



United States Department of the Interior
FISH AND WILDLIFE SERVICE
Division of Ecological Services



American Burying Beetle *Nicrophorus americanus*
Rangewide Survey Guidance
Updated 4-20-11

Introduction

This document provides guidance in designing and conducting presence/absence surveys for the endangered American burying beetle (*Nicrophorus americanus*) (ABB) throughout their current and historic range and replace any previous Service recommended guidance. These surveys may only be conducted by those individuals possessing a valid scientific/recovery permit, as defined under section 10(a)(1)(A) of the Endangered Species Act (ESA), issued by the U.S. Fish and Wildlife Service. Surveys for ABBs conducted beyond the scope of a presence/absence survey must be coordinated with the Service. The appropriate state wildlife agency should be contacted for any state guidelines and permits. Justification and references for this guidance is provided in a separate document entitled "Scientific Justification for the American Burying Beetle *Nicrophorus americanus* Rangewide Survey Guidance" available at <http://www.fws.gov/southwest/es/oklahoma/beetle1.htm>.

Survey Parameters

Time of Year for Surveys

In Texas, Oklahoma, Kansas, and Arkansas, the southcentral portion of the ABB's range, surveys should begin no earlier than May 20 and end no later than September 20. In Nebraska and South Dakota, the northcentral portion of the ABB's range, surveying may be conducted during two periods within the primary active season. The first period is from June 7 to July 1 after ABBs have emerged from the soil and before ABBs bury in the soil for reproduction and brood rearing. The second period is from August 7 to September 1 after reproduction when both senescent (old) and teneral (ABBs newly pupated and emerged from the soil) ABBs are present and before ABBs bury in the soil for the winter.

Timeframe a Survey is Valid

Survey results are only valid until the beginning of the next ABB active season (May 20 in the southern portion of the ABB range and June 7 in the northern portion of the ABB range). Thus a survey conducted in Oklahoma on June 1, 2011, would only be valid until May 20, 2012, and a survey conducted in Nebraska on June 22, 2011, would only be valid until June 7, 2012.

Minimum Survey Effort (Temporal Scale)

The minimum survey effort needed, to effectively determine ABB presence or absence (utilizing cup or bucket traps), is five (5) consecutive nights as described below.

Survey Effort Radius (Spatial Scale)

The effective survey radius of a transect is 0.5-mile from the perimeter of a transect.

Weather Requirements

An additional night of surveying is required in the northcentral and southcentral area when:

- the temperature falls below 60°F,
- rainfall is greater than 0.5 inch, and
- wind speed is greater than 8 mph between 7:00 PM and 7:00 AM.

The goal is to survey for 5 consecutive nights; however, weather may interfere. It is not necessary to restart the survey in order to have five (5) consecutive nights of sampling, unless five (5) consecutive nights of unsuitable weather occurs. All additional nights of surveys conducted due to weather issues must be noted in the “*ABB Survey Data Collection Form*” (Appendix 1) and the “*ABB Survey Summary Report*” (Appendix 2).

The necessary temperature, rain, and wind information should be collected from <http://www.wunderground.com/history>. This information must be recorded on the “*ABB Survey Data Collection Form*” and the “*ABB Survey Summary Report*”.

For a list of weather stations in your state:

- From the homepage, hover over the Local Weather tab and click on Weather Stations in the drop down menu.
- At the bottom, right of the page is a text box entitled PWS Network. Select the appropriate state and click View.

For a map of weather stations in your state:

- From the homepage, hover over the Maps & Radar and click on WunderMap in the drop down menu.
- At the right of the page is a text box entitled Select a Location. Type in the appropriate city and state and click Go.

For weather data history in your state:

- From the homepage, hover over the Local Weather tab and click on History Data in the drop down menu.
- Enter the nearest city to the location of the survey and the date of the survey, and then click Submit. (The nearest weather station will be automatically selected).
- The weather data for the day selected will display at the top of the page. Scroll down this page to view the hourly weather data.
- Weather data is reported from midnight to midnight. View the appropriate days to determine the weather at your survey site from 7 pm to 7 am.

Transect

A transect (Figure 1) is defined as either of the following (Figure 1 depicts habitat sampling stations and habitat variables, but the Service is not recommending collecting habitat data):

- A. Eight 32-oz (1-liter) cup pitfall traps, spaced 66 feet (20 meters) apart for a total length of 460 feet (140 meters), see figure 2.
- B. Five 1-gallon (4.4 liter) bucket pitfall traps, spaced 92 feet (28 meters) apart for a total length of 460 feet (140 meters), see figure 3 and 4.
- C. One 5-gallon (22 liter) bucket pitfall trap where each bucket represents a transect, see figure 3 and 4.

Transect Spacing and Placement

The effective trapping area of a transects is 0.5 mile. Transects should be spaced a minimum of 1.0 mile apart to achieve reliable survey results. Transects should be placed on the highest spots in the survey area and should be placed along the upwind edge of the survey area if possible. However, placing transects on high reliefs takes precedent over upwind placement.

Traps

Each pitfall trap consists of a cup or bucket trap, bait, and cover. Utilization of other trap design and equipment that deviates from that described here must be coordinated with and approved by the Service. Each trap along a transect is termed a station.

Cup Traps

Each of the eight pitfall cup trap stations along a transect consist of two 32-ounce (1.0 liter) cups, with a minimum diameter of 5 inches (Figure 2). The two cups at each station are stacked together and placed in an appropriate sized hole in the ground. Stacking the cups one inside the other facilitates removal of trapped insects. The top cup can easily be pulled out and replaced while the second cup remains in the ground to maintain the integrity of the hole. The lip of the trap cups should be 0.5 to 1.0 inch above ground level and a berm of 0.5 to 1 inch of soil built up to the lip of the cup to create a gradient from ground level upwards to the rim of the cup for ABBs to access the cup. This also prevents water runoff from filling the cup. The cup should not exceed 1 inch from the ground. Approximately 1 inch of un-moistened soil should be placed in the bottom of the cup. The addition of water to such a small amount of soil can result in drowning or clogging of spiracles. A 1 to 2 inch squared piece of wetted sponge should be placed in the bottom of the trap cups atop the soil.

The bait for cup traps is provided via a plastic cup about 5 to 6 ounce (20 milliliter) with a diameter of about 1.5 inches. The bait cup is suspended over the cup trap with wire. The distance between the lip of the bait cup and the lip of the cup trap should not be less than 2 inches. Examples of bait cup types are those used in restaurants for carryout of salad dressing or styro-foam coffee cups with the top portion cut off leaving only the bottom 1 inch of the cup. The bait cup should be large enough to hold the proper amount of bait (described below), but small enough to be suspended over the cup trap and still allow ABBs to crawl into the cup trap and not the bait cup. Bait suspended over the pitfall trap via skewer or similar device is not recommended. The bait dries out and the odor emitted is greatly weakened.

Wire is used to secure and suspend the bait cup over the trap cup. To accomplish this and not allow ABBs to access the bait cup, the wire needs to be very thin, hand malleable, but sturdy enough to support a full bait cup. The wire is inserted into one side of the bait cup near the top and pushed all the way through the cup and out the other side of the cup; about 4 inches of wire should extend on either side of the exterior of the bait cup. Bend wire on either side of the bait cup down and push into the ground to suspend and secure the bait cup over the trap cup. The reason for separate bait and trap cups is to protect the ABB from coming in contact with the bait. As the bait liquefies or becomes gummy ABBs could be harmed if they contact with the bait.

1 Gallon Bucket Traps

Each of the five pitfall bucket trap stations along a transect consist of two 1-gallon buckets, with a minimum diameter of 6 inches. The two buckets at each station are stacked together and placed in an appropriate sized hole in the ground. Stacking the buckets one inside the other facilitates removal of trapped insects. The top bucket can easily be pulled out and replaced while the second bucket remains in the ground to maintain the integrity of the hole. The lip of the buckets should be 0.5 to 1.0 inch above ground level and a berm of 0.5 to 1 inch inches of soil built up to the lip of the bucket to create a gradient from ground level upwards to the rim of the cup for ABBs to access the cup. This also prevents water runoff from filling the bucket. The bucket should not exceed 1 inch from the ground. Approximately 2 inch of un-moistened soil should be placed in the bottom of the bucket. The addition of water to such a small amount of soil can result in drowning or clogging of spiracles. A 2-3 inch squared piece of wetted sponge should be placed in the bottom of the trap buckets atop the soil. The bait for bucket traps is placed in the bucket on top of the soil so ABBs have access to the bait.

5 Gallon Bucket Traps

One 5-gallon (18.92 liter) bucket with a diameter of 11.2 inches (28.5 centimeter) is used for each transect (Figure 3 and 4). The lip of the trap bucket should be 1 to 2 inches above ground level and a berm of 1 to 2 inches of soil built up to the lip of the bucket to create a gradient from ground level upwards to the rim of the bucket. The bucket lip should not exceed 2 inches from the ground. Approximately 3 to 4 inches of soil should be placed in the bottom of the bucket to give

trapped burying beetles room to burrow into the soil to avoid competitors, high temperatures, and low humidity levels. Loose, friable soil with little or no clay content should be used and the soil should be moistened but not wetted.

Figures 3 and 4 depict a mesh screen and a jar, respectively, excluding ABB access to the bait, we are not recommending ABB exclusion from bait. We recommend placing the bait on the soil in the bucket so ABBs can have contact with the bait. The bait for bucket traps is placed in the bucket on top of the soil so ABBs have access to the bait.

All Trap Types

Traps must have smooth sides, free of any texture or ridges to prevent ABBs from climbing out. Metal cans should be avoided because as soon as any rust appears, ABBs may be able climb out of the trap. Traps will be located on the terrain to prevent inundation during rainfall events as beetles can drown easily in even a small amount of water.

A cover is needed to deter scavenger's access to the trap, prevent rainfall from entering the trap, and to provide shade to captured insects to deter desiccation. The cover over traps should be rigid; light in color; weighted or secured to the ground; less than six inches in depth, and raised off the ground about 1 to 2 inches to allow ABBs to crawl into the trap and to allow the scent of the bait to escape.

In areas where scavengers are a significant problem, wire mesh should be installed between the pitfall trap (including the bait) and the cover. The piece of wire mesh should extend vertically at least 4 inches past the lip of the trap and mesh size should be at least 1 inch to allow ABBs access to trap, but prevent larger animals from stealing the bait. The wire mesh should be secured to the ground with stakes, and a hard cover will still need to be used. In addition, covers over cup traps should extend vertically at least 4 inches out on all sides from the edge of the trap to prevent scavengers from reaching under the cover and grabbing the bait without disturbing the trap.

Bait

Any type of carrion is suitable for use as bait, as long as it is the appropriate size in correlation with trap size and produces a pungent odor that ABBs are able to detect (Appendix 3).

The appropriate size of bait for trap cups is between 0.5 to 0.7 ounces (15-20 grams). Bait must be placed in a suspended bait cup as described above to prevent ABBs from contact with the bait. A small amount of water should be added to the bait cup to prolong the moisture content and odor.

The appropriate size of bait for 1-gallon bucket traps is about 6 ounces (174 grams). The bait for bucket traps is provided as a whole carcass with hair/feathers intact. Rats can be obtained from online bait dealers (e.g., RodentPro.com). The bait should be placed in the bucket on top of the soil so ABBs have access to the bait.

The appropriate size of bait for 5-gallon bucket traps is between 9.7 to 13.2 ounces (275-374 grams). The bait for bucket traps is provided as a whole carcass with hair/feathers intact. Rats can be obtained from online bait dealers (e.g., RodentPro.com). The bait should be placed in the bucket on top of the soil so ABBs have access to the bait.

All bait must be aged or ripened, and emit a pungent odor to be effective. Whether for buckets or bait cups for cup traps, the bait must be placed into a sealed container or bag, and placed in the sun for a minimum of one day. If the day is relatively cool (less than 85°F [29°C]), the bait should stay in the sun longer. Do not fill the container or bag completely full, because gas pressure is increased as the bait rots and the extra room is need for this expansion.

During trapping efforts, any bait that has dried out or no longer emits a pungent odor must be replaced with new, prepared bait. Discarded or old bait should not be left at or near the current trapping area. This could lure ABBs away from the baited pitfall traps.

Setting and Checking Traps

Each trap must be checked by 10:00 A.M. each morning in the southern portion of the range and by 11:00 A.M. in the northern area. Checking traps entails collecting all trapped ABBs, recording and releasing other *Nicrophorus* species; replacing any missing or dry bait, re-moistening sponge if needed, replacing floatation device if needed, and replacing/resituating any disturbed parts of the trap.

Any injured or lethargic ABBs that are clearly alive should be released immediately. ABBs that appear to be dead should be collected and monitored, as described below under Processing ABBs, and held for at least 20 minutes for accurate determination of their condition. Any dead ABBs should be handled as described below under Accidental Death of ABBs.

Ants

Traps should not be placed within 23 feet (7 meters) of native or non-native ant colonies. If ants are discovered in a trap, it should be relocated at least 23 feet away.

Disturbed bait or traps

Additional nights of trapping will be required if traps are disturbed, as indicated below.

For cup traps, if four or more cup traps and/or bait cups are disturbed, and no ABBs have been captured during a 5-night survey period and additional night of survey is needed. Table 1 below provides the specific number of additional trap nights necessary depending on the number of cup traps disturbed.

Table 1. Additional nights of survey needed during surveys using cup traps if traps are disturbed.

# of traps &/or bait disturbed	# of additional nights to survey per transect
0-3	0 additional trapping needed
4-8	1 transect for 1 night

For 1-gallon bucket traps, if two or more cup traps and/or bait cups are disturbed, and no ABBs have been captured during a 5-night survey period an additional night of survey is needed. Table 2 below provides the specific number of additional trap nights necessary depending on the number of cup traps disturbed.

Table 2. Additional nights of survey needed during surveys using 1-gallon bucket traps if traps are disturbed.

# of traps &/or bait disturbed	# of additional nights to survey per transect
0-2	0 additional trapping needed
3-5	1 night

For 5-gal bucket traps, since only one trap is used per transect, an additional night of trapping is needed if a bucket is disturbed.

Processing Captures

Identification *Nicrophorus* Species

All other *Nicrophorus* species must be identified and recorded. Appendices 4 and 5 provide descriptions of the *Nicrophorus* species and a key for species differentiation, respectively.

Processing ABBs includes gender determination, age determination, taking measurements, marking (if authorized) and data recording of all ABBs captured. All information must be recorded on the “*ABB Data Collection Form*”.

Captured ABBs should only be held for a maximum of 30 minutes, preferably much less than this. ABBs held for longer than 10 minutes should be placed in a hard, plastic container with a damp sponge and then the container placed in an iced cooler. ABBs are sensitive to prolonged heat exposure.

Clipping of the elytra, adhesion of bee tags, painting, or marking in any way is no longer standard protocol during surveys or trap and relocation. These actions now require prior authorization from the Service. Measuring pronotum is voluntary; however, the Service would appreciate the collection of this data. Measuring of the pronotum should be done with calipers.

ABBs should be released near (within 2,000 feet) the transect where they were captured. Further, ABBs should be released about 10 feet away from the foot traffic along the transect and a minimum of about 500 feet away from vehicle pathway to avoid trampling.

Gender Determination

The gender of ABBs can be distinguished based on the orange-red marking located between the frons and mandibles on the head. These markings are rectangular on males and triangular on females (Figure 5). The markings to determine gender are distinct, so this should not be difficult and must be completed on the “*ABB Survey Data Collection Form*”.

Age Determination

ABBs that have pupated during the current active season are referenced as new (i.e. newly emerged) and ABBs pupated the previous year are referenced as old (emerged the previous active season and overwintered as adults). Newly emerged ABBs can be distinguished from old ABBs by their softer bodies and more shiny appearance. In addition, the orange-red pronotum appears to be more orange (less red) and lighter in hue in newly emerged ABBs. The pronotum of older ABBs are more red than orange and are a deeper hue. Older ABBs are often missing body parts, especially legs or antennae. In addition, the mandibles of older adults appear more worn at the tip. The age of ABBs should be recorded as old, young, or unknown. It is also important to consider the time of year when assessing age.

Accidental Death of ABBs

All mortalities of ABBs must be accounted for and an “*ABB Accidental Death Form*” (Appendix 6) must be completed for each individual ABB and must be submitted within 2 calendar days via email to abbcontact@fws.gov at the Oklahoma Ecological Services Field Office and to the appropriate Ecological Services Field Office. A copy of the hardcopy “*ABB Accidental Death Form*” must be submitted to the appropriate Regional Permit Coordinator along with the annual report.

Dead ABBs should be placed in cotton within a sealable, rigid container to prevent jostling of the ABB causing limb and antennae damage. Each specimen must have a unique alphanumeric name assigned. This alphanumeric name should be the first letter of the first 2 words of the permittee company or individual (e.g. Acme Company, first dead ABB = AC001). A label with the date found dead, permittee, legal description (down to quarter section at least), and specimen alphanumeric name should be placed inside each container to ensure future identification. Only place one ABB specimen per container to avoid mixing up specimens. Place the container on ice until the ABB can be prepared. Dead ABBs are to be submitted to the Service or a Service approved facility with corresponding “*ABB Accidental Death Form*”.

The dead specimens, along with a hardcopy of the “*ABB Accidental Death Form*” must be deposited with the Service or a Service approved facility. The appropriate Ecological Services Field Office will provide recommendations as to which facility or facilities for deposits.

Reporting

For each survey effort, the following forms must be completed and submitted to the Service: “*ABB Survey Summary Report*” (Appendix 2) and “*ABB Survey Data Collection Form*” (Appendix 1). Only complete and accurate reporting

forms will be accepted. Incomplete and/or inaccurate forms will be returned and the surveys will be considered invalid until the forms are corrected and/or properly completed, and submitted. When sending corrected forms, indicate that it is a correction, identify what specifically has been corrected, and the project name.

The objective of these reporting requirements is to streamline maintenance of the ABB Survey Database that the Service maintains and provides to the public via our website. To assist the Service in this effort, specific entry of data is needed. All names of companies, months, locations, soil types, plant species, persons, etc. are to be spelled out, no abbreviations (i.e. May instead of 5, Joe Smith instead of J. Smith). Avoid using punctuation (i.e. Joe L Smith instead of Joe L. Smith, or S of Pawhuska instead of S. of Pawhuska). All latitude and longitude data should be reported in decimal degrees and the coordinate system/projection should be in NAD 83. Longitude should have a negative sign preceding the number. Do not include the N or W with the latitude or longitude number. Each survey should have a specific and individual name to distinguish it from other surveys (i.e. Acme oil well 14). Specific and individual survey report identifiers are necessary to ensure the proper survey is referenced in the Service's response of approval or disapproval of a survey effort, if questions arise, or if the survey is for a specific project. If a survey is conducted for a specific project, the project name must be specified in the ABB survey report and any other correspondence submitted to the Service.

Nebraska and South Dakota Reporting

In addition to the above reporting, all captures of ABB will be recorded in the format of the Natural Heritage's Biological Conservation Database housed by the Nebraska Game and Parks Commission and South Dakota Game, Fish, and Parks Department, including recording captures in a Geographic System Database, as applicable, for future reference and analysis. Forms can be downloaded at <http://gfp.sd.gov/wildlife/threatened-endangered/default.aspx>.

An "ABB Survey Summary Report" is to be completed for each survey effort. There are two formats of this "ABB Survey Summary Report" - an electronic format and a hardcopy format.

1. The electronic format of the "ABB Survey Summary Report (electronic)" (Appendix 2) is to be submitted electronically in excel file format (PDF formats will not be accepted) to ABBcontact@fws.gov. Electronic file names should include the survey name, county, and the form name (i.e. Acme oil well 14 Osage Summary Report)
2. The hardcopy of the "ABB Survey Summary Report (hardcopy)" along with all the corresponding "ABB Survey Data Collection Forms" (see below) are to be mailed to the appropriate Ecological Services Field Office (refer to your permit for addresses).

For each transect, each night during a survey effort an "ABB Survey Data Collection Form" is to be completed. Hardcopies of all "ABB Survey Data Collection Form" along with the appropriate "ABB Survey Summary Report" are to be submitted to the appropriate Ecological Services field office (refer to your permit for addresses). There is also an "ABB Survey Summary Header" describing the column headers in "ABB Survey Summary Report". All forms can be downloaded from the Oklahoma Ecological Services Field Office's website <<http://www.fws.gov/southwest/es/oklahoma/beetle1.htm>>.

Location Data

At each transect 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. GPS locations must be provided in decimal degrees, NAD 83, and the appropriate meridian should be referenced.

Protocols and Forms

All forms can be downloaded from the Oklahoma Ecological Services Field Office's website <<http://www.fws.gov/southwest/es/oklahoma/beetle1.htm>>.

Other Federal and/or State Requirements

A state permit is needed to conduct surveys for the ABB in each state. In addition, Nebraska has a Nongame and Endangered Species Conservation Act that must be followed.

Conclusion

The Service appreciates compliance with this protocol and associated reporting. The reports enable the Service to monitor the status of the ABB. However, these surveys also provide the necessary information for companies to avoid impacts to ABBs for project implementation. In addition, maintaining a survey database provides survey data that can be utilized by the public during project planning.

Attachments

Appendix 1-8

Figures 1-5

Other pictures are available on our website: <<http://www.fws.gov/southwest/es/oklahoma/beetle1.htm>>.

Note

This guidance was developed from the above references, U.S. Fish and Wildlife Service's July 14, 2005, "ABB Survey Guidance", U.S. Fish and Wildlife Service Working Group on May 6, 2004, U.S. Fish and Wildlife Service Working Group on March 29-30, 2010, and other meetings between Service personnel and permittees in 2009, 2010, and 2011. The Oklahoma Ecological Services Field Office, in coordination with other Field Offices, updates this survey protocol as necessary due to new findings. This guidance strives to streamline and update American burying beetle survey recommendations among the various states of its current and historic range.