatcher is paired, watch for interactions within a territory. Refer to the section, "Determining Breeding Status" for signs of pairing and breeding activity. Do not report a territorial male as a pair unless you observe one or more of the signs listed below. In some cases, it may be possible only to estimate the number of singing individuals. In other cases, it may take multiple site visits to differentiate territories or pairs.

Determining Breeding Status.—One way to determine if the flycatchers found at a particular site are migrants or territorial is to find out if they are still present during the "non-migrant" period, which generally is from about June 15 to July 20 (Unitt, 1987). A Willow Flycatcher found during this time probably is a territorial bird, although there is a small chance it could be a non-territorial floater (Paxton and others, 2007). If the management question is simply whether the site is a potential breeding area, documenting the presence of a territorial flycatcher during the non-migrant period may meet all survey objectives, and the site may not need to be resurveyed during the remainder of that breeding season.

However, in some cases, surveyors will be interested in knowing not only if territorial Southwestern Willow Flycatchers are present at a site, but also whether breeding or nesting efforts are taking place. Some males maintain territories well into July yet never succeed in attracting a mate, so unpaired males are not uncommon (McLeod and others, 2007; Ellis and others, 2008; Ahlers and Moore, 2009). Thus, an assumption that each singing male represents a breeding pair may not be well founded, especially in small populations. If it is important to determine whether a pair is present and breeding in that territory, move a short distance away from where the bird was sighted, find a good vantage point, and sit or lie quietly to watch for evidence of breeding. Signs of breeding activity include:

a. observation of another unchallenged Willow Flycatcher in the immediate vicinity (indicates possible pair);
b. *whitt* calls between nearby flycatchers (indicates possible pair);
c. interaction twitter calls between nearby flycatchers (indicates possible pair);
d. countersinging or physical aggression against another flycatcher or bird species (suggests territorial defense);
e. physical aggression against cowbirds (suggests nest defense);
f. observation of Willow Flycatchers copulating (verifies attempted breeding);
g. flycatcher carrying nest material (verifies nesting attempt, but not nest outcome);
h. flycatcher carrying food or fecal sac (verifies nest with young, but not nest outcome);
i. locating an active nest (verifies nesting). Recall that general survey permits do not authorize nest searching or monitoring, and see section, "Special Considerations";
j. observation of adult flycatchers feeding fledged young (verifies successful nesting).

You may be able to detect flycatcher nesting activity, especially once the chicks are being fed. Adults feed chicks at rates of as many as 30 times per hour, and the repeated trips to the nest tree or bush are often quite evident. Be sure to note on the flycatcher survey form any breeding activity that is observed, including detailed descriptions of the number of birds, and specific activities observed. Also note the location of breeding activities on an aerial photograph, map, or sketch of the area.

The number of flycatchers found at a site also can provide a clue as to whether they are migrants or territorial birds. Early season detections of single, isolated Willow Flycatchers often turn out to be migrants. However, discovery of a number of Willow Flycatchers at one site usually leads to verification that at least some of them remain as local breeders. This underscores the importance of completing a thorough survey of each site to be confident of the approximate number of flycatchers present.

In some cases, regardless of the time and diligence of your efforts, it will be difficult to determine the actual breeding status of a territorial male. In these instances, use your best professional judgment, or request the assistance of an experienced surveyor or an agency flycatcher coordinator to interpret your observations regarding breeding status.

Reporting Results.—There is little value in conducting formal surveys if the data are not recorded and submitted. Fill in all appropriate information on the Willow Flycatcher survey form while still in the field, and mark the location of detections on a copy of the USGS topographic map. Make a habit of reviewing the form before you leave any site—trying to remember specific information and recording it later can lead to missing and inaccurate data. Note the location of the sighting on an aerial photograph or sketch of the site. Attaching photographs of the habitat also is useful. Whenever a Willow Flycatcher territory or nest site is confirmed, notify the USFWS or appropriate State wildlife agency as soon as you return from the field. The immediate reporting of flycatcher detections or nests may differ among USFWS regions and States—discuss these reporting procedures with your respective State and USFWS flycatcher coordinators.

Complete a survey form (appendix 1) for each site surveyed, whether or not flycatchers are detected. "Negative data" (that is, a lack of detections) are important to document the absence of Willow Flycatchers and help determine what areas have already been surveyed. Make and retain a copy of each survey form, and submit the original or a legible copy. Electronic copies of the survey forms also are acceptable and are available online (http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/). All survey forms must be submitted to the USFWS and the appropriate State wildlife agency by the specified deadline identified in your permits. Timely submission of survey data is a permit requirement, and will ensure the information is included in annual statewide and regional reports.

Special Considerations

To avoid adverse impacts to Willow Flycatchers, follow these guidelines when performing all surveys:

1. Obtain all necessary Federal, State, and agency permits and permissions prior to conducting any surveys. Failure to do so leaves you liable for violation of the Endangered Species Act, various State laws, and prosecution for trespass.
2. Do not play the recording more than necessary or needlessly elicit vocal responses once Willow Flycatchers have been located and verified. This may distract territorial birds from caring for eggs or young, or defending their territory. If flycatchers are vocalizing upon arrival at the site, and your objective is to determine their presence or absence at a particular site—there is no need to play the recording. Excessive playing of the recording also may attract the attention of predators or brood parasites. Stop playing the survey recording as soon as you have confirmed the presence of a Willow Flycatcher, and do not play the recording again until you have moved 30–40 m to the next survey location.
3. Proceed cautiously while moving through Willow Flycatcher habitat. Continuously check the area around you to avoid disturbance to nests of Willow Flycatchers and other species. Do not break understory vegetation, even dead branches, to create a path through the surveyed habitat.
4. Do not approach known or suspected nests. Nest searches and monitoring require specific State and Federal permits, have their own specialized methodologies (Rourke and others, 1999), and are not intended to be a part of this survey protocol.
5. If you find yourself close to a known or suspected nest, move away slowly to avoid startling the birds or force-fledging the young. Avoid physical contact with the nest or nest tree, to prevent physical disturbance and leaving a scent. Do not leave the nest area by the same route that you approached. This leaves a “dead end” trail that could guide a potential predator to the nest/nest tree. If nest monitoring is a component of the study, but you are not specifically permitted to monitor the nest, store a waypoint with your GPS, affix flagging to a nearby tree at least 10 m away, and record the compass bearing to the nest on the flagging. Report your findings to an agency flycatcher coordinator or a biologist who is permitted to monitor nests.
6. If you use flagging to mark an area where flycatchers are found, use it conservatively and make certain the flagging is not near an active nest. Check with the property owner or land-management agency before flagging to be sure that similar flagging is not being used for other purposes in the area. Unless conducting specific and authorized/permitted nest monitoring, flagging should be placed no closer than 10 m to any nest. Keep flagging inconspicuous from general public view to avoid attracting people or animals to an occupied site, and remove it at the end of the breeding season.
7. Watch for and note the presence of potential nest predators, particularly birds, such as Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), jays, and magpies. If such predators are in the immediate vicinity, wait for them to leave before playing the recording.
8. Although cowbird parasitism is no longer considered among the primary threats to flycatcher conservation it remains useful to note high concentrations of cowbirds in the comment section of the survey form. While conducting surveys, avoid broadcasting the flycatcher vocalizations if cowbirds are nearby, especially if you believe you may be close to an active flycatcher territory. The intent of not broadcasting flycatcher vocalizations is to reduce the potential for attracting cowbirds to a flycatcher territory or making flycatcher nests more detectable to cowbirds.
9. Non-indigenous plants and animals can pose a significant threat to flycatcher habitat and may be unintentionally spread by field personnel, including those conducting flycatcher surveys. Simple avoidance and sanitation measures can help prevent the spread of these organisms to other environments. To avoid being a carrier of non-indigenous plants or animals from one field site to another visually inspect and clean your clothing, gear, and vehicles before moving to a different field site. A detailed description on how to prevent and control the spread of these species is available by visiting the Hazard Analysis and Critical Control Point Planning for Natural Resource Management web site (http://www.haccp-nrm.org). One species of particular interest is the tamarisk leaf-beetle (*Diorhabda* spp.). If you observe defoliation of saltcedar while conducting flycatcher surveys and believe that *Diorhabda* beetles may be responsible, notify your USFWS coordinator immediately. Other non-native species of concern in survey locations are the quagga mussel (*Dreissena rostriformis bugensis*), cheatgrass (*Bromus tectorum*), red brome (*Bromus rubens*), giant salvinia (*Salvinia molesta*), water milfoil (*Myriophyllum spicatum*), parrot’s feather (*M. aquaticum*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

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References Cited

Ahlers, D., and White, L., 2000, 1999 Willow Flycatcher survey results: Fish Creek and Gooseberry Creek drainages, Utah: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Ahlers, D., and Moore, D., 2009, A review of vegetation and hydrologic parameters associated with the Southwestern Willow Flycatcher – 2002-2008, Elephant Butte Reservoir Delta, NM: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Allison, L.J., Paradzick, C.E., Rourke, J.W., and McCarthey, T.C., 2003, A characterization of vegetation in nesting and non-nesting plots for Southwestern Willow Flycatchers in central Arizona: Studies in Avian Biology, v. 26, p. 81–90.

Arizona Game and Fish Department, 2006, DRAFT, Arizona's Comprehensive Wildlife Conservation Strategy–2005-2015: Arizona Game and Fish Department, Phoenix, Arizona. (Also available at http://www.azgfd.gov/pdfs/w_c/cwcs/downloads/CWCS_Final_May2006.pdf.)

Bibby, C.J., Burgess, N.D., and Hill, D.A., 1992, Bird census techniques: Academic Press, London, U.K.

Browning, M.R., 1993, Comments on the taxonomy of *Empidonax traillii* (Willow Flycatcher): Western Birds, v. 24, p. 241–257.

Busch, J.D., Miller, M.P., Paxton, E.H., Sogge, M.K., and Keim, P., 2000, Genetic variation in the endangered Southwestern Willow Flycatcher: Auk, v. 117, p. 586–595.

California Department of Fish and Game, 1991, Endangered and threatened animals of California: State of California, The Resources Agency, Department of Fish and Game, Sacramento, California, 5 p.

Cardinal, S.N., Paxton, E.H., and Durst, S.L., 2006, Home range, movement, and habitat use of the Southwestern Willow Flycatcher, Roosevelt Lake, AZ—2005: U.S. Geological Survey report to the Bureau of Reclamation, Phoenix, AZ, 21 p.

Craig, D., Schlorff, R.W., Valentine, B.E., and Pelles, C., 1992, Survey protocol for Willow Flycatchers (*Empidonax traillii*) on National Forest Service lands in the Pacific Southwest region: U.S. Forest Service Region 5, Vallejo, CA.

Dahl, T.E., 1990, Wetlands losses in the United States, 1780s to 1980s: U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 13 p.

Davidson, R.F., and Allison, L.J., 2003, Effects of monogamy and polygyny on reproductive success in Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in Arizona: Studies in Avian Biology, v. 26, p. 118–124.

DeLay, L.S., Stoleson, S.H., and Farnsworth M., 2002, A quantitative analysis of the diet of Southwestern Willow Flycatchers in the Gila Valley, New Mexico: Final report to T&E Inc., accessed July 28, 2008, at http://sbsc.wr.usgs.gov/cprs/research/projects/swwf/Reports/NM_SWWF_Diet_Report_2002.pdf.

DeLoach, C.J., Carruthers, R.I., Lovich, J., Dudley, T.L., and Smith, S.D., 2000, Ecological interactions in the biological control of saltcedar (*Tamarix* spp.) in the U.S.: Toward a new understanding, *in* Spencer, N.R., ed., Proceedings of X International Symposium on Biological Control, July 1999, Montana State University, Bozeman, p. 819–874.

Drost, C.A., Paxton, E.H., Sogge, M.K., and Whitfield, M.J., 2003, Food habits of the Southwestern Willow Flycatcher at the Kern River, California: Studies in Avian Biology, v. 26, p. 96-103.

Dudley, T.L., and DeLoach, C.J., 2004, Saltcedar (*Tamarix* spp.), endangered species, and biological weed control—can they mix?: Weed Technology, v. 18, p. 1542–1551.

Durst, S.L., 2004, Southwestern Willow Flycatcher potential prey base and diet in native and exotic habitats: Flagstaff, Arizona, Northern Arizona University, M.S. Thesis, 86 p.

Durst, S.L., Theimer, T.C., Paxton, E.H., and Sogge, M.K., 2008a, Age, habitat, and yearly variation in the diet of a generalist insectivore, the Southwestern Willow Flycatcher: Condor, v. 110, p. 514-525.

Durst, S.L., Sogge, M.K., Stump, S.D., Walker, H.A., Kus, B.E., and Sferra S.J., 2008b, Southwestern Willow Flycatcher breeding sites and territory summary—2007: U.S. Geological Survey Open-File Report 2008-1303, 31 p. (Also available at http://pubs.usgs.gov/of/2008/1303.)

Ellis, L.A., Weddle, D.M., Stump, S.D., English, H.C., and Graber, A.E., 2008, Southwestern Willow Flycatcher final survey and monitoring report: Arizona Game and Fish Department, Research Technical Guidance Bulletin #10, Phoenix, Arizona, USA.

Finch, D.M., Kelly, J.F., and Cartron, J.E., 2000, Chapter 7: Migration and Winter Ecology, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 71-82.

General Accounting Office, 1988, Public rangelands: Some riparian areas restored but widespread improvement will be slow: General Accounting Office, U.S. Government, Washington, D.C.

Graf, W.L., Stromberg, J., and Valentine, B., 2002, Rivers, dams, and Willow Flycatchers: A summary of their science and policy connections: Geomorphology, v. 47, p. 169–188.

Haas, W.E., 2003, Southwestern Willow Flycatcher field season 2002 data summary: Varanus Biological Services, Inc., San Diego, CA.

Harris, J.H., 1991, Effects of brood parasitism by Brown-headed Cowbirds on Willow Flycatcher nesting success along the Kern River, California: Western Birds, v. 22, no. 1, p. 13-26.

Hatten, J.R., and Paradzick, C.E., 2003, A multiscaled model of Southwestern Willow Flycatcher breeding habitat: Journal of Wildlife Management, v. 67, p. 774–788.

Hatten, J.R., and Sogge, M.K., 2007, Using a remote sensing/GIS model to predict Southwestern Willow Flycatcher breeding habitat along the Rio Grande, New Mexico: U.S. Geological Survey Open-File Report 2007-1207, 27 p. (Also available at http://pubs.usgs.gov/of/2007/1207.)

Hubbard, J.P., 1987, The status of the Willow Flycatcher in New Mexico: Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, New Mexico, 29 p.

Hubbard, J.P., 1999, A critique of Wang Yong and Finch's field-identifications of Willow Flycatcher subspecies in New Mexico: Wilson Bulletin, v. 11, p. 585-588.

Koronkiewicz, T.J., 2002, Intraspecific territoriality and site fidelity of wintering Willow Flycatchers (*Empidonax traillii*) in Costa Rica: Flagstaff, Arizona, Northern Arizona University, M.S. thesis, 73 p.

Koronkiewicz, T.J., and Sogge, M.K., 2000, Willow Flycatcher (*Empidonax traillii*) winter ecology study–Costa Rica 1999/2000: U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center/Colorado Plateau Research Station report.

Koronkiewicz, T.J., McLeod, M.A., Brown, B.T., and Carothers, S.W., 2006a, Southwestern Willow Flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2005: Annual report submitted to Bureau of Reclamation, Boulder City, NV by SWCA Environmental Consultants, Flagstaff, AZ.

Koronkiewicz, T.J., Sogge, M.K., van Riper, C., and Paxton, E.H., 2006b, Territoriality, site fidelity, and survivorship of Willow Flycatchers Wintering in Costa Rica: Condor, v. 108, p. 558-570.

Koronkiewicz, T.J., and Whitfield, M.J., 1999, Winter ecology of the Southwestern Willow Flycatcher: San Diego Natural History Museum and Kern River Research Center report.

Kus, B.E., Beck, P.P., and Wells, J.M., 2003, Southwestern Willow Flycatcher populations in California: distribution, abundance, and potential for conservation: Studies in Avian Biology, v. 26, p. 12-21.

Lynn, J.C., Koronkiewicz, T.J., Whitfield M.J., and Sogge, M.K., 2003, Willow Flycatcher winter habitat in El Salvador, Costa Rica, and Panama—Characteristics and threats: Studies in Avian Biology, v. 26, p. 41-51.

Marshall, R.M., and Stoleson, S.H., 2000—Chapter 3: Threats, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 13–24.

Maynard, W.R., 1995, Summary of 1994 survey efforts in New Mexico for Southwestern Willow Flycatcher (*Empidonax traillii extimus*): New Mexico Department of Game and Fish, Santa Fe, NM, Contract #94-516-69, 48 p.

McLeod, M.A., Koronkiewicz, T.J., Brown, B.T., and Carothers, S.W., 2007, Southwestern Willow Flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries, 2006: Annual report submitted to Bureau of Reclamation, Boulder City, Nevada by SWCA Environmental Consultants, Flagstaff, AZ, 194 p.

Moore, D., 2005, Status and monitoring of Southwestern Willow Flycatchers within Elephant Butte Reservoir, New Mexico: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Moore, D., 2007, Vegetation quantification of Southwestern Willow Flycatcher nest sites: Rio Grande from La Joya to Elephant Butte Reservoir Delta, New Mexico, 2004-2006: Bureau of Reclamation, Technical Service Center, Denver, CO.

Moore, D., and Ahlers, D., 2009, 2008 Southwestern Willow Flycatcher study results: selected sites along the Rio Grande from Velarde to Elephant Butte Reservoir, New Mexico: Report by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Munzer, O.M., English, H.C., Smith, A.B., and Tudor A.A., 2005, Southwestern Willow Flycatcher 2004 survey and nest monitoring report: Nongame and Endangered Wildlife Program Technical Report 244, Arizona Game and Fish Department, Phoenix, Arizona, 73 p.

New Mexico Department of Game and Fish, 1996, List of threatened and endangered: Amendment No. 1, NMAC 33.1; 31 January 1996: New Mexico Department of Game and Fish, Santa Fe, New Mexico.

Nishida, C., and Whitfield, M.J., 2007, Winter distribution of the Willow Flycatcher (*Empidonax traillii*) in Ecuador and Northern Mexico: Report to the Bureau of Reclamation, Boulder City, NV.

Owen, J.C., Sogge, M.K., and Kern, M.D., 2005, Habitat and gender differences in the physiological condition of breeding Southwestern Willow Flycatchers: Auk, v. 122, no. 4, p. 1261-1270.

Paradzick, C.E., and Woodward, A.A., 2003, Distribution, abundance, and habitat characteristics of Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in Arizona, 1993–2000: Studies in Avian Biology, v. 26, p. 22–29.

Paxton, E.H., 2000, Molecular genetic structuring and demographic history of the Willow Flycatcher: Flagstaff, Arizona, Northern Arizona University, MS thesis, 43 p.

Paxton, E.H., 2008, Geographic variation and migratory connectivity of Willow Flycatcher subspecies: Flagstaff, Arizona, Northern Arizona University, Ph.D. dissertation, 100 p.

Paxton, E.H., and Owen, J.C., 2002, An aging guide for Willow Flycatcher nestlings: Flagstaff, Arizona, Colorado Plateau Field Station, Northern Arizona University, 18 p.

Paxton, E.H., Sogge, M.K., Durst, S.L., Theimer, T.C., and Hatten, J.R., 2007, The ecology of the Southwestern Willow Flycatcher in central Arizona—a 10-year synthesis report: U.S. Geological Survey Open-File Report 2007-1381, 143 p.

Pearson, T., Whitfield, M.J., Theimer, T.C., and Keim P., 2006, Polygyny and extra-pair paternity in a population of Southwestern Willow Flycatchers: Condor, v. 108, p. 571–578.

Phillips, A.R., 1948, Geographic variation in *Empidonax traillii*: Auk, v. 65, p. 507-514.

Phillips, A.R., Marshall, J., and Monson, G., 1964, The birds of Arizona: Tucson, Arizona, University of Arizona Press, 212 p.

Pulliam, H.R., 1988, Sources, sinks, and population regulation: American Naturalist, v. 132, p. 652-661.

Bureau of Reclamation, 2009, Elephant Butte Reservoir five-year operational plan—Biological Assessment: Bureau of Reclamation, Albuquerque Area Office, Albuquerque, NM.

Rourke, J.W., McCarthey, T.D., Davidson, R.F., and Santaniello, A.M., 1999, Southwestern Willow Flycatcher nest monitoring protocol: Nongame and Endangered Wildlife Program Technical Report 144, Arizona Game and Fish Department, Phoenix, Arizona.

Rothstein, S.I., Kus, B.E., Whitfield, M.J., and Sferra S.J., 2003, Recommendations for cowbird management in recovery efforts for the Southwestern Willow Flycatcher: Studies in Avian Biology, v. 26, p. 157–167.

Schuetz, J.G., and Whitfield, M.J., 2007, Southwestern Willow Flycatcher monitoring and removal of Brown-headed Cowbirds on the South Fork Kern River in 2006: Report to the U.S. Army Corps of Engineers, Sacramento, CA.

Schuetz, J.G., Whitfield, M.J., and Steen V.A., 2007, Winter distribution of the Willow Flycatcher (*Empidonax traillii*) in Guatemala and Mexico: Report by the Southern Sierra Research Station, Weldon, California.

Seager, R., Ting, M., Held, I., Kushnir, Y., Lu, J., Vecchi, G., Huang, H., Harnik, N., Leetma, A., Lau, N., Li, C., Velez, J., and Naik N., 2007, Model projections of an imminent transition to a more arid climate in southwestern North America: Science Express, April 5, 2007.

Sedgwick, J.A., 2000, Willow Flycatcher (*Empidonax traillii*), *in* Poole, A., and Gill, F., eds., The Birds of North America, No. 533: The Birds of North America, Inc., Philadelphia, Pennsylvania.

Sedgwick, J.A., 2001, Geographic variation in the song of Willow Flycatchers—Differentiation between *Empidonax traillii adastus* and *E.t. extimus*: Auk, v. 118, p. 366-379.

Seutin, G., 1987, Female song in Willow Flycatchers (*Empidonax traillii*): Auk, v. 104, p. 329-330.

Sferra, S.J., Corman, T.E., Paradzick, C.E., Rourke, J.W., Spencer, J.A., and Sumner, M.W., 1997, Arizona Partners in Flight Southwestern Willow Flycatcher survey—1993–1996 summary report: Nongame and Endangered Wildlife Program Technical Report 113, Arizona Game and Fish Department, Phoenix, Arizona, 46 p.

Shook, R.S., Stoleson, S.H., and Boucher, P., 2003, A field evaluation of the Southwestern Willow Flycatcher survey protocol: Studies in Avian Biology, v. 26, p. 177-179.

Siegle, R., and Ahlers, D., 2004, Brown-headed Cowbird management techniques manual: Techniques Manual by the Bureau of Reclamation, Technical Service Center, Denver, Colorado.

Sogge, M.K., Koronkiewicz, T.J.; van Riper, C., and Durst, S.L., 2007a, Willow Flycatcher nonbreeding territory defense behavior in Costa Rica: Condor, v. 109, p. 475-480.

Sogge, M.K., Kus, B.E., Sferra, S.J., and Whitfield, M.J., 2003b, Ecology and conservation of the Willow Flycatcher—Studies in Avian Biology 26: Cooper Ornithological Society, Camarillo, CA, 210 p.

Sogge, M.K., and Marshall, R.M., 2000, Chapter 5: A survey of current breeding habitats, *in* Finch, D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 43-56.

Sogge, M.K., Marshall, R.M., Tibbitts, T.J., and Sferra, S.J. 1997a, A Southwestern Willow Flycatcher natural history summary and survey protocol: National Park Service Technical Report NPS/NAUCPRS/NRTR-97/12, 37 p.

Sogge, M.K., Paxton, E.H., and Tudor, A.A., 2006, Saltcedar and Southwestern Willow Flycatchers: lessons from long-term studies in central Arizona, *in* Aguirre-Bravo, C., Pellicane, P.J., Burns, D.P., and Draggan, S., eds., Monitoring science and technology symposium: unifying knowledge for sustainability in the Western hemisphere: September 20-24, 2004, Denver, Colorado: Proceedings RMRS-P-42CD, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado, p. 238–241.

Sogge, M.K., Sferra, S.J., McCarthey, T.D., Williams, S.O., and Kus, B.E., 2003a, Distribution and characteristics of Southwestern Willow Flycatcher breeding sites and territories: Studies in Avian Biology, v. 26, p. 5-11.

Sogge, M.K., Sferra, S.J., and Paxton, E.H., 2008, Saltcedar as habitat for birds—Implications to riparian restoration in the Southwest: Restoration Ecology, v. 16, p. 146-154.

Sogge, M.K., Tibbitts, T.J., and Petterson, J., 1997a, Status and breeding ecology of the Southwestern Willow Flycatcher in the Grand Canyon: Western Birds, v. 28, p. 142-157.

Sogge, M.K., Tibbitts, T.J., van Riper, C., and May, T., 1995, Status of the Southwestern Willow Flycatcher along the Colorado River in Grand Canyon National Park—1995, Summary report: National Biological Service Colorado Plateau Research Station/Northern Arizona University, 26 p.

Spencer, J.A., Sferra, S.J., Corman, T.E., Rourke, J.W., and Sumner, M.W., 1996, Arizona Partners in Flight 1995 Southwestern Willow Flycatcher survey: Nongame and Endangered Wildlife Program Technical Report 79, Arizona Game and Fish Department, Phoenix, Arizona, 46 p.

State of Arizona, 1990, Final report and recommendations of the Governor's riparian habitat task force, Executive Order 89-16: Streams and riparian resources, Phoenix, Arizona, October 1990, 28 p.

Stein, R.C., 1963, Isolating mechanisms between populations of Traill's Flycatchers: Proceedings of the American Philosophical Society, v. 107, no. 1, p. 21-50.

Stoleson, S.H., and Finch, D.M., 2003, Microhabitat use by breeding Southwestern Willow Flycatchers on the Gila River, NM: Studies in Avian Biology, v. 26, p. 91-95.

Stoleson, S.H., Whitfield, M.J., and Sogge, M.K., 2000, Chapter 8: Demographic characteristics and population modeling, *in* Finch D.M., and Stoleson, S.H., eds., Status, ecology, and conservation of the Southwestern Willow Flycatcher: U.S. Forest Service Rocky Mountain Research Station General Technical Report-60, p. 84-94.

Tibbitts, T.J., Sogge, M.K., and Sferra, S.J., 1994, A survey protocol for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*): National Park Service Technical Report NPS/NAUCPRS/NRTR-94/04.

Unitt, P., 1987, *Empidonax traillii extimus*: an endangered subspecies: Western Birds, v. 18, no. 3, p. 137-162.

U.S. Fish and Wildlife Service, 1991, Notice of review: animal candidate review for listing as endangered or threatened species, November 21, 1991: Federal Register 56:58804-58836.

U.S. Fish and Wildlife Service, 1993, Proposal to list the Southwestern Willow Flycatcher as an endangered species and to designate critical habitat, July 23, 1993: Federal Register 58:39495-39522.

U.S. Fish and Wildlife Service, 1995, Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher: Federal Register 60:10694 (February 27, 1995).

U.S. Fish and Wildlife Service, 1997, Final determination of critical habitat for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*): Federal Register 62(140):39129-39147.

U.S. Fish and Wildlife Service, 2002, Southwestern Willow Flycatcher (*Empidonax traillii extimus*) final recovery plan: U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service, 2005, Designation of critical habitat for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*), Final Rule: Federal Register 70:60886–61009 (October 19, 2005).

Utah Division of Wildlife Resources, 1997, Utah Sensitive Species List – March 1997: Utah Division of Wildlife Resources, Salt Lake City, Utah, 28 p.

Whitfield, M.J., 1990, Willow Flycatcher reproductive response to brown-headed cowbird parasitism: Chico, California, California State University, Masters theses, 25 p.

Whitfield, M.J., and Enos, K., 1996, A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California, 1996: Report to the U.S. Army Corps of Engineers, Sacramento District and the California Department of Fish and Game.

Whitfield, M.J., and Sogge, M.K., 1999, Range-wide impacts of Brown-headed Cowbird parasitism on the Southwestern Willow Flycatcher (*Empidonax traillii extimus*), 1999: Studies in Avian Biology, v. 18, p. 182-190.

Whitfield, M.J., and Strong, C.M., 1995, A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California: California Department of Fish and Game, Bird and Mammal Conservation Program Report 95-4, Sacramento, California, 17 p.

Wiesenborn, W.D., and Heydon, S.L., 2007, Diet of Southwestern Willow Flycatcher compared among breeding populations in different habitats: Wilson Journal of Ornithology, v. 119, p. 547–557.

Wilbur, S.R., 1987, Birds of Baja California: Berkeley, California, University of California Press.

Yard, H.K., and Brown, B.T., 1999, Willow Flycatcher nest resuse in Arizona: Journal of Field Ornithology, v. 70, p. 211–213.

Yard, H.K., and Brown, B.T., 2003, Singing behavior of the Southwestern Willow Flycatchers in Arizona: Studies in Avian Biology, v. 26, p. 125–130.

Appendix 1. Willow Flycatcher Survey and Detection Form

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher (WIFL) Survey and Detection Form (revised April 2010)

Site Name_____ State_____ County _____
USGS Quad Name _____ Elevation _____ (meters)
Creek, River, Wetland, or Lake Name_____
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? Yes___ No____

Survey Coordinates: Start: E_____ N_____ UTM Datum_____(See instructions)
Stop: E_____ N_____ UTM Zone _____
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.

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

Survey # / Observer(s) (Full Name)	Date (m/d/y) Survey time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N / If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding; potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1 Observer(s)	Date / Start / Stop / Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 2 Observer(s)	Date / Start / Stop / Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 3 Observer(s)	Date / Start / Stop / Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 4 Observer(s)	Date / Start / Stop / Total hrs ___						# Birds	Sex	UTM E	UTM N
Survey # 5 Observer(s)	Date / Start / Stop / Total hrs ___						# Birds	Sex	UTM E	UTM N
Overall Site Summary. Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total Survey Hrs_____		Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any Willow Flycatchers color-banded? Yes___ No ___ If yes, report color combination(s) in the comments section on back of form and report to USFWS.				

Reporting Individual _____ Date Report Completed_____ _____
US Fish and Wildlife Service Permit #_____State Wildlife Agency Permit #_____

Submit form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.

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

Reporting Individual _____Phone # _____
Affiliation _____ E-mail _____
Site Name_____Date Report Completed _____

Did you verify that this site name is consistent with that used in previous years? Yes ____ No _____ Not Applicable ___
If site name is different, what name(s) was used in the past?_____
If site was surveyed last year, did you survey the same general area this year? Yes ____ No ____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes ____ No ____ If no, summarize below.

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

Length of area surveyed: _____ (meters)

Vegetation Characteristics: Mark the category that best describes the predominant tree/shrub foliar layer at this site (check one):

_____ Native broadleaf plants (entirely or almost entirely, > 90% native, includes high-elevation willow)

_____ Mixed native and exotic plants (mostly native, 50 - 90% native)

_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)

_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
_____

Average height of canopy (Do not include a range): _____ (meters)

Attach copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections.
Attach sketch or aerial photo showing site location, patch shape, survey route, location of any WIFLs or WIFL nests detected.
Attach photos of the interior of the patch, exterior of the patch, and overall site; describe any unique habitat features.

Comments (attach additional sheets if necessary)
_____
_____
_____
_____
_____
_____

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM N	UTM E	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Attach additional sheets if necessary

Appendix 2. Willow Flycatcher Survey Continuation Sheet / Territory Summary Table

Always check the U.S. Fish and Wildlife Service Arizona Ecological Services Field Office web site (http://www.fws.gov/southwest/es/arizona/) for the most up-to-date version.

Willow Flycatcher Survey Continuation Sheet

(For reporting additional detections and territories; append to Survey and Detection form)

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

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)

Comments_____

Appendix 3. Instructions for Completing the Willow Flycatcher Survey and Detection Form and the Survey Continuation Sheet

These instructions are provided as guidance for completing the standard survey form. It is particularly important to provide the correct type and format of information for each field. Complete and submit your survey forms to both the appropriate State Willow Flycatcher coordinator and the U.S. Fish and Wildlife Service (USFWS) by September 1 of the survey year. You also may complete forms digitally (Microsoft© Word or Excel) and submit them via email with attached or embedded topographic maps and photographs.

Page 1 of Survey Form

Site Name. Standardized site names are provided by the flycatcher survey coordinators for each State and should be consistent with the naming of other sites that might be in the area. If the site is new, work with your State or USFWS flycatcher coordinator to determine suitable site names before the beginning of the survey season. If the site was previously surveyed, use the site name from previous years (which can be obtained from the State or USFWS flycatcher coordinator). If you are uncertain if the site was previously surveyed, contact your State or USFWS flycatcher coordinator.

USGS Quad Name. Provide the full quad name, as shown on the appropriate standard 7.5-minute topographic maps.

Creek, River, Wetland, or Lake Name. Give the name of the riparian feature, such as the lake or watercourse, where the survey is being conducted.

Survey Coordinates. Provide the start and end points of the survey, which will indicate the linear, straight-line extent of survey area, based on Universal Transverse Mercator coordinates (UTMs). California surveyors only: provide latitude/longitude geographic coordinates instead of UTMs in the UTM fields and identify them as such. If the start and end points of the survey changed significantly among visits, enter separate coordinates for each survey in the comments section on the back of the survey sheet. Note that we do not need the coordinates for the detailed path taken by the surveyor(s).

Datum. Indicate the datum in which the coordinates are expressed: NAD27, WGS84, or NAD83. The datum can be found in the settings of most GPS units. Note that Arizona prefers NAD27 and New Mexico prefers NAD83.

Zone. Provide the appropriate UTM zone for the site, which is displayed along with the coordinates by most GPS units. Zones for California are 10, 11, or 12. The zone for Arizona is 12. Zones for New Mexico are 12 or 13.

Survey #. Survey 1 – 5. See the protocol for an explanation of the number of required visits for each survey period. **Note:** A survey is defined as a complete protocol-based survey that occurs over no more than 1 day. If a site is so large as to require more than a single day to survey, consider splitting the site into multiple subsites and use separate survey forms for each. Casual site visits, pre-season or supplemental visits, or follow-up visits to check on the status of a territory should not be listed in this column, but should be documented in the Comments section on page 2 or in the survey continuation sheet.

Date. Indicate the date that the survey was conducted, using the format mm/dd/yyyy.

Start and **Stop.** Start and stop time of the survey, given in 24-hour format (e.g., 1600 hours rather than 4:00 p.m.).

Total hours. The duration of time (in hours) spent surveying the site, rounded to the nearest tenth (0.1) hour. For single-observer surveys, or when multiple observers stay together throughout the survey, total the number of hours from survey start to end. If two or more observers surveyed sections of the site concurrently and independently, sum the number of hours each observer spent surveying the site.

Number of Adult WIFLs. The total number of individual adult Willow Flycatchers detected during this particular survey. Do not count nestlings or recently fledged birds.

Number of Pairs. The number of breeding pairs. Do not assume that any bird is paired; designation of birds as paired should be based only on direct evidence of breeding behaviors described in the protocol. If there is strong evidence that the detected bird is unpaired, enter "0". If it is unknown whether a territorial bird is paired, enter "–". Note that the estimated number of pairs can change over the course of a season.

Number of Territories. Provide your best estimate of the number of territories, defined as a discrete area defended by a resident single bird or pair. This is usually evidenced by the presence of a singing male, and possibly one or more mates. Note that the estimated number of territories may change over the course of a season.

Nest(s) Found? Yes or No. If yes, indicate the number of nests. Renests are included in this total.

Comments about this survey. Describe bird behavior, evidence of pairs or breeding, evidence of nest building, evidence of nestlings/fledglings, nesting, vocalizations (e.g., interaction twitter calls, *whitts*, *britts*, *wheeos*, *fitz-bews*/countersinging), potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.). If *Diorhabda* beetles are observed, contact your USFWS and State flycatcher coordinator immediately. Please be aware that permits are needed for nest monitoring.

GPS Coordinates for WIFL Detections. Provide the number of birds (e.g., unpaired, paired, or groups of birds) and corresponding UTMs. If known, provide the sex of individuals.

Overall Site Summary. For each of these columns, provide your best estimate of the overall total for the season. Do not simply total the numbers in each column. In some cases where consistent numbers were detected on each survey, the overall summary is easy to determine. In cases where numbers varied substantially among the different surveys, use professional judgment and logic to estimate the most likely number of adults, pairs, and territories that were consistently present. Be careful not to double count individuals. Record only territorial adult Southwestern Willow Flycatchers, do not include migrants, nestlings, or fledglings in the overall summary. In complex cases, consult with your State or USFWS flycatcher coordinator.

Total Survey Hours. The sum of all hours spent surveying the site.

Were any WIFLs color-banded? Circle or highlight "Yes" or "No". If yes, report the sighting and color combination (if known) in the comments section on back of form, and contact your USFWS coordinator within 48 hours after returning from the survey. Note that identifying colors of bands is difficult and might require follow-up visits by experienced surveyors.

Reporting Individual. Indicate the full first and last name of the reporting individual.

Date Report Completed. Provide the date the form was completed in mm/dd/yyyy format.

U.S. Fish and Wildlife Service Permit #. List the full number of the required federal permit under which the survey was completed.

State Wildlife Agency Permit #. If a State permit is required by the State in which the survey was completed, provide the full number of the State permit. State permits are required for Arizona and California. State permits are recommended for New Mexico.

Page 2 of Survey Form

Affiliation. Provide the full name of the agency or other affiliation (which is usually the employer) of the reporting individual.

Phone Number. Self-explanatory; include the area code.

E-mail. Self-explanatory.

Was this site surveyed in a previous year? Indicate "Yes", "No", or "Unknown."

Did you verify that this site name is consistent with that used in previous years? Indicate "Yes" or "No". This can be determined by checking survey forms from previous years or consulting with agency flycatcher coordinators.

If site name is different, what name(s) was used in the past? Enter the full site name that was used in previous years.

If site was surveyed last year, did you survey the same general area this year? Indicate "Yes" or "No". If no, indicate the reason and how the survey varied in the Comments section.

Did you survey the same general area during each visit to this site this year? If no, indicate the reason in the Comments section and delineate the differing route of each survey on the topographical map.

Management Authority for Survey Area. Mark the appropriate management authority.

Name of Management Entity or Owner (e.g., Tonto National Forest). Provide the name of the organization or person(s) responsible for management of the survey site.

Length of area surveyed. Estimate the linear straight-line distance of the length of the area surveyed, in kilometers. This is not an estimate of the total distance walked throughout the survey site. Do not provide a range of distances.

Vegetation Characteristics: Mark only one of the categories that best describes the predominant tree/shrub foliar layer at the site.

Native broadleaf habitat is composed of entirely or almost entirely (i.e., > 90%) native broadleaf plants.

Mostly native habitat is composed of 50–90% native plants with some (i.e., 10–50%) non-native plants.

Mostly exotic habitat is composed of 50–90% non-native plants with some (i.e., 10–50%) native plants.

Exotic/introduced habitat is composed entirely or almost entirely (i.e., > 90%) of non-native plants.

Identify the 2–3 predominant tree/shrub species in order of dominance. Identify by scientific name.

Average height of canopy. Provide the best estimate of the average height of the top of the canopy throughout the patch. Although canopy height can vary, give only a single (not a range) overall height estimate.

Attach the following: (1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections; (2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests; (3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments. Include the flycatcher territory number and GPS location. You also may include a compact disc of photographs.

Comments. Include any information that supports estimates of total territory numbers and breeding status. You may provide additional information on bird behavior, banded birds, evidence of pairs or breeding, nesting, potential threats (e.g., livestock, cowbirds, saltcedar leaf beetles [*Diorhabda* spp.] etc.), and changes in survey length and route throughout the season. Attach additional pages or use the continuation sheet if needed.

Table. If Willow Flycatchers are detected, complete the table at the bottom of the form. Identify flycatchers by territory number and include the dates detected, UTMs, whether or not pairs were detected, and whether or not nests were located. Also describe the observation. For example, the surveyor might have observed and heard a bird *fitz-bew* from an exposed perch, heard and observed two birds interacting and eliciting a twitter call, heard a bird *fitz-bew* while observing another carrying nesting material, heard birds from territory 1 and 2 countersinging, etc. This information provides supporting information for territory and breeding status. Use the continuation sheet if needed.

Appendix 4. Example of a Completed Willow Flycatcher Survey and Detection Form (with map)

Willow Flycatcher (WIFL) Survey and Detection Form (revised April, 2010)

Site Name: **DL-08** State: **New Mexico** County: **Socorro**
USGS Quad Name: **Paraje Well** Elevation: **1,356** (meters)
Creek, River, or Lake Name: **Rio Grande**
Is copy of USGS map marked with survey area and WIFL sightings attached (as required)? ***Yes*** **X** ***No*** ____
Survey Coordinates: Start: E **306,009** N **3,715,506** UTM Datum: **NAD 83** (See instructions)
Stop: E **304,339** N **3,711,922** UTM Zone: **13**
If survey coordinates changed between visits, enter coordinates for each survey in comments section on back of this page.
*****Fill in additional site information on back of this page*****

Survey # Observer(s) (Full Name)	Date (m/d/y) Survey Time	Number of Adult WIFLs	Estimated Number of Pairs	Estimated Number of Territories	Nest(s) Found? Y or N If Yes, number of nests	Comments (e.g., bird behavior; evidence of pairs or breeding;-potential threats [livestock, cowbirds, *Diorhabda* spp.]). If *Diorhabda* found, contact USFWS and State WIFL coordinator.	GPS Coordinates for WIFL Detections (this is an optional column for documenting individuals, pairs, or groups of birds found on each survey). Include additional sheets if necessary.			
Survey # 1	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	5/24/2009						1	M	305,276	3,714,926
D. Savage	Start:						1	M	305,131	3,714,628
	5:45	5	0	5	N	Suitable breeding habitat dispersed throughout site. WIFLs were very vocal, and covering large areas. No obvious signs of pairing were observed. Approximately 10 head of cattle were found within this site.	1	M	305,191	3,714,778
	Stop:						1	M	305,394	3,715,009
	10:15						1	M	305,084	3,714,732
	Total hrs:									
	4.5									
Survey # 2	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/10/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	6:00	11	4	7	Y (3)	Portions of site are flooded, 1-2 ft deep. Two males found during 1st survey appear unpaired. Three pairs confirmed based on nesting, and another pair suspected based on vocal interactions and nonaggressive behavior with another flycatcher. Two additional territories (1 pair and 1 unpaired male) found during this survey.	2	M/F	305,191	714,778
	Stop:						2	M/F	305,394	3,715,009
	10:15						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.3						1	M	305,010	3,714,524
Survey # 3	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	6/21/2009						1	M	305,276	3,714,926
S. Kennedy	Start:						1	M	305,131	3,714,628
	5:30	12	5	7	Y (4)	Portions of site still flooded. All territories found in Survey 2 are still active. The two males found during Surveys #1 and #2, still believed to be unpaired. All other territories are believed to be paired. Several cows observed in vicinity of active territories.	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.5						2	M/F	305,010	3,714,524
Survey # 4	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/1/2009						1	M	305,276	3,714,926
D. Moore	Start:						1	M	305,131	3,714,628
	6:00	12	5	7	Y (4)	Site is no longer flooded, but saturated soils persist throughout most of site. No change in territory numbers or status. All SWFL pairs very quiet - only a few whits and fitz-bews. Light rain over night, vegetation was saturated early in the morning. Lots of mosquitos!	2	M/F	305,191	3,714,778
	Stop:						2	M/F	305,394	3,715,009
	10:00						2	M/F	305,084	3,714,732
	Total hrs:						2	M/F	305,001	3,714,640
	4.0						2	M/F	305,010	3,714,524
Survey # 5	Date:						# Birds	Sex	UTM E	UTM N
Observer(s):	7/10/2009						1	M	305,131	3,714,628
D. Moore	Start:						2	M/F	305,191	3,714,778
	5:30	11	5	6	Y (4)	Site beginning to dry out, some portions still muddy. One of the unpaired males could not be detected. It was hard to hear SWFLs due to breezy conditions early in the morning.	2	M/F	305,394	3,715,009
	Stop:						2	M/F	305,084	3,714,732
	10:00						2	M/F	305,001	3,714,640
	Total hrs:						2	M/F	305,010	3,714,524
	4.5									
Overall Site Summary Totals do not equal the sum of each column. Include only resident adults. Do not include migrants, nestlings, and fledglings. Be careful not to double count individuals. Total survey hrs: 21.8		Total Adult Residents	Total Pairs	Total Territories	Total Nests	Were any WIFLs color-banded? Yes ____ No **X** If yes, report color combination(s) in the comments section on back of form and report to USFWS.				
		12	5	7	4					

Reporting Individual: **Darrell Ahlers** Date Report Completed: **8/20/2009**
US Fish & Wildlife Service Permit #: **TE819475-2** State Wildlife Agency Permit #: **N/A**

Submit ***form to USFWS and State Wildlife Agency by September 1st. Retain a copy for your records.***

Fill in the following information completely. Submit form by September 1st. Retain a copy for your records.

Reporting Individual **Darrell Ahlers** Phone # **(303) 445-2233**
Affiliation **Bureau of Reclamation** E-mail dahlers@usbr.gov
Site Name **DL-08** Date report Completed **8/20/2009**
Was this site surveyed in a previous year? Yes__**x**__ No____ Unknown____
Did you verify that this site name is consistent with that used in previous yrs? Yes **x** No _____ Not Applicable _____
If name is different, what name(s) was used in the past? **Not applicable**
If site was surveyed last year, did you survey the same general area this year? Yes **x** No _____ If no, summarize below.
Did you survey the same general area during each visit to this site this year? Yes **x** No _____ If no, summarize below.

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

Length of area surveyed: **2.5** (km)

Vegetation Characteristics: Check (only one) category that best describes the predominant tree/shrub foliar layer at this site:

_____ Native broadleaf plants (entirely or almost entirely, > 90% native)
X Mixed native and exotic plants (mostly native, 50 - 90% native)
_____ Mixed native and exotic plants (mostly exotic, 50 - 90% exotic)
_____ Exotic/introduced plants (entirely or almost entirely, > 90% exotic)

Identify the 2-3 predominant tree/shrub species in order of dominance. Use scientific name.
Salix Gooddingii, Populus spp., Tamarix spp.

Average height of canopy (Do not include a range): **6** (meters)

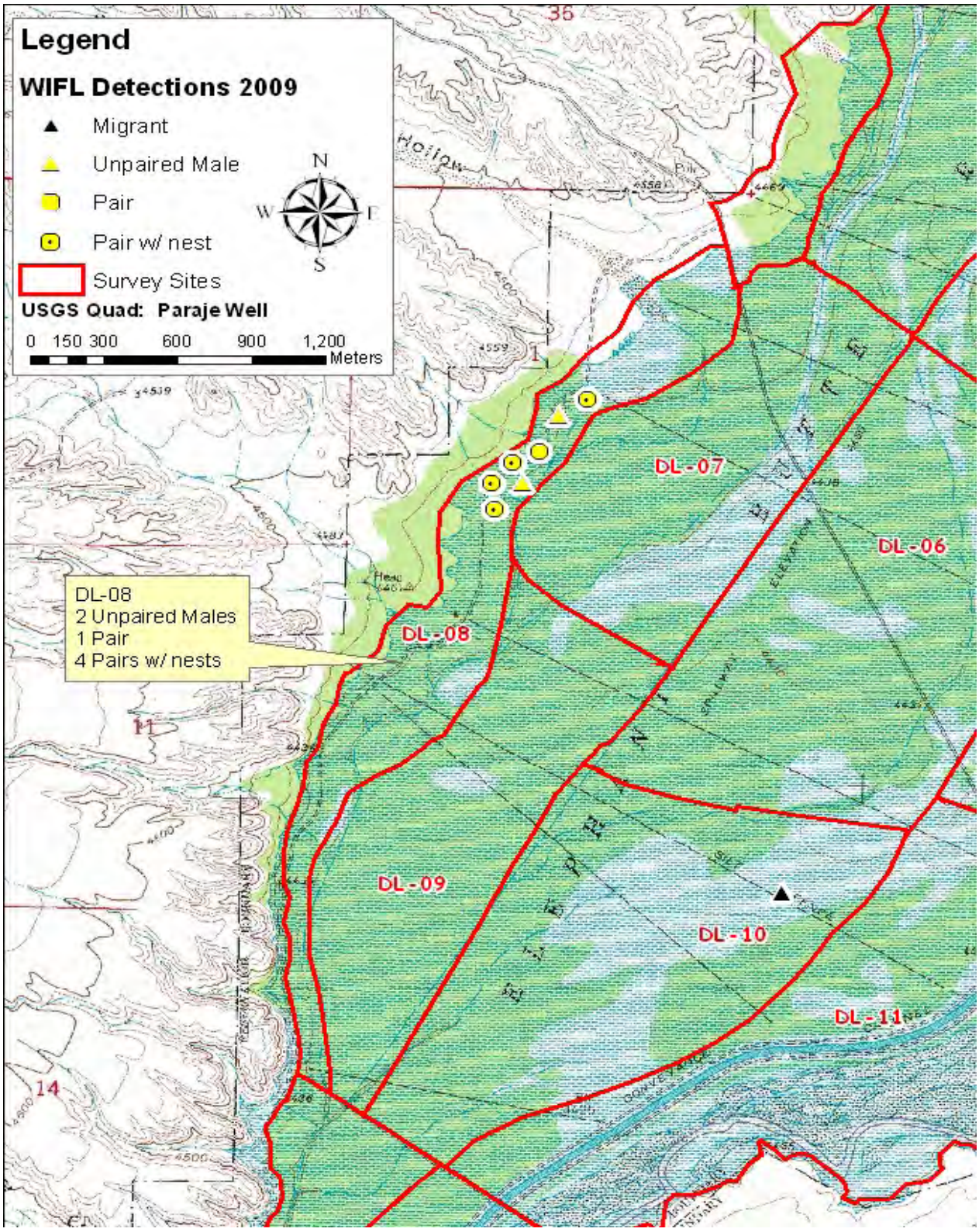
Attach the following: 1) copy of USGS quad/topographical map (REQUIRED) of survey area, outlining survey site and location of WIFL detections;
2) sketch or aerial photo showing site location, patch shape, survey route, location of any detected WIFLs or their nests;
3) photos of the interior of the patch, exterior of the patch, and overall site. Describe any unique habitat features in Comments.

Comments (such as start and end coordinates of survey area if changed among surveys, supplemental visits to sites, unique habitat features. Attach additional sheets if necessary.
Great habitat with saturated or flooded soils throughout most of the site on 1st survey. Site began to dry by the end of the breeding season. SWFL territories are dominated by Gooddings willow, however Tamarix spp. tends to be increasing in density compared to previous years. Site is supported by flows from the Low Flow Conveyance Channel.

Territory Summary Table. Provide the following information for each verified territory at your site.

Territory Number	All Dates Detected	UTM E	UTM N	Pair Confirmed? Y or N	Nest Found? Y or N	Description of How You Confirmed Territory and Breeding Status (e.g., vocalization type, pair interactions, nesting attempts, behavior)
1 (Unpaired male)	5/24, 6/10,6/21,7/1	305,276	3,714,926	N	N	extended presence at site from 5/24 through 7/1, no evidence of pairing
2 (Unpaired male)	5/24, 6/10,6/21,7/1, 7/10	305,131	3,714,628	N	N	extended presence at site from 5/24 through 7/10, no evidence of pairing
3 (Pair)	5/24, 6/10,6/21,7/1, 7/10	305,191	3,714,778	Y	Y	Pair confirmed based on vocalizations and observation of unchallenged WIFL
4 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,394	3,715,009	Y	Y	Confirmed breeding status with nest
5 (Pair w/nest)	5/24, 6/10,6/21,7/1, 7/10	305,084	3,714,732	Y	Y	Confirmed breeding status with nest
6 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,001	3,714,640	Y	Y	Confirmed breeding status with nest
7 (Pair w/nest)	6/10,6/21,7/1, 7/10	305,010	3,714,524	Y	N	Confirmed breeding status with nest

Attach additional sheets if necessary


Legend
WIFL Detections 2009
Migrant
Unpaired Male
Pair
Pair w/ nest
Survey Sites
USGS Quad: Paraje Well
0 150 300 600 900 1,200
Meters
N
W
E
S
DL-08
2 Unpaired Males
1 Pair
4 Pairs w/ nests
DL-07
DL-06
DL-08
DL-09
DL-10
DL-11
35
1
11
14

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