

MEXICAN SPOTTED OWL SURVEY PROTOCOL

U.S. FISH AND WILDLIFE SERVICE, 2003

INTRODUCTION

The following protocol is designed for surveying areas where human activities may remove or modify Mexican spotted owl (hereafter, "owl"; *Strix occidentalis lucida*) habitat or otherwise adversely affect the species. The owl was listed as threatened on April 15, 1993 (See, 58 Fed. Reg. 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 gives the benefit of the doubt to the listed species with respect to such gaps in the information base [H.R. Conf. Rep. No. 697, 96th Cong., 2nd Sess. 12 (1979)].

It is important to note that this survey protocol expresses our scientific opinion on adequate owl survey methods. This does not constitute law, rules, regulations, or absolute requirements. This protocol includes guidance and recommendations. 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. The public will be notified of changes to the protocol. We encourage anyone who has additional scientific information that can add to our understanding of what is needed to provide for long-term conservation of this species and its ecosystem to submit such information to us at any time. 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 permitting requirements are implied. Circumstances may dictate that owl surveys be conducted differently on a case by case basis. If surveys cannot be accomplished pursuant to this protocol, we commend contacting the nearest Ecological Services Field Office for guidance on survey methods before proceeding. We will make every effort to be flexible in the use and application of this protocol.

The U.S. Fish and Wildlife Service 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 in the area. A properly conducted survey will help the public determine whether or not further consultation with us 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 U.S. Fish and Wildlife Service 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 owls was developed by the Southwestern Region of the U.S. Forest Service 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 for the past 11 years. The Forest Service reissued the inventory protocol in 1994, again in 1995, and issued the latest version in February 1996. The Forest Service incorporated recommendations from the draft and subsequent final Recovery Plan for the Mexican Spotted Owl (Recovery Plan) (USDI 1995) regarding the designation of protected activity centers (PACs) around owl locations, but did not modify the overall survey design.

Through application of the existing protocol and through the use of the data gathered by the protocol surveys in informal and formal consultations under section 7 of the Act, the Service has found instances where the refinement of the protocol would benefit both the species and those working with it. On January 26, 1998, the U.S. Fish and Wildlife Service met with a group of experts to review the Forest Service protocol and available literature and improve and update the document. The following draft document is the result of those discussions and subsequent review by U.S. Fish and Wildlife Service biologists.

This protocol provides owl surveyors with a U.S. Fish and Wildlife Service-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 areas where habitat alterations or disturbances to owls are likely to occur; and (3) provide information to allow designation of PACs.

Individuals surveying for owls should meet training standards. These standards strongly encourage surveyors to have knowledge of this protocol; 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 raptor species. Orienteering skills, including use of map and compass, 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. This take could result in criminal or civil penalties.

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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 visits 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.

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 may be affected by management actions. If an area is relatively large, it can be subdivided into manageable units in order to achieve the best survey results. In general, the survey area should include the project area and a 0.5 mile buffer from its exterior boundaries. Within the project area, survey all areas that contain **protected habitat** and **restricted habitat**, as defined in the Recovery Plan (USDI 1995), or canyon habitat. Descriptions of owl habitat for different areas and physiographic provinces should be available from various State and Federal wildlife agencies. Surveyors are encouraged to survey any areas or habitat that might support owls.

Where known **protected activity centers (PACs)** exist within the survey area, calling routes may be adjusted to lessen disturbance to established PACs. However, consider the need to monitor known PACs for current occupancy and reproductive status.

- 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 0.25 to no more than 0.5 miles apart depending upon topography and background noise levels. Nighttime calling routes and calling stations should be delineated on a map and then reviewed in the field. Corrections can be made at this time to improve the effectiveness of the calling stations along the calling route.

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 times include two hours following sunset and two hours prior to sunrise. Surveys should be concentrated around these periods.
2. Use nighttime surveys for all continuous 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. Therefore, it is suggested that surveyors use all three of these calls during surveys, with the four-note call as the primary call.
5. Discontinue calling when a potential owl **predator** is detected. Surveyors should move on to another calling station out of earshot of the predator and resume calling. Surveyors should return to the station(s) skipped to complete the calling route.
6. 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 15 miles per hour or when the observer feels that the wind is limiting their ability to hear an owl. Consider using the Beaufort Wind Strength scale. Level 4 describes winds 13-18 miles per hour as a moderate breeze capable of moving thin branches, raising dust, and raising paper.

B. SURVEYS

In order to ensure complete coverage of the survey area, select the best survey method for the situation and/or terrain. An owl survey may 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/or (3) leapfrog techniques. Each of these methods involves calling for owls and listening for their responses. Each of these methods are designed for nighttime calling. 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 may be drawn in but do not respond vocally.

1. CALLING STATIONS

- a. Calling stations should be spaced approximately 0.25 miles to no more than 0.5 miles apart depending on topography and background noise. In some situations, closer and more calling stations may increase 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, include calling stations at points and canyon heads. The 0.25 to 0.5 mile distance between calling stations also applies in canyon habitat.
- b. Spend at least 15 minutes at each calling station: 10 minutes devoted to calling and listening in an alternating fashion, and the last 5 minutes listening. Owl response time varies, most likely due to 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. The U.S. Fish and Wildlife Service recommends that the sequence of calling stations be varied, 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, predator location, or other factors.

- d. **Intermediate calling stations** should be used when weather or other 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 may 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 may be appropriate. Continuous calling means 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 actively listening. In canyon habitat, the continuous calling method is only recommended when combined with calling stations.

- a. Walk slowly so 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 along the route to listen for owl responses.

3. LEAPFROG METHOD

The leapfrog method is very useful when there are driveable roads that 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 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 they walk towards the vehicle, drives the truck at least 0.5 mile past the second person (i.e.

“leapfrogs”), leaves the vehicle there, then resumes calling along the survey route.

- c. Repeat this procedure until complete coverage of the survey area is accomplished.

3. Number and Timing of Surveys

Owl detection rates change with season and activity. Ganey (1990) found that calling activity was highest during the nesting season (March-June). Information from past survey efforts indicates that owl response may also vary with habitat type and/or reproductive chronology (Table 1). Generally, late March through late June is the optimal time period to detect owls.

Surveys conducted during these months 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 inferring absence, for locating nest groves and/or delineating PACs.

Specific criteria on number and timing of surveys are used to determine whether a **complete inventory** has been accomplished. 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, no more than one year should intervene between the surveys and project implementation. An additional year of surveys is recommended prior to project implementation if more than one **breeding season** has elapsed since the last complete survey and no owls have been detected. If more than 4 years have elapsed between the end of the two years of survey and the initiation of the proposed action, then another complete inventory is recommended prior to project implementation.

- A. Complete coverage of a survey area is achieved when four **complete surveys** have been conducted. A complete survey may be a combination of a pre-call (daytime cruise of habitat to be night called) and a night field outing and, if owls are detected, a **daytime follow-up visit**. All field outings where no day location of owls is known must include night calling. However, if owls are located during a pre-call, no night calling of the survey area is required. Surveyors may want to conduct additional surveys in an area if there is reason to believe owls may be present.
- B. Ensure the four complete surveys are spread out over the breeding season (1 March - 31 August) by:

1. Conducting a minimum of two surveys during 1 March - 30 June, with no more than one survey in March. All four surveys may be completed during this period (1 March - 30 June). Owl calling activity tends to increase from March through May (Ganey 1990), so this time period is optimal for locating owls.
 2. Complete all surveys by 31 August, with no more than one of the four required surveys completed in July or 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 added (e.g., more than the recommended 4 surveys), more than one complete survey may be completed in August.
 3. After finishing a complete survey, wait at least 5 full days before beginning the next complete survey. For example, assume a visit ends on the 30th of April. Using a proper five-day spacing (1-5 May), the next possible survey date would be 6 May. (See section 3D below for an exception.)
- C. A given complete survey of the area to be inventoried should be conducted within a period of 7 consecutive days. If the area is too large to be surveyed in 7 days, it should be divided into smaller areas based on available habitat, topography, and other important factors.
- D. In **remote areas** surveyors may 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 a Service biologist prior to proceeding with this deviation from the survey protocol.
- E. The 2-to 3-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 may be discontinued in a given area when data indicate that the entire survey area is designated as PACs.
- G. Consider vocal or visual locations of owls outside the breeding season (1 September - 28 February) as extra information that may be of assistance in locating nesting owls in the upcoming breeding season.

4. After Hearing a Mexican Spotted Owl

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

- A. Time the owl(s) was first heard, the type of call heard, the owl's sex, and whether **juveniles** were heard.
- B. A compass bearing from the surveyor's location to the location where the owl was heard. If possible, triangulate the owl's location, taking compass bearings from 2-3 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 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 a 2-5 minutes, the surveyor should continue calling in order 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 determining the owl's location (see section 4B above), move approximately 0.5 to 0.75 miles 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 visit as soon as possible (see section 5 below).

5. Conducting Daytime Follow-up Visits

As with nighttime surveys, follow-up daytime searches assure quality of results and standardization of effort. Calling to elicit territorial responses is also used during daytime follow-up visits. A daytime follow-up visit helps locate owl roosts or nest sites 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. 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 habitat within at least a 0.5 mile radius of the response location. This means walking throughout the area, calling, listening, and watching for owl sign (whitewash, pellets, etc.). A minimum of 4 person-hours should be spent searching for owls. If 2 to 3 people conduct the daytime follow-up visit, then two hours time is most likely sufficient.

- A. Complete a daytime follow-up visit 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 visit, the smaller the probability of locating the bird and finding its roost or nest location. This is especially true if the owl(s) are non-nesting. If the daytime follow-up visit is performed over 48 hours from the nighttime detection, and no owls are found, the survey is considered incomplete and the nighttime surveys should continue.
- B. Conduct daytime follow-up visits in the early morning or late afternoon/early evening. The optimal dawn period is 0.5 hour before sunrise to 2 hours after sunrise and the optimal dusk period is 2 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.
- C. The search area for a daytime follow-up visit is a specific, smaller area within the broader survey area in which an owl was detected.
 1. Minimum search area is all protected, restricted, and canyon habitat within at least a 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, search the best habitat.

3. Study aerial photos and maps of the area to identify habitat patches and topographic features such as canyons or drainages in order to prioritize daytime survey locations.
- D. To conduct a thorough search for owls, the surveyor should systematically walk and call all protected, restricted, and canyon habitat 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 you are not able to complete a daytime follow-up visit for any reason, or feel the search effort was not satisfactory because of the presence of predators or weather, conduct a second follow-up visit 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 may wish to consider adding additional surveys to account for nocturnal responses with no corresponding daytime location. Field personnel conducting surveys need to be given the flexibility to return as many times as necessary to find the owl(s). Surveyors may need to assess the confidence of the nighttime response and determine if additional nighttime surveys are needed to more accurately determine the location of the responding 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, do not linger in nest sites or over-call an area.

6. 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 mice to **adult/subadult** owl(s) and observing the owls' subsequent behavior. Surveyors should be prepared to offer four mice (one at a time) to at least one member of the pair or to the single owl located on the daytime follow-up visit. 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 with mice several hundred yards to reach their nests or young. It is not necessary to complete the four-mouse 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 juveniles are seen then reproduction 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.

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 (≤ 0.25 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 on a nest.
4. One or both adults are observed with young.

B. "Single status" is inferred from:

1. The presence or response of a single owl within the same general area 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 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 owl which 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 by:

If surveys are conducted according to this protocol, or an alternative protocol approved by the Service, and no owls are heard, a reasonable inference can be made that owls are “absent” within the given area at the time the surveys were conducted. However, absence does not necessarily indicate that owls never occupy the area.

- F. Separate territories are inferred by:

Any two owl responses more than 0.5 miles apart should be considered separate territories unless daytime follow-up visits indicate otherwise. Ideally, to rule out the existence of multiple territories, surveyors on two or more crews should coordinate efforts to begin calling simultaneously near each suspected activity area. If more than one survey crew elicits responses from owls of the same sex at roughly the same time, then additional territories probably exist. However, if responses vary from those above, the results are considered inconclusive and additional attempts to determine status should continue.

8. Determining Nesting Status and Reproductive Success

Determining reproductive success is not required if breeding season restrictions are applied to all management projects in order to protect owl reproduction in any given year (USDI 1995). However, reproduction surveys are always valuable as they may provide information on nest tree locations, which provide the best data for determining 100 acre **nest buffers** and delineating PAC boundaries as recommended in the Recovery Plan (USDI 1995). If the exact location of the nest is not found, but juveniles are seen prior to 1 August, the area where the juveniles are seen may 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. 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 nest site.
2. Use mousing to determine nesting status. The site will be 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 will be 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.
 - 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 may fail before surveys are conducted, the non-nesting status includes owls that did not attempt to nest as well as those that have failed. Non-nesting status is inferred during a daytime follow-up visit if:
 - a. The female is observed roosting for a full 60 minutes (1 April - 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 at least two prey items.
 - c. All pairs determined to be non-nesting should receive at least one daytime follow-up visit between 15 May and 15 July to confirm that no juveniles were produced.
6. Nesting status unknown:
- a. If owls are found after 1 June, without young-of-the-year, nesting status is unknown.
 - b. If no owls are found after 1 June (at those sites where owls were present prior to 1 June), nesting status is unknown.

B. Determining Reproductive Success

1. Once a pair is classified as nesting, conduct reproductive success surveys after the time the young-of-the-year leave the nest (fledge), usually in early to mid-June. Conduct reproductive success surveys between 15 May and 15 July for pairs for which nesting status was not established.
2. Schedule at least two visits to the site spaced at least one week apart to locate and count fledged young, timing the visits so that the fledged young are observed as soon after leaving the nest as possible.
3. Use visual searches and/or mousing. 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 on at least two occasions, separated by at least one week, zero young are recorded.

9. Annual Reporting

An annual report of the activities conducted (including field data forms, if appropriate) should be submitted to the Division of Endangered Species as well as the appropriate state Ecological Services Field Office. If applicable, hard copies of any unpublished or published reports generated by the study and other data which would be useful for the conservation or recovery of the owl should be submitted to the Ecological Services Field Office(s).

10. Disposition of Dead, Injured, or Sick MSO

Upon locating a dead, injured, or sick owl, initial notification should be made to the U.S. Fish and Wildlife Service's Law Enforcement Office in Arizona (telephone: 480/835-8289), Colorado (telephone: 303/274-3560), New Mexico (telephone 505/346-7828), or Utah (telephone: 801/625-5570) within three working days of its finding. Written notification should be made within five calendar days and should include the date, time, and location of the animal, a photograph, if possible, and any other pertinent information. The notification should be sent to the Law Enforcement Office with a copy to the appropriate U.S. Fish and Wildlife Service Ecological Services Field Office. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling specimens to preserve the biological material in the best possible state. If possible, the remains of intact owl(s) should be provided to the appropriate U.S. Fish and Wildlife Service Ecological Services Field Office. If the remains of the owl(s) are not intact or are not collected, the information noted above should be obtained and the carcass left in place. Injured animals should be transported to a qualified veterinarian by an authorized biologist. Should the treated owl(s) survive, the Service should be contacted regarding the final disposition of the animal.

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

March	April	May	June	July	August	September
1 10 20 31	1 10 20 30	1 10 20 31	1 10 20 30	1 10 20 31	1 10 20 31	1 10 20 30
Courtship						
	Nesting					
		Juveniles seen at or proximal to nest tree				
			Juveniles moving from nest tree but still usually within 100 m. Parents feeding juveniles			
					Adults begin to ignore juveniles. Juveniles wander more widely	
						Juveniles disperse, adults wander more widely
↑			↑			

GLOSSARY

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 never occupy the area.
Adult	A Mexican spotted owl ≥ 2 years old. For more information on identifying adult or subadult Mexican spotted owls, please see Moen et al. 1991.
Breeding Season	The time period from 1 March through 31 August that includes courtship, nesting, nestling- and fledgling-dependency periods. This is the period of time in which surveys should be conducted. This time period may 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) minimum of five days between surveys; (3) no more than one survey in March; (4) minimum of two surveys by 30 June; (5) all surveys completed by 31 August, with no more than 1 survey in each of July and August; and (6) two years of survey.
Complete Survey	A survey is complete when all calling stations or calling routes within a survey area have been 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 was 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.

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) by conducting an intensive search within a 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. 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 an Mexican spotted owl's location or used to improve calling coverage of an area when weather or other conditions require. Not required to be established prior to the field outing in which they are used.
Juvenile	A Mexican spotted owl is considered as juvenile age class in the first 5 months after hatching. Juveniles 1 to 3 months old are very white with downy plumage over all of the body or evident on breast and head; at 4 to 5 months old, juveniles begin losing downy plumage (Moen et al. 1991).
Mousing	Mousing is a term used to describe the act of offering prey items to Mexican spotted owls. The purpose of mousing Mexican spotted owls is to determine the reproductive status of the owl(s) (i.e., pair, nesting, non-nesting, reproductive). A male Mexican spotted owl may take a prey item to an unseen female, likewise adult owls may 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 Buffer	A 100-acre area within designated activity centers centered around the nest site. The nest area should include habitat that resembles the structural and floristic characteristics of the nest site. These 100 acres will be deferred from treatment (thinning, burning, etc.).
Nest Stand	An area of vegetation that contains a Mexican spotted owl nest, and which is homogeneous in terms of tree size, forest structure, and species composition.
Nestling	A young owl that is still in the nest.

Predator	Potential Mexican spotted owl predators include the following: great-horned owl (<u>Bubo virginianus</u>), northern goshawk (<u>Accipiter gentilis</u>), red-tailed hawk (<u>Buteo jamaicensis</u>), golden eagle (<u>Aquila chrysaetos</u>), and procyonid mammals (e.g., coati (<u>Nasua nasua</u>) and ringtail (<u>Bassariscus astutus</u>).
Protected Activity Center (PAC)	An area of 600 acres (minimum size) surrounding the “activity center,” 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 600 acres 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 for the life of the Recovery Plan, even if Mexican spotted owls are not located there in subsequent years.
Protected Habitat	Protected habitat includes all Mexican spotted owl protected activity centers, all areas in mixed-conifer and pine-oak types with slope greater than 40 percent where timber harvest has not occurred in the past 20 years. Specific guidelines and the rationale for these guidelines are provided in the Recovery Plan (USDI 1995).
Remote Area	Generally, any survey area that requires more than 4 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 from the District Office or main departure point. All remote areas should be agreed to by the Service on a case-by-case basis prior to using the survey protocol to clear a project.

Restricted Habitat	Mixed-conifer and pine-oak forest types found on steep slopes that have been treated within the past 20 years and riparian forests. Restricted habitat is also mixed conifer and pine-oak NOT found on steep slopes. These areas are not protected as strictly as Protected Habitat/Areas, but specific guidelines for management activities and target/threshold conditions exist (USDI 1995).
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, white-wash, and other evidence.
Subadult	Mexican spotted owls in the first and second years of life. 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.

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- U.S. Department of Interior (USDI) U.S. Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl: Vol. I. Albuquerque, New Mexico. 172 pp. This recovery plan may be viewed and/or copied by contacting the New Mexico Ecological Services Field Office, 2105 Osuna Northeast, Albuquerque, NM 87113.

SUGGESTED READING

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MSO Survey Protocol Outline

Complete Inventory 4 complete surveys each year (minimum 5 days apart)
No more than one survey in March
Minimum of 2 surveys must be completed prior to June 30th
No more than 1 survey in each of July and August
All surveys completed by 31 August
2 consecutive 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 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 (2 visits to confirm nesting, minimum 1 week apart), 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 (2 visits to infer non-nesting, minimum 3 weeks apart):
 - a) One of owl pair fed 4 mice (know fate of all 4 mice)
 - b) Female refuses mouse and/or roosts for minimum 1 hour (1 April - 30 April)
- 3) Pair is located after 1 June:
 - a) NESTING STATUS UNKNOWN
 - b) Conduct reproductive visit, go to 5a

5. REPRODUCTIVE SUCCESS VISITS

A) NESTING STATUS UNKNOWN

- 1) Two visits, One week apart, feed 4 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