

**APPENDIX D - MEXICAN SPOTTED OWL SURVEY PROTOCOL
U.S. FISH AND WILDLIFE SERVICE, 2012 (UPDATED 3/15/2022)**

INTRODUCTION

We designed following field survey protocol 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 U.S. Fish and Wildlife Service (FWS) listed the owl 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 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 we based upon the best scientific data available, is a work in progress. We will modify this protocol as new information becomes available. We will notify the public of changes to the protocol and surveyor qualifications through postings to the FWS’s [Arizona Ecological Services Field Office](#) (AESO) website. 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 we need 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. Circumstances dictate how surveyors implement owl surveys. If biologists cannot accomplish surveys 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 effect on owls and/or owl habitat. A properly conducted survey will help agencies determine whether 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 effects 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).

The Southwestern Region of the U.S. Forest Service issued the generally accepted protocol for inventorying Mexican spotted owls in 1988. They revised the protocol in 1989 and in 1990

appended it 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).

Individuals surveying for owls should meet certain training standards. The FWS will review and approve experience 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. Surveys use night calling to elicit responses from owls and locate the general areas occupied by them. Use daytime visits to locate roosting and/or nesting owls and to further pinpoint the activity centers of individual owls.

If owls are located, surveyors may use mice or visual observations to locate mates, nests, and young. The information collected from nighttime calling surveys and daytime 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 management actions may affect owls or their habitat. If an area is relatively large, we recommend subdividing it into manageable subunits to achieve the best survey results. In general, the survey area should include the project area and an 800-meter (0.5-mile) area from its exterior boundaries. Within the survey area, survey all areas that contain forested **recovery habitat**, riparian forest, and canyon habitat, or might support owls, as defined in this revised Recovery Plan. Where known **protected activity centers (PACs)** exist within the survey area, surveyors may adjust calling routes 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. Delineate nighttime calling routes and calling stations on a map, review stations in the field, and then relocate, 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. Surveyors can imitate calls or play recordings of owl vocalizations (*e.g.*, use of a digital caller).
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. Spotted owls use the four-note call the most frequently when defending a territory. We recommend 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 they detect a potential owl **predator**, and should move on to another calling station out of earshot of the predator before resuming calling. Surveyors should return later to the station(s) skipped to complete the calling route. If the surveyor detects the predator again, the surveyor may try active listening rather than calling at the station. Other solutions for 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. Surveyors should not conduct calling 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 appropriate survey method for the situation and/or terrain. An owl survey might require a combination of methods, including: 1) calling stations; and/or 2) continuous calling routes to obtain complete coverage of an area. 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.

Whichever method is used it is imperative that 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, place stations 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, we recommend 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, surveyors could reverse the order of the calling stations. Varying the order of calling stations avoids potential bias related to time of night or other factors.
- d. **Intermediate calling stations:** Use intermediate calling stations 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, we recommend combining the continuous calling method 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. 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). Late March through late June is the optimal time to detect owls. Surveys conducted during March-June will increase the likelihood of detecting owls. Additionally, if properly conducted surveys do not detect owls, particularly at these peak times, then inferences about absence of owls in a given area will be stronger. Use responses in September only to document presence. Surveys in September are not reliable for locating nests, delineating PACS, and/or inferring absence.

We use specific criteria on number and timing of surveys to define a **complete inventory**. A complete inventory requires that at least four properly scheduled complete surveys be conducted 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 we recommend one additional year of survey 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. We recommend conducting the four complete surveys during the time of highest owl calling activity breeding season (1 March - 30 June):
 1. We recommend conducting all four surveys occur 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 is optimal for locating owls.
 2. All surveys must be completed 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. Conduct a complete survey of the area within seven consecutive days. If the area is too large to survey in seven consecutive days, divide the survey area 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. **Prior to proceeding with this deviation from the survey protocol, you must clear this with the FWS prior to proceeding with defining an area as remote.**
- 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. Surveyors can discontinue surveying a given area when data indicate that the area is an owl site, per the Recovery Plan (USFWS 2012).
- G. We consider vocal or visual locations of owls outside the breeding season (1 September - 28 February) as extra information that can be of assistance in locating nesting owls in the upcoming breeding season.

4. Methods after Detecting a Mexican Spotted Owl

Once a surveyor detects an owl, they do the following:

- 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 and estimated distance 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 their 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. Make every effort to estimate and map the location of the owl when you heard the first response. 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. We also use calling to elicit territorial responses 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 delay between the nighttime response and daytime follow-up survey, the smaller the probability of locating the owl 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 conducted more 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 surveys observed spotted owls 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 past surveys have detected owls. 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 where you detected the owl.
 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. Study aerial photos and maps of the area 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, within the 48 hour period.
- F. If no owl(s) are located during complete daytime follow-up visits, the surveyor should return to conduct nighttime surveys. The survey protocol recommends a minimum of four complete surveys to an area, 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, do not conduct daytime follow-up surveys in inclement weather and surveyors should avoid calling when potential owl predators are present.

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

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

Mousing is a 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 up to four mice (one at a time) to 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. We consider a mouse "refused" if, after 30 minutes, an owl does not take the mouse.

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 an owl has unequivocally taken a mouse 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. An owl caches a mouse 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 offer 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 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 them to observe the "true" mouse fate. Such observations should trigger another daytime follow-up (minimum of 5 days later) 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 above mousing guidelines).
3. A female owl is observed or heard on a nest.
4. One or both adult (or subadult) owls 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 when surveys detect two responses from owls that are more than 800 meters (0.5 mile) apart. Consider these responses to be 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 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 located 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. Conduct nesting-status surveys between 1 April and 1 June. We base the start date (1 April) 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 is a tool used to determine nesting status. We can classify the owls 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.
 - 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.

- c. All pairs considered 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, conduct reproductive success surveys between 15 May and 15 July.
2. Conduct at least two visits to the site spaced at least one week apart 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. Use visual searches and/or mousing 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 period, then record zero young. 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

Submit an annual report of the activities conducted (including field data forms, GIS files, etc.) to the FWS Permits Office in Albuquerque, New Mexico, as well as the appropriate state FWS ESFO. If applicable, also submit electronic 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 to the FWS.

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

Upon locating a dead, injured, or sick owl, contact the FWS's Law Enforcement Office (Southwestern Region at 505-248-7889 or Mountain-Prairie Region at 303-236-7570) within two working days (48 hours) of its finding, or as noted in your Section 10 permit. Provide written notification 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. Send the notification to the Law Enforcement Office with a copy to the appropriate FWS ESFO (see Section 10 permit). After coordination with the appropriate FWS ESFO, authorized biologists may transport sick and injured owls to a licensed and permitted wildlife rehabilitator or veterinarian. Should the treated owl(s) survive, the FWS will determine the final disposition of the animal. Handle salvaged specimens or owls that did not survive rehabilitation with care to preserve the biological material, and provide the remains of intact owl(s) 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, obtain the information noted above.

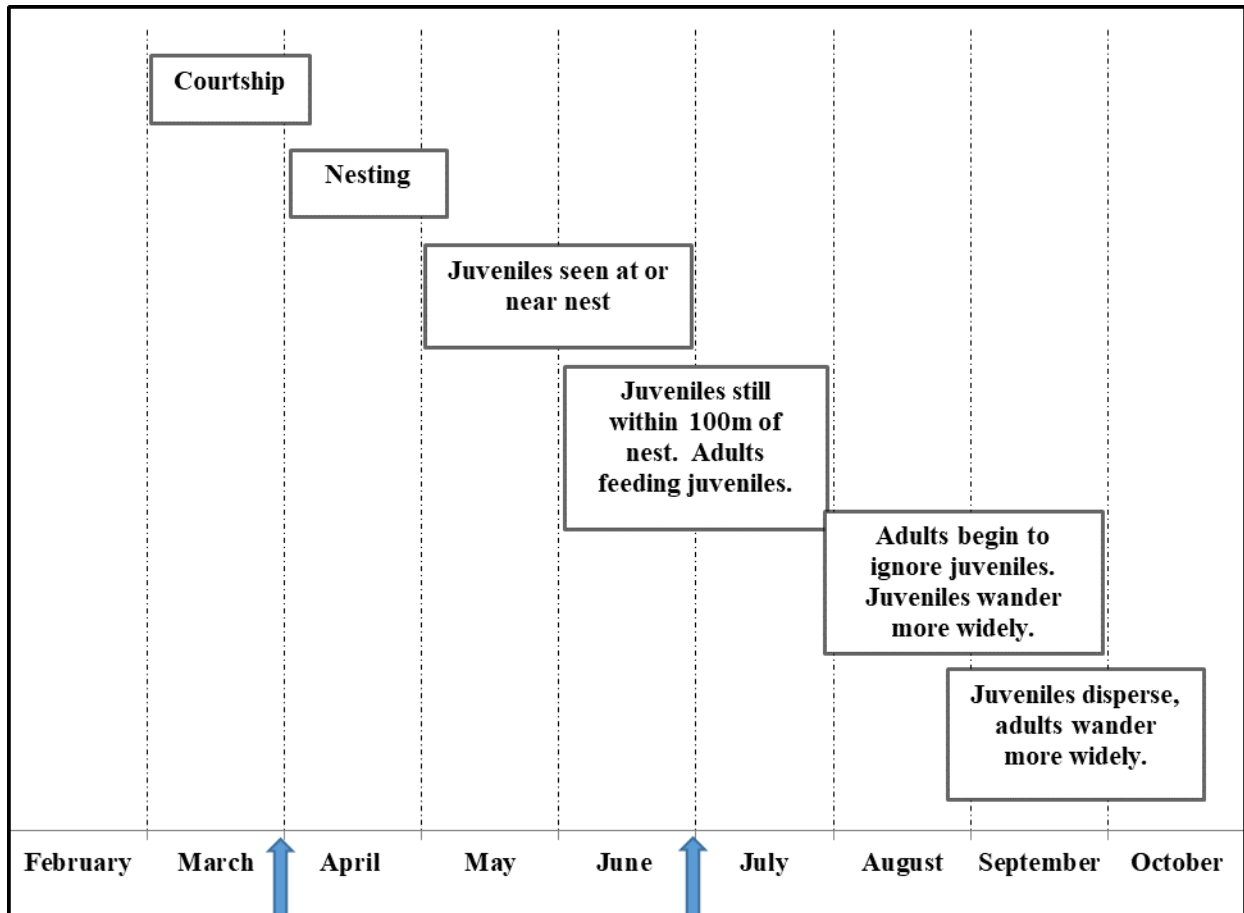


Figure D.1. Generalized reproductive chronology for the Mexican spotted owl. The area between the arrows at the bottom of the table indicates periods of high probability of detecting owls. Chronology may vary slightly with area, elevation, and/or in response to weather.

11. Glossary for Appendix D - Survey Protocol

Absence: Absence of Mexican spotted owls can be inferred when no response is recorded after 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) are 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 period from 1 March through 31 August that includes courtship, nesting, and nestling- and fledgling-dependency periods.

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 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: Surveyors should conduct a daytime follow-up visit 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. Conduct the follow-up visit during daylight hours and complete 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, surveyors may use mousing 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. Retain all PACs 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 the Recovery Plan (USFWS 2012).

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 Mexican spotted owls and/or the presence of pellets, whitewash, feathers, or other evidence of owls.

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

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13. Suggested Reading for Appendix D – Survey Protocol

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14. Mexican Spotted Owl Survey Protocol Outline

Complete Inventory:

- Minimum four complete surveys each year (minimum five days apart, seven days to finish a complete survey)
- PAC monitoring: Recommend up to six complete surveys if no owls detected
- No more than one survey in March
- Minimum of two surveys prior to June 30th (recommend all four surveys completed prior to June 30th). No more than one survey in August and all surveys completed by 31 August
- Two years of complete surveys

Survey Outline:

1. Owl(s) Detected, go to 3
2. No Owls Detected (4 complete surveys inventory, 6 complete surveys PAC monitoring), Absence inferred for survey area
3. PRESENCE - Conduct a daytime follow-up visit (preferably within 24 hours of detection, but must be within 48 hours of detection).
 - 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: Offer 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 offered up to 4 mice). If one of the following occurs, nesting confirmed, reproduction unknown, go to 5B:
 - a. If one of the following occurs, nesting confirmed, reproduction (# fledged owls) unknown, go to 5B:
 - i. Female owl on nest.
 - ii. Owl takes prey to nest.
 - iii. Young in nest with adult present.
 - b. If one of the following occurs, non-nesting inferred, non-reproduction inferred (two visits to infer non-nesting, minimum three weeks apart):
 - i. One of owl pair offered four mice (know fate of all four mice).
 - ii. Single owl eats and/or caches all four mice and/or caches two mice and refuses (30 min) to take a third mouse.
 - iii. Female refuses mouse and/or roosts for minimum one hour (1 April - 30 April).
 - c. Pair (but no young) located after 1 June:
 - i. NESTING STATUS UNKNOWN.
 - ii. Conduct reproductive visit if need to know # juveniles fledged; go to 5A.
5. REPRODUCTIVE SUCCESS VISITS
 - A. NESTING STATUS UNKNOWN
 - a. Recommend two visits, one week apart.
 - b. May use mousing to see if juveniles present.
 - B. NESTING STATUS KNOWN
 - a. One visit to look for juveniles (this may take more than one visit to locate all juveniles produced).
 - b. If surveyor does not find juveniles, may mouse adults to locate juveniles.