



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



DRAFT
American Burying Beetle *Nicrophorus americanus*
Range wide Survey Guidance
Updated 4-20-12

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 replaces any previous Service recommended guidance. These surveys may only be conducted by 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 ABB 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.

Survey Parameters

Time of Year for Surveys

In Texas, Oklahoma, Kansas, and Arkansas – the south-central 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 north-central 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 is complete and 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 south-central portion of the ABB range and June 7 in the north-central portion of the ABB range). Thus a survey conducted in Oklahoma on June 1, 2012, would only be valid until May 20, 2013, and a survey conducted in Nebraska on June 22, 2012, would only be valid until June 7, 2013.

All traps must be in place and baited by dusk each night. Check and clear traps of ABBs by 11:00 A.M. in the north-central portion of the range, and by 10:00 A.M. in the south-central portion of the range, for every day the traps are open. Traps can be baited at the same time they are checked each morning, provided the bait does not dry out. Because ABB are nocturnal, the risk of ABB captures during the day is extremely low. However, exposure to full sunlight and temperatures over 25°C (77°F) even for a few hours, can result in mortality (Service, 1991).

Survey Effort Radius (Spatial Scale)

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

Minimum Survey Effort (Temporal Scale)

The minimum survey effort to effectively determine ABB presence or absence is three (3) consecutive nights. Creighton *et al.* (1993) and the Service (1991) recommend surveying for a minimum of three (3) consecutive nights to adequately determine the presence or absence of ABB in an area. Bedick *et al.* (2004) recommends a range of three (3) to five (5) nights, preferably five (5) nights. However, after three (3) consecutive nights of trapping, surveyor observations report trapping success declines. Researchers also report that if ABB have not been captured within the three (3) consecutive nights of surveying then ABB are unlikely, although not impossible, to be captured (FWS Arkansas Ecological Services Field Office personal communication with Ana Hiott, 2003). Therefore, the Service believes a survey goal of three (3) consecutive nights should accurately determine the presence/absence of ABB; however, weather may interfere.

Weather Requirements

An additional night of surveying is required in the north- and south-central portions of the range when:

- the night time temperature falls below 60°F,
- wind speed is greater than 8 mph for an average duration of 20% between 7:00 PM and 7:00 AM.

It is not necessary to restart the survey in order to have three (3) consecutive nights of sampling, unless three (3) consecutive nights of unsuitable weather occurs. Record all additional nights of surveys conducted due to weather constraints in the “*ABB Survey Data Collection Form*” (Appendix A) and the “*ABB Survey Summary Report*” (Appendix B).

The necessary temperature and wind information should be collected from <http://www.wunderground.com/history> (or other appropriate weather reporting website such as a mesonet site that would provide the required fields of data). This information must be recorded on the “*ABB Survey Data Collection Form*” and the “*ABB Survey Summary Report*”.

For a list of weather underground 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 underground 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 underground 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 is defined as any one (1) of the following:

- A. One 5-gallon (22 liter) above ground bucket where each bucket represents one transect.
- B. One 5-gallon (22 liter) bucket pitfall trap where each bucket represents one transect.
- C. Five 1-gallon (4.4 liter) bucket pitfall traps spaced 92 feet (28 m) apart for a total length of 460 feet (140 m).

Transect Spacing and Placement

The Service considered ABB's mobility, small size, recorded movement distances, and distance from which they can detect carrion to determine the effective trapping area of a transect to be 0.5 mile (0.805 km). Transects should be spaced a minimum of 1.0 mile (1.609 km) apart to achieve reliable survey results. Transects should be placed on the highest points in the survey area and should be placed along the upwind edge of the survey area if possible. High relief areas take precedent over upwind placement. (Do not place traps in depressions that may hold water if rain occurs.)

Traps

Each trap design consists of a bucket trap with preferred cover option and bait. Utilization of other trap designs and equipment that deviates from the traps described herein must be coordinated with and approved by the Service. All buckets will be washed using bleach and thoroughly rinsed prior to being used for each trapping survey effort.

Bucket Trap Design 1

Above-Ground Bucket-Trap

See Attachment X (Leasure et al. 2012) for instructions, materials, figures and schematics.

Bucket-Trap Design 2

5 Gallon Bucket Pit-fall Trap

(see Figure 1 below)

Materials

1. Two 5-gallon (18.92 liter) buckets with a diameter of 11.2 inches (28.5 centimeter) or greater
2. Piece of plywood at least 4 inches wider than diameter of bucket
3. Piece of wire mesh (\geq 1-inch mesh size) to allow ABB to enter but still exclude small mammals
4. Four garden staples
5. Two 1-inch by 1-inch sticks large enough to hold the cover off the bucket
6. Shovel or ground auger

Place one bucket inside the other bucket, and place both in a pre-dug hole. Stacking the buckets one inside the other facilitates removal of trapped insects by easily pulling the top bucket out, while the second bucket remains in the ground to maintain the integrity of the hole. The rim of the buckets should be 0.5 to 1.0 inch above ground level and a berm of soil built up to the rim of the bucket to create a gradient from ground level upwards to the rim for ABBs to access the bucket. This also prevents water runoff from filling the bucket.

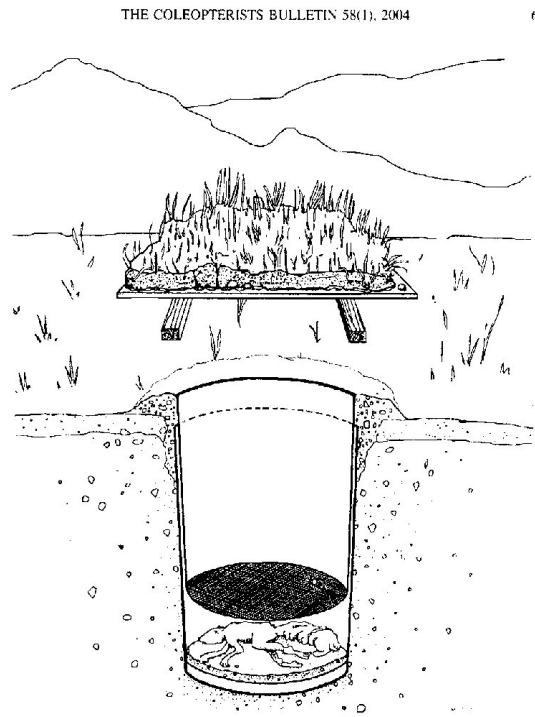
Place approximately 3 to 4 inches of loose, friable, moist (but not wet) soil with little or no clay content, in the bottom of the bucket to give trapped burying beetles room to burrow into the soil allowing trapped beetles to avoid competitors, high temperatures, and low humidity levels.

Place the wire mesh over the buckets and secure in place with the garden staples to help exclude vertebrate scavengers.

Lay the 1 x 1 sticks over the wire mesh then place the cover over on top of the sticks.

Place additional weight (soil, rocks, etc.) 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 as depicted in the following graphic.



This graphic excludes ABB access to the bait; the Service does not recommend ABB exclusion from bait. The bait should be placed directly on top of the soil inside the bucket.

Figure 1. Pitfall trap design (Bedick et al. 2004).

1 Gallon Bucket Traps

Materials

1. Ten 1-gallon (3.8 liter) buckets with a minimum diameter of 6 inches (15.24 cm)
2. Five pieces of plywood at least 4 inches wider than diameter of bucket
3. Piece of wire mesh (\geq 1-inch mesh size) to allow ABB to enter but still exclude small mammals
4. Four garden staples for each trap (20 total)
5. Two 1-inch by 1-inch sticks large enough to hold the cover off the bucket
6. One 1-inch square sponge
7. Shovel or ground auger

Place one bucket inside the other bucket, and place both in a pre-dug hole at each of the five bait stations. Stacking the buckets one inside the other facilitates removal of trapped insects by easily pulling the top bucket out, while the second bucket remains in the ground to maintain the integrity of the hole. The rim of the buckets should be 0.5 to 1.0 inch above ground level and a berm of soil built up to the rim of the bucket to create a gradient from ground level upwards to the rim for ABBs to access the bucket. This also prevents water runoff from filling the bucket.

Place approximately 2 inches of un-moistened soil in the bottom of the bucket. Do not add water to the soil as this can result in drowning or clogging of ABB's spiracles. Instead, place a 2-3-inch square piece of wetted sponge in the bottom of the trap bucket on top of the soil along with the bait so ABBs have access to the bait and to the sponge.

Place the wire mesh over the buckets and secure in place with the garden staples to exclude vertebrate scavengers.

Lay the 1 x 1 sticks over the wire mesh then place the cover over on top of the sticks.

Place additional weight (soil, rocks, etc.) 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.

Place the cover on top of the sticks and over the bucket trap.

General Pitfall Trap Designs

Traps must have smooth sides, free of any texture or ridges to prevent ABBs from climbing out. Do not place pit-fall traps in areas where inundation during rainfall events could occur as beetles can drown easily in even a small amount of water. Close traps if high winds or severe thunderstorms are predicted for the survey area.

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

If using a pit-fall trap design in areas where scavengers are a significant problem, wire mesh should be installed between the pitfall trap and the cover. The piece of wire mesh should be configured 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 be required.

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 C.) The USFWS recommends 5-gallon 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. 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 help to prevent loss of beetles to desiccation, which Bedick (1997) determined to be a potential mortality factor for Silphidae on hot mornings and also helps to prevent inter-beetle predation.

The appropriate size of bait for 1-gallon bucket traps is about 6 ounces (174 grams). The bait for all bucket traps is preferred to be a whole carcass with hair/feathers intact. 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. The bait will be aged in airtight containers for 3 to 7 days, depending on the temperature and other weather conditions. Do not fill the container or bag completely full, because as the bait rots gas pressure inside the container is increased and the extra room is needed 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 traps.

Setting and Checking Traps

In the south-central portion of the range, each trap must be checked the following morning by 10:00 A.M. (9:00 A.M. in Arkansas) and by 11:00 A.M. in the north-central portion. Checking traps entails recording and releasing all *Nicrophorus* species; replacing any missing or dry bait, re-moistening sponge if needed, and replacing/resituating any disturbed parts of the trap.

Any injured or lethargic ABBs that are clearly alive should be released immediately. Collect and monitor all ABBs that appear to be dead, and hold for at least 20 minutes for accurate determination of their condition. Any dead ABBs should be processed as described below under Accidental Death of ABBs.

Ants

Do not place traps within 23 feet (7 meters) of any ant colonies. If ants are discovered in a trap, relocate the trap at least 23 feet away.

Disturbed bait or traps

Additional nights of trapping will be required if traps are disturbed. For 1-gallon bucket traps, if two or more traps are disturbed, and no ABBs have been captured during a 3-night survey period an additional night of survey is needed.

For 5-gallon bucket traps one additional night of trapping is required if the bucket is disturbed and no ABB have been captured during a 3-night survey period.

Processing Captures

Identification Nicrophorus Species

Identify and record all *Nicrophorus* species. Appendix D provides descriptions of the *Nicrophorus* species, and Appendix E provides a dichotomous key.

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

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

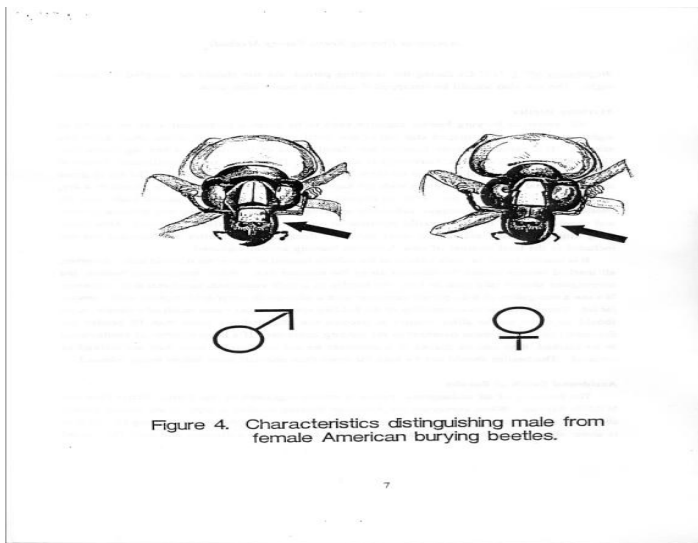
Clipping of elytra, adhesion of bee tags, painting, or marking in any way is not necessary. The local Ecological Services Field Office will determine the applicability of these activities. If measuring of the pronotum is warranted, calipers should be used.

Release ABBs near (within 2,000 feet) transect where they were captured, but at least 10 feet away from foot traffic along the transect, and a minimum of 500 feet from vehicle pathway to avoid trampling.

Gender Determination

The gender of ABBs is distinguishable by the orange-red marking located between the frons and mandibles on the head. These markings are rectangular on males and triangular on females (Figure 2). ABB gender must be recorded on the “*ABB Survey Data Collection Form*”.

Figure 2. Characteristics distinguishing male from female ABB (Ceighton et al. 1993).



Age Determination

ABBs that have pupated during the current active season are referenced as new (i.e. newly emerged or teneral) and ABBs pupated the previous year are referenced as old (emerged the previous active season and overwintered as adults). Newly emerged ABB can be distinguished from older ABB by their softer bodies and more shiny appearance, the pronotum appear more orange (less red) and lighter in hue. Older ABB's pronotum appear more red than orange, are deeper in hue, and they are often missing body parts, especially legs or antennae, and their mandibles appear more worn at the tip. Record the ages of ABB as old, young, or unknown, on all data forms. It is also important to consider the time of year when assessing age. More mature ABB will emerge earlier in the season while there will be more younger ABB captured later in the season. This distinction should be more pronounced in the north-central range of the species.

Accidental Death of ABBs

All mortalities of ABBs must be recorded on the “ABB Accidental Death Form” (Appendix F) for each individual ABB and must be submitted within two (2) calendar days via email to abbcontact@fws.gov at the Oklahoma Ecological Services Field Office and to the local Ecological Services Field Office in your area. The hardcopy “ABB Accidental Death Form” must be submitted to the appropriate Regional Permit Coordinator along with the annual permittee report.

Place dead ABBs in cotton within a sealable, rigid container to prevent jostling which could cause limb or antennae damage. Each specimen must have a unique alphanumeric name assigned. This alphanumeric name should be the first letter of the first two (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 a latitude and longitude coordinate in decimal degrees; NAD 83. Place the alphanumeric name inside each container to ensure accurate future identification. Place one ABB specimen per container. Place the container on ice until the ABB can be prepared.

Deposit dead specimens, along with a hardcopy of the “ABB Accidental Death Form” (Appendix I) to 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, complete an “ABB Survey Data Collection Form” (Appendix A) and “ABB Survey Summary Report” (Appendix B) and submit these to the Service. Incomplete and/or inaccurate forms are not valid and the associated surveys will be considered invalid. When sending corrected forms, indicate on the form that it is a corrected form, indicate the project name, and identify what specifically has been corrected.

Specific data entry criteria are required to maintain functionality of the Service's ABB database. 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), with no punctuation (i.e. Joe L Smith instead of Joe L. Smith, or S of Pawhuska instead of S. of Pawhuska). Report all latitude and longitude data in decimal degrees and indicate the coordinate system/projection, which should be 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 when the Service responds to a survey effort, if questions arise, or if the survey is for a specific project. Specify the project proponent and their project name must in the ABB survey report and any other correspondence submitted to the Service (Acme Company, XYZ pipeline). This is the company that is ultimately responsible for the results of your survey, and not just the Consulting firm that may have hired you to perform these surveys.

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>.

Complete an “*ABB Survey Summary Report*” for each survey effort – both an electronic and a hardcopy format.

1. The electronic format of the “*ABB Survey Summary Report (electronic)*” (Appendix B) 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)*” (Appendix G) 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 Forms*” 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*” (Appendix H) describing the column headers in “*ABB Survey Summary Report*”.

Location Data

At each transect, the appropriate meridian should be referenced, a GPS location (in decimal degrees, NAD 83), and digital photograph will be taken to document the location of the trap and the general habitat characteristics of the trap site.

Protocols and Forms

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

Other Federal and/or State Requirements

A state permit is needed to conduct surveys for the ABB in each state. In Nebraska, there is a Nongame and Endangered Species Conservation Act that also 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 from project implementation. Additionally, maintaining a survey database provides data that can be utilized by the public during project planning.

Attachments

Appendix A-H and X

Figures 1-2

Other pictures are available on our website: http://www.fws.gov/southwest/es/Oklahoma/ABB_Add_Info.htm .

References

Bedick, J.C., 1997. Distribution and ecology of the American burying beetle (*Nicrophorus americanus* Oliver) in south-central Nebraska. Master's Thesis, University of Nebraska, Lincoln. 94 pp.

Bedick, J.C., B.C. Ratcliffe, and L.G. Higley. 2004. A new sampling protocol for the endangered American burying beetle, *Nicrophorus americanus* Olivier (Coleoptera, Silphidae). *The Coleopterists Bull.* 58: 57-70.

Creighton, J.C., M.V. Lomolino, and G.D. Schnell. 1993. Survey methods for the American burying beetle (*Nicrophorus americanus*) in Oklahoma. Oklahoma Biological Survey, University of Oklahoma, Norman. 12pp

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, ABB Science Workshop on March 12, 2012, and other meetings between Service personnel and permittees in 2009, 2010, 2011, and 2012. 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.