

Appendix B

American Burying Beetle Trapping Protocol and Conservation Measures for Use in Nebraska

American Burying Beetle Nebraska Trapping Protocol

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Trapping methods are used for both Presence/Absence surveys and Capture and Relocation. Trapping for the American burying beetle (*Nicorphorus americanus*) (ABB) will be conducted with a modified version of the U.S. Fish and Wildlife Service's (1991) protocol, as described by Bedick et al. (2004). Trapping for the ABB may be conducted during two periods in the year. The first period in early summer (approximately June 7th to July 1st) is after beetles have emerged from hibernation and prior to beetles going underground during the larvae rearing cycle. The second trapping period is in late summer (approximately August 7th to September 1st), after the larval cycle when both senescent and teneral beetles are present. For the early summer period, trapping will be conducted when the average temperature at midnight is 60 degrees Fahrenheit or greater. It is recommended that trapping be conducted when the average temperature at midnight is 60 degrees Fahrenheit or greater. Trapping of ABB may be conducted during this period when the average temperature at midnight is 55 degrees Fahrenheit or greater, however, false negative presence data may be obtained under these conditions.

A positive control should be used in association with trapping. A positive control establishes that conditions were correct in a given geographic area and that ABB were active during the timeframe of the trapping. Only one ABB capture is necessary to establish a positive control. The positive control window may be up to seven days prior to trapping, or during, but not after the trapping timeframe. There are several locations within Nebraska with a recent history of dense populations and that have been documented through regular research.

Coordination with USFWS and the Commission may provide existing projects with positive controls. When trapping south of the Platte River, Lincoln County may be used and for trapping north of the Platte River, an area near the town of Chambers can be used.

Adult ABBs will be captured by use of baited pitfall traps consisting of a five-gallon (18.92 Liter) plastic bucket (diameter 28.5cm). Bedick (1997) found a five-gallon bucket to be the most appropriate pitfall trap when sampling for the ABB because they provide a larger surface area for each beetle to escape from other carrion beetles. Alternatively, a one-gallon bucket may be used as a pitfall trap in those instances where burial of the five-gallon bucket would be difficult.

All buckets will be washed using bleach and thoroughly rinsed prior to being used as traps. All buckets will be buried in the ground, with approximately 4-5 cm of the bucket above ground level. Soil will then be built up around the bucket, creating a gradient from ground level upwards to the bucket rim. This will be done to limit the amount of water entering the buckets through runoff and splashing of water during rainfall events. Buckets will be located on the terrain so as to prevent inundation during rainfall events as beetles can drown very easily in even a small amount of water. Traps should not be placed within 10 feet of ant colonies, as they can kill the beetles that have been captured. Approximately 5-8 cm of moist soil will be placed in the bottom of the bucket, in order to give trapped carrion beetles room to burrow into the soil to avoid competitors, high temperatures and low moisture levels above the soil. To prevent rainfall and debris from directly entering the bucket, a square piece of plywood (37 cm by 37 cm) will be placed on top of the trap, supported by two or more sticks/narrow boards ranging from 1.5-2.5 cm in thickness. Additional weight (soil, rocks, etc.) will then be placed on top of the trap cover

to reduce bait loss to vertebrate scavengers and to prevent the cover from being moved by wind or small animals.

It is recommended that all traps be baited with previously-frozen, 275-374 g laboratory rats (*Rattus norvegicus* – available from online dealers such as RodentPro.com). If rats are not available, bait items of comparable size and structure may be used. The bait will be aged in airtight containers for 3 to 7 days, depending on the temperature and other weather conditions. In contrast to the previous protocol, the bait will not be placed into containers within the traps. What is critical is that the bait be ripe and emit a powerful odor as beetles key in on odor to locate food. With larger numbers of traps spread across a relatively large area, it is better to allow carrion beetles to feed on the bait, which also helps maintain moisture levels in the soil within the trap and reduces stress. This will also prevent loss of beetles to inter-beetle predation and desiccation, which has been determined to be a potential mortality factor for Silphidae on hot mornings by Bedick (1997). Traps will be spaced no farther than 1 mile (1.6 km) apart to ensure that the entire survey area will be covered by the predicted radius of the trap (0.5-mile (800 m)). Traps will be set on the first trap day before 1800 hours and checked every subsequent morning by 1100 hours.

Trapping will be conducted for a minimum of five consecutive days. When trapping for ABB, if weather conditions are unsuitable for trapping during the 5 consecutive days, it is not necessary to begin the 5 day session again, but rather add one night of trapping for each night of unsuitable conditions. Unsuitable weather conditions include nights when the temperature drops below 55°F or raining. It is assumed that on nights with unsuitable conditions, the beetles will not be active.

At each trap site, a GPS location and digital photograph will be taken to document the location of the trap and the general habitat characteristics of the trap site. All carrion beetles captured will be identified to species whenever there is available time and resources, and the ABB will be sexed by use of Ratcliffe (1996). If the goals and objectives of the survey effort are to assess population status and requires marking beetles, all ABB captured will be recorded and marked using a drop of model paint (such as Testors) placed on the pronotum or the posterior portion of one or both elytra. Paint will be applied in a manner that will not cause damage to the elytra. If the purpose of the trapping effort is to clear an area, marking beetles is not necessary. All ABB captured during the second trapping period (August 7th through September 1) will be evaluated for being either teneral or senescent, if the surveyor(s) have been properly trained. Captured ABB will be released as quickly as possible. For research purposes, the ABB may be released at the point of capture or at locations away from the capture point if such release methods are identified in an approved research design and the release sites have been evaluated as providing suitable habitat for the beetle. For the purpose of clearing a site of ABB prior to disturbance activities, captured beetles will be released in suitable habitat at a minimum distance of two miles away from the capture site. The release sites should be included in proposed conservation measures by the project proponent for concurrence on the project. All captures of ABB will be recorded in the format of the Natural Heritage's Database housed by the Nebraska Game and Parks Commission, including recording captures in a Geographic Information System Database, as applicable, for future reference and analysis. Results of surveys will be sent to the Nebraska Game and Parks Commission and the US Fish and Wildlife Service.

References

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Conservation Measures for the American Burying Beetle (ABB)
Provided by the U.S. Fish and Wildlife Service, Nebraska Ecological Services Field Office
Nebraska Game and Parks Commission

Background

The federally and state endangered American burying beetle (ABB) is the largest member of the carrion beetle family and has a lifespan of about one year. It ranges from 1 to 1.5 inches in length, has four red-orange spots on its wing covers, and is distinguished by its larger size and its orange-red pronotum. The ABB was common over the eastern half of North America as recently as the 1920's, but has disappeared over 90 percent of their historic range (Sikes and Raithel 2002). The ABB's current range now includes Rhode Island, Oklahoma, Arkansas, and Nebraska. Reasons for the decline are not well understood but human activity, light pollution, pesticides, and habitat loss are all considered contributing factors (Sikes and Raithel 2002). In Nebraska, historical records of ABB have been observed in Antelope, Custer, and Lancaster counties. Other counties that have suitable habitat include: Antelope, Blaine, Boone, Boyd, Brown, Cherry, Custer, Dawson, Frontier, Garfield, Gosper, Grant, Holt, Hooker, Keya Paha, Lincoln, Logan, Loup, Rock, Thomas, and Wheeler. See enclosed map for current distribution and potential habitat areas.

The ABB has been captured in a variety of habitats including grasslands, grazed pasture, bottomland forest, riparian zones, and oak-hickory forests (Creighton et al. 1993; Lomolino and Creighton 1996; NatureServe Explorer 2007; and U.S. Fish and Wildlife Service 1991) and have been labeled a vegetation generalist (Lomolino et al. 1995). In Nebraska, ABB have been found in mesic areas such as wet meadows, and wetlands in association with relatively undisturbed semi-arid, sandhill and loam grasslands. Such areas have been observed to have a thick stand of grassland vegetation with some woody vegetation. ABB are also found in the Loess Canyons, primarily located in Lincoln County. These steep loess hills and canyons support mixedgrass prairie, but much of the area is heavily invaded by eastern red cedars (Schneider et al. 2005).

It is suspected that carrion availability in a given area is more indicative of ABB presence than vegetation structure since carrion is the sole food source for ABB and is an essential component in a complex reproductive cycle for the species (U.S. Fish and Wildlife Service 1991). The ABB is able to efficiently locate carrion (Bedick et al. 1999) and have been moving over two miles to a carrion source (Creighton and Schnell 1998). Because of their habit of feeding on carrion, their sole food source, the species may be found in marginal habitat like roadsides where they likely forage on roadkill.

For the ABB to use the carrion for reproductive purposes, the carrion must also be the approximate size of a squirrel and also be located in an area where soil conditions are conducive to excavation by ABBs (Anderson 1982, Lomolino and Creighton 1996). When the ABB locates a suitable carcass, a mated pair will bury the carcass for egg deposition and brood rearing. The larvae feed on the carcass and remain underground through the pupal stage and the parents care for the developing young underground. The development process from egg to adult takes approximately 48 – 65 days (Ratcliffe and Spomer 2002). Adults and newly hatched adults (teneral) will emerge from the ground to feed in preparation for winter hibernation. Current

research suggests that the adults return to the ground to overwinter. In Nebraska, ABB have been found in association with soils composed of some clay with a prominent duff (litter) layer have also been observed.

Adult ABB are fully nocturnal and are typically active when night time temperatures reach 60° F. Thus, the ABB active period in Nebraska can be as long as April 1 to October 29, with peak periods of activity in June and August. The first peak active period in early summer (approximately June 7th to July 1st) is after beetles have emerged from hibernation and prior to beetles going underground during the larvae rearing cycle. The second peak active period is in late summer (approximately August 7th to September 1st), after the larval cycle when both senescent and teneral beetles are present. ABB enter an inactive period spent underground throughout the winter when the nighttime low temperatures are consistently 60° F or below. In Nebraska, this typically occurs from October 29 to April 1.

Purpose

American burying beetle surveys are designed to ensure awareness and resolution to any potential conflicts between ABB and potentially disruptive human activities. To prevent conflict, two types of actions are recommended depending on location: **Presence/Absence Surveys and Capture/Relocation Conservation Measures**. In addition, **Maintaining Clear Activities** may be necessary depending on the situation. One factor when deciding which actions are necessary is the American Burying Beetle Distribution Map (Attached). In areas of counties with ABB, first a Presence/Absence Survey should be conducted to determine if relocation is necessary. ABB Habitat should assume presence and implement Capture and Relocation conservation measures, followed by Maintaining Clear Activities.

These measures/surveys and activities are to occur in areas of suitable habitat in construction areas. Construction areas include areas that will be impacted by construction, where heavy equipment and materials will be staged and/or stored, all areas within the Limits of Construction, potential haul or temporary roads and borrow site areas. Areas of basic unsuitable habitat are defined below. Since this species is found in a variety of habitats, the Commission and Service encourage the project proponent to discuss additional unsuitable habitat or potential habitat if the project proponent desires further guidance in determining where conservation activities are necessary.

If the project proponent chooses to conduct a survey, the Nebraska ABB Survey Protocol is recommended (See Attached). A valid section 10 permit from the U.S. Fish and Wildlife Service (Service) and Scientific and Education Permit from the NGPC is required for anyone conducting such surveys. All survey results, positive or negative, must be submitted in writing to these Agency offices for review prior to initiating any ground disturbing activities.

Presence Absence Survey (PA)

An initial screening of the project may reduce the area where the PA survey is necessary. Urban areas dominated by pavement, areas dominated by row crop agriculture and areas consistently inundated with water need not be surveyed for presence or absence. Wet meadows, often

associated with wetlands and riparian areas are ideal habitat and cannot be eliminated. Open grassland areas surrounded by trees also represent potential habitat. If the project proponent chooses to reduce the PA survey area based on these habitat criteria, a revised area where the PA survey will be conducted should be submitted to the US Fish and Wildlife Service (Service) and the NE Game and Parks Commission (Commission) to ensure areas of potential habitat are not inadvertently omitted.

The PA Survey needs to be conducted when the ABB is active. Research suggests that when the average temperature at midnight is 60 degrees Fahrenheit or greater, detection results are the most consistent. PA Survey of ABB may be conducted during this period when the average temperature at midnight is 55 degrees Fahrenheit or greater, however, false negative presence data may be obtained under these conditions. Each situation is unique and the project proponent will need to determine, based on local conditions if surveys are valid or if a repeat is necessary. The Commission would welcome questions as they arise during a survey. A photograph should be taken of each trap site and sent to the Commission.

The Presence Absence Survey needs to be conducted for a minimum of 5 consecutive trap nights^{*}. If no beetles are captured during those 5 nights, the ABB is considered to be absent and the area is considered “clear.” This information needs to be sent to the Service and the Commission. If the project has concurrence from these agencies, then *no further conservation measures are necessary and construction may begin*. If a beetle is caught anytime during those 5 days, this is considered a positive survey and the P/A may cease. Depending on the project, if capture and relocation measures are recommended they may begin immediately if conditions are adequate. If capture and relocation measures will not follow the P/A survey, any ABB captured during the PA Survey should be released on site. Notify the Service and Commission of any change of trapping type. Survey results must be submitted to both the Commission and the Service. A photo should be taken of the first ABB captured to serve as a voucher specimen.

Capture and Relocation (CR) Conservation Measure

An initial screening of the project may reduce the area where the CR Conservation measure is necessary. Urban areas dominated by pavement, areas dominated by row crop agriculture and areas consistently inundated with water need not have an attempt to remove ABB. Wet meadows, often associated with wetlands and riparian areas are ideal habitat and cannot be eliminated. Open grassland areas surrounded by trees also represent potential habitat. If the project proponent decides to reduce the CR area based on these habitat criteria, a revised area where the CR Conservation measures will be conducted should be submitted to the Service and the Commission to ensure areas of potential habitat is not inadvertently omitted.

The CR Conservation Measures need to be conducted when the ABB is active. Research suggests that when the average temperature at midnight is 60 degrees Fahrenheit or greater, detection and capture results are the most consistent. CR Conservation Measures of ABB may be conducted during this period when the average temperature at midnight is 55 degrees

^{*} When trapping for ABB, if weather conditions are unsuitable for trapping during the 5 consecutive days, it is not necessary begin the session again, but rather add one night to the end of the session. For each unsuitable trap night Unsuitable weather conditions include nights when the temperature drops below 55°F or it is raining.

Fahrenheit or greater, however, false negative presence data may be obtained under these conditions. Each situation is unique and the project proponent will need to determine, based on local conditions if surveys are valid or if a repeat is necessary. The Commission would welcome questions as they arise during a survey or trapping series. A photograph should be taken of each trap site and sent to the Commission.

Trapping for relocation must be conducted for a minimum of 5 consecutive nights[†]. For an area to be “cleared” the last three consecutive nights must have no ABB. Any captured ABB must be moved to suitable habitat areas located at least 2 miles from the area of construction. Photo documentation of the release sites should be taken and submitted to the Service and Commission. Upon completion of the capture and relocation measures, if the project is within the known ABB distribution, *Maintaining Clear Activities must be implemented within 3 days of establishing “clear,” regardless of the presence or absence of ABB.* If the project is not in the current distribution area of the map and no ABB were detected, no further conservation actions are necessary for that calendar year. Results of the survey must be submitted to both the Commission and the Service. A photo should be taken of the first ABB captured to serve as a voucher specimen.

If a site cannot be cleared by the capture and relocation procedure after 10 days of trapping, contact the Service and the Commission for additional guidance. This situation is considered unlikely, and will need to be dealt with on a case by case basis. Additionally, no more than 50 ABB should be moved to each re-location site.

If the project will impact suitable ABB habitat or impact areas of known ABB occurrences for multiple years, a new survey, the capture relocation procedure and the standard conservation measures may be necessary for each year of construction. Surveys results are typically only valid for one season. The sequence of construction will determine what measures are necessary. In this situation, it is recommended that the details and necessary measures be determined through the information consultation process between the Commission and Service.

Maintaining Clear Activities

The purpose of Maintaining Clear (MC) Activities are to ensure that once an area is “cleared” that ABB are not attracted to the site during construction. MC Activities are necessary when the ABB is active, so depending on the disturbance timeframe, the maximum time they may be necessary is from April 1 through September 15. Upon completion of Capture and Relocation Conservation Measures, Maintaining Clear Activities must be implemented within 3 days. However, these activities may be implemented prior to survey or capture/relocation completion. These activities are designed to deter ABB from utilizing the site, so it may be in the project proponent’s best interest to begin these activities as early as April 1. If only these activities are being implemented (if the clearing activities occurred the previous fall), then these activities

[†] When trapping for ABB, if weather conditions are unsuitable for trapping during the 5 consecutive days, it is not necessary begin the session again, but rather add one night to the end of the session. For each unsuitable trap night Unsuitable weather conditions include nights when the temperature drops below 55°F or it is raining.

should begin by April 15th if the construction will occur after that time. If construction will occur on or before April 15th, then these MC Activities should begin 2 weeks prior to April 15th.

The project proponent will prepare the area by removing any and all carcasses prior to construction. Carcasses as small as songbirds are ideal food for the ABB, so this removal activity must be thorough. Carcass removal must continue until September 15 or until construction is completed, whichever is earlier. Carcass removal can be done at any time throughout the day, but the preferred timing is late afternoon. This will ensure that the nocturnal ABB is not drawn to the area by road kill caused by daytime traffic. Disposal of carcasses should be at least 0.5 miles from the project site.

In addition, the area of construction should be mowed such that the vegetation is as low as possible without causing erosion. This short vegetation height shall be maintained by the project proponent for the duration of the project. Along with mowing, the residual vegetation from mowing needs to be removed from the area. Possible methods are raking, windrowing or bailing. Alternatively, mowing can be done approximately every 2 weeks and the vegetation kept less than 8 inches tall. No vegetation removal is necessary if this height is maintained. All construction, work vehicles and personal vehicles should be staged in mowed areas.

Photo documentation of these MC activities is in the best interest of the project proponent. The Service and Commission request that photographs of mowing and carrion that is removed be included in weekly reports to the Environmental Analyst (Commission) and Wildlife Biologist (Service).

Unusual Circumstances

This protocol was developed as a standard for most projects that may disturb ABB habitat, but unique situations may require an individualized approach. If the project proponent has an alternative to the suggested conservation actions described in this protocol, the Service and Commission will discuss potential alternative methods for avoiding take of American burying beetle.

Night Work and Light Pollution Concerns

In areas of known ABB populations or where ABB have been positively identified night work may need to be restricted during the ABB active seasons due to potential impacts to the species. The appropriate action would need to be determined on a case by case situation. However, artificial light sources have been implicated in causing insect population losses (Pyle *et al* 1981). The ABB's attraction to artificial lighting could cause it to fly from suitable habitat resulting in excessive energy expenditure and reduced reproductive success as well as make it vulnerable to nocturnal predators such as other insects and bats. The Service and Commission are aware that the ABB is attracted to ultraviolet light since several individuals have been trapped on other project areas using black light traps. In addition, forms of insect control used at residential areas, which involve the use of black lights as an attractant and a lethal electric grid have been known to kill ABBs.

To avoid attracting the ABB from nearby habitats to the proposed project site, it is recommended that the following conservation measures be implemented for permanent structures:

- a. All exterior lighting sources should be low pressure sodium vapor lights;
- b. All exterior lighting should have downward shields installed to direct light to the ground and not illuminate the project area;
- c. All exterior lighting should be low mast to minimize light dispersion thereby reducing the attraction to the ABB;
- d. Where possible, a vegetative screen consisting of native trees and shrubs should be established between the proposed permanent facilities and nearby habitats that may harbor the ABB; and
- e. No light traps should be used as a means of insect control.

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