FINAL PERFORMANCE REPORT

Federal Aid Grant No. F13AF01248 (T-76-1)

Assessment of the Density and Spatial and Temporal Variation of the American Burying Beetle (*Nicrophorus americanus*) in Oklahoma

Oklahoma Department of Wildlife Conservation

January 1, 2014 through June 30, 2017

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State: Oklahoma   **Grant Number:** F13AF01248 (T-76-1)

Grant Program: State Wildlife Grants

Grant Title: Assessment of the Density and Spatial and Temporal Variation of the American
                  Burying Beetle (*Nicrophorus americanus*) in Oklahoma

Grant Period: January 1, 2014 – June 30, 2017

Project Leader: Barney Luttbeg, Department of Integrative Biology, Oklahoma State
                  University, Stillwater, Oklahoma.

I.   OBJECTIVE:

We will estimate the distribution, abundance and temporal variation of the American
Burying Beetle (*Nicrophorus americanus,* ABB) in Oklahoma by sampling methods,
mark-recapture studies, and analyses of historical ABB data. Spatial coordinates and
meteorological data will be recorded for each sampling location along with the number of
N. americanus captured (categorized into sex and age classes) and will be provided in
each Performance Report.

II.   SUMMARY OF PROGRESS

A.   APPROACH

Burying beetle sampling was conducted in accordance with the U.S. Fish and Wildlife
Service (USFWS)'s ABB Oklahoma Presence/Absence Live-trapping Survey Guidance
(USFWS 2012, rev. 2015) as approved by the Oklahoma Ecological Services Field Office
in Tulsa. Five-gallon bucket traps were baited with dead rats, set overnight, and checked
in the morning. Captured ABBs were individually marked with a small dot of acrylic paint
on their elytra, with color and location indicating individual identity.

We used existing data provided by the USFWS with a little supplementation from our
samples to estimate whether there have been trends in American Burying Beetles caught
per unit of trapping effort. There is much heterogeneity in trapping effort across
Oklahoma. We identified three counties (Atoka, Osage north of highway 60, and
Pittsburg) where there have been consistent trapping efforts. Separately, for each county
we fit generalized linear models with a negative binomial link function to model how the
count of ABB caught per night varied over successive years (with the first year of data
being year 1). To model the catch per unit effort we included an offset term for the number

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of trap nights (Zurr et al. 2009). For each county we fit 4 alternative models ranging from year having no effect, year having a linear effect, and year also having a 2nd or 3rd polynomial effects on ABB caught per unit effort. For each county we used Akaike Information Criterion to judge which of the 4 models was best supported by that county's trapping data, and present the results from that model.

B.   RESULTS

Trapping was done at 7 Wildlife Management Areas (WMAs) owned or managed by the Oklahoma Department of Wildlife Conservation (ODWC), 3 State Parks, and 2 National Wildlife Refuges (NWRs). American Burying Beetles were caught fairly regularly at Osage WMA, McClellan-Kerr WMA, Hulah WMA, Hugo WMA, and Sequoyah NWR. They were also caught at Keystone WMA, but at a very low rate. We did not detect ABB at Oologah WMA, Robbers Cave WMA or State Park, Osage State Park, Sequoya State Park, and Little River NWR. ABB were caught at a low rate with 27 individuals caught (Table 2) with no recaptures.

Historical ABB data available for Osage County (north of highway 60) ranged from 2006 to 2016. The best of the models for describing this data was ABB caught $\sim$ year + year^2 + year^3 (Figure 1). It appears that ABBs caught per trap night have increased over the past few years. However, it should be noted that trapping location, timing, and effort is not standardized in this data set, and thus the results could be due more trapping at more favorable locations or times. For Atoka County there was data from 2001 to 2016, and the best model was "year" having no effect on number of ABBs caught per trap night (Figure 2). Data available for Pittsburg County ranged from 1993 to 2016, and the best model for describing the data was linear (1st order polynomial) effect of year on ABB caught with a slight (but detectable) increase over the years. The same caveats given for the Osage County results also apply to Pittsburg County.

III.   RECOMMENDATIONS

We found that ABB still occur fairly regularly at several WMAs and NWRs in eastern Oklahoma. Despite intensive sampling, the species was found sparingly on Keystone WMA and was not detected on Oologah WMA. This supports the idea that there are "hot spots" where conservation efforts are likely to have more of a positive effect on ABB populations. Our analysis of longer term trends in ABB caught per unit effort indicated perhaps an increase in ABB numbers in Osage and Pittsburg counties. However, to obtain more accurate estimates of American Burying Beetle population trends in Oklahoma, standardized and repeated sampling at various locations is needed.

IV.   SIGNIFICANT DEVIATIONS

No significant deviations.

V.   EQUIPMENT

No equipment purchased during this period.

VI.   REFERENCES

Zuur AF, Ieno EN, Walker NJ, Saveliev AA, and Smith GM. 2009. Mixed effects models and extensions in ecology with R. New York: Springer.

U.S. Fish and Wildlife Service (2015). American Burying Beetle (*Nicrophorus americanus*) Oklahoma Presence/Absence Live-trapping Survey Guidance. Tulsa, Oklahoma, Oklahoma Ecological Services Field Office.

VII.   PREPARED BY: Barney Luttbeg
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DATE: August 15, 2017

APPROVED BY: _____
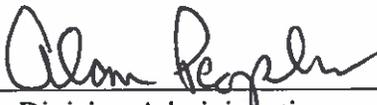
Wildlife Division Administration
Oklahoma Department of Wildlife Conservation
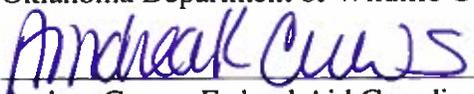
Andrea Crews, Federal Aid Coordinator
Oklahoma Department of Wildlife Conservation

Table 1 - Summary of trapping efforts including the number of nights traps were set, the number of American burying beetles (ABB) caught, and the number of other burying beetles caught.

Dates	County	Unit	Trap nights	ABB caught	Other burying beetles caught
May 30-June1, 2014	Osage	Osage WMA	3	0	4
July 10-12, 2014	Wagoner	McClellan-Kerr WMA	6	0	19
July 10-12, 2014	Muskogee	McClellan-Kerr WMA	3	8	10
July 22-24, 2014	Nowata	Oologah WMA	3	0	14
July 22-24, 2014	Rogers	Oologah WMA	6	0	19
July 22-24, 2014	Pawnee	Keystone WMA	9	0	58
August 12-14, 2014	Osage	Hulah WMA	3	1	7
August 12-14, 2014	Osage	Osage Hills SP	3	0	22
August 12-14, 2014	Osage	Osage WMA	9	4	55
June 10-12, 2015	Sequoyah	Sequoyah NWR	15	3	28
June 24-26, 2015	Latimer	Robber's Cave State Park	9	0	28
June 24-26, 2015	Latimer	Robber's Cave WMA	6	0	26
July 29-31, 2015	Cherokee	Sequoyah State Park	15	0	42
August 4-6, 2015	Creek	Keystone WMA	9	1	8
August 4-6, 2015	Osage	Keystone WMA	6	0	33
July 1-3, 2016	Choctaw	Hugo WMA	15	0	58
July 9-11, 2016	Rogers	Oologah WMA	15	0	34
July 12-14, 2016	Osage	Hulah WMA	12	5	90
July 16-18, 2016	McCurtain	Little River NWR	15	0	53
July 21-23, 2016	Choctaw	Hugo WMA	12	3	88
July 21-23, 2016	Pushmataha	Hugo WMA	3	2	14
August 9-11, 2016	Creek	Keystone WMA	9	0	82
August 9-11, 2016	Osage	Keystone WMA	6	0	72

Table 2 - Summary of American Burying Beetles caught

Date	County	Unit	Sex	Age class	Pronotum width
July 10, 2014	Muskogee	McClellan-Kerr WMA	M	adult	11.3
July 10, 2014	Muskogee	McClellan-Kerr WMA	M	adult	11.2
July 10, 2014	Muskogee	McClellan-Kerr WMA	M	adult	10
July 10, 2014	Muskogee	McClellan-Kerr WMA	M	adult	10
July 12, 2014	Muskogee	McClellan-Kerr WMA	M	adult	11
July 12, 2014	Muskogee	McClellan-Kerr WMA	F	adult	10.5
July 12, 2014	Muskogee	McClellan-Kerr WMA	M	teneral	9.1
July 12, 2014	Muskogee	McClellan-Kerr WMA	F	adult	8.7
August 12, 2014	Osage	Osage WMA			
August 12, 2014	Osage	Osage WMA			
August 12, 2014	Osage	Osage WMA			
August 13, 2014	Osage	Osage WMA			
August 14, 2014	Osage	Hulah WMA			
June 10, 2015	Sequoyah	Sequoyah NWR	M	teneral	10
June 10, 2015	Sequoyah	Sequoyah NWR	F	teneral	9.1
June 10, 2015	Sequoyah	Sequoyah NWR	F		6.5
August 5, 2015	Creek	Keystone WMA	M	teneral	10
July 12, 2016	Osage	Hulah WMA	F	teneral	8.1
July 12, 2016	Osage	Hulah WMA	F	adult	7.8
July 12, 2016	Osage	Hulah WMA	F	adult	7.2
July 12, 2016	Osage	Hulah WMA	F	adult	9.1
July 14, 2016	Osage	Hulah WMA	M	teneral	8.6
July 21, 2016	Choctaw	Hugo WMA	M	adult	11.3
July 21, 2016	Choctaw	Hugo WMA	F	adult	8.6
July 21, 2016	Pushmataha	Hugo WMA	M	teneral	12.7
July 22, 2016	Pushmataha	Hugo WMA	M	teneral	12.6
July 23, 2016	Choctaw	Hugo WMA	M	adult	11.6

Figure 1: American Burying Beetles caught per night of trapping effort in Osage County (north of highway 60) from 2006 to 2016. Data within a year are randomly jittered left and right to avoid points overlapping, thus giving a better view of the data. The solid line shows the best fitting model for the data, which was ABB ~ exp(-11.5 + 6.86 year – 1.20 year^2 + 0.06 year^3 + offset (log(total trap nights))).
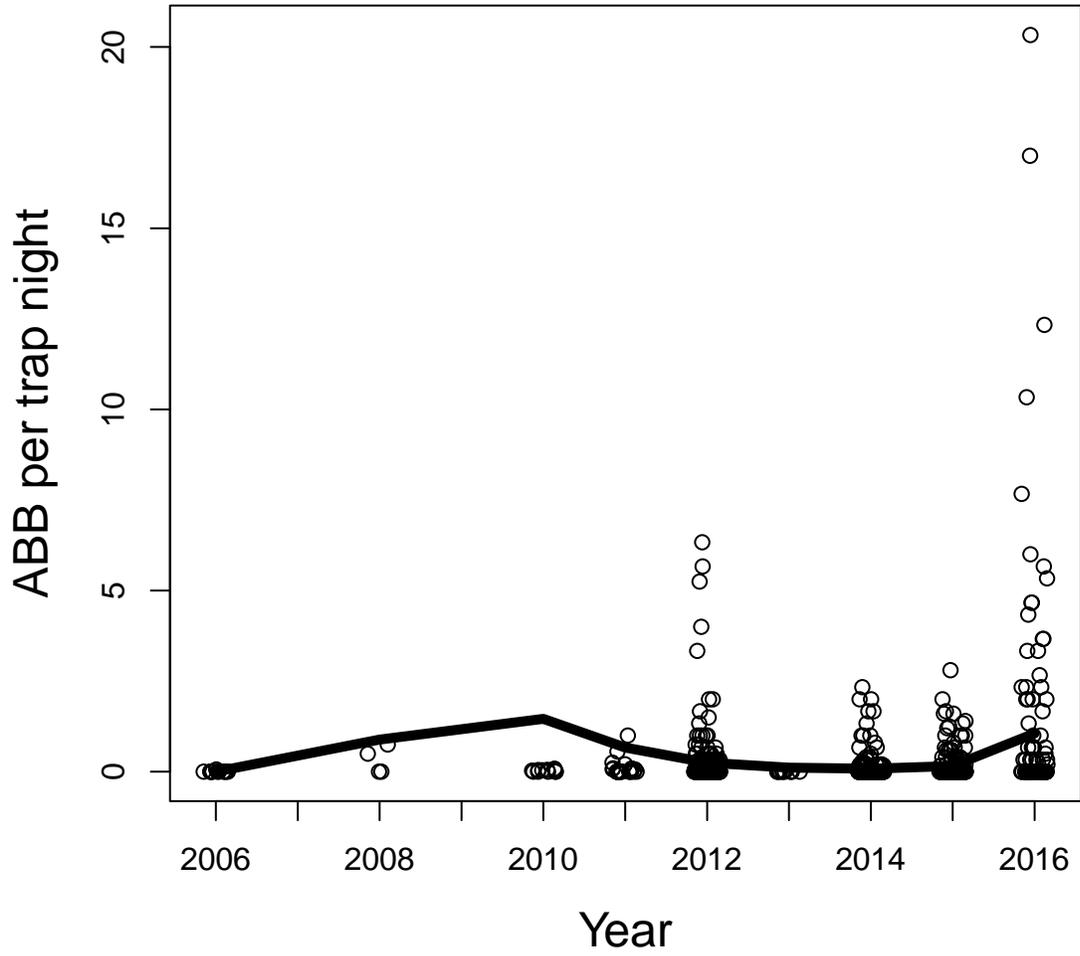
Figure 2: American Burying Beetles caught per night of trapping effort in Atoka County from 2001 to 2016. Data within a year are randomly jittered left and right to avoid points overlapping, thus giving a better view of the data. The solid line shows the best fitting model for the data, which was ABB ~ exp(-2.61 + offset (log(total trap nights))).
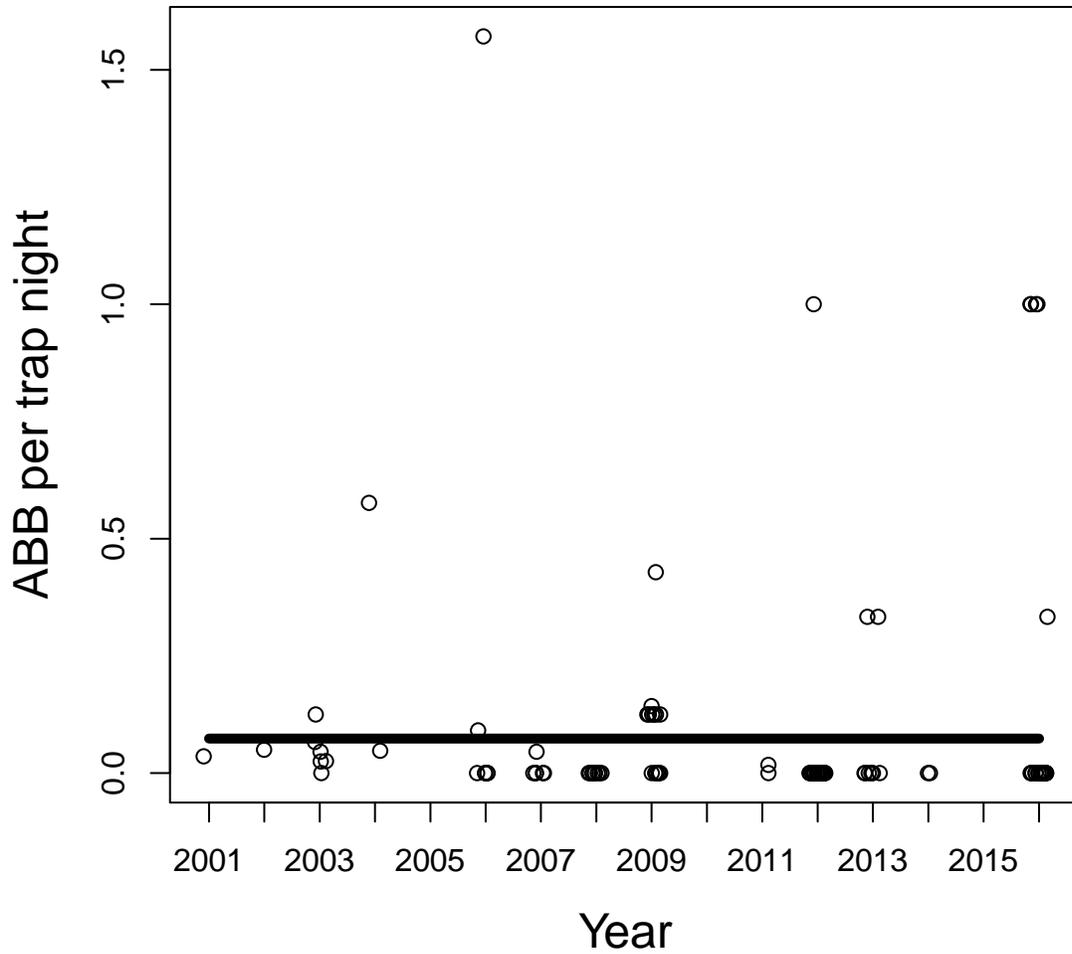
Figure 3: American Burying Beetles caught per night of trapping effort in Pittsburg County (north of highway 60) from 1993 to 2016. Data within a year are randomly jittered left and right to avoid points overlapping, thus giving a better view of the data. The solid line shows the best fitting model for the data, which was ABB ~ exp(-4.29 + 0.16 year + offset (log(total trap nights))).