REFERENCE

Valitzski, S, G. D'Angelo, G. Gallagher, D. Osborn, K. Miller, and R. Warren. Deer Responses to Sounds From a Vehicle-Mounted Sound-Production System. *Journal of Wildlife Management,* Vol. 73, No. 7, 2009, pp. 1072-1076.

INTRODUCTION

Researchers from the University of Georgia and Berry College recently completed a project designed to evaluate the impact of pure tones (i.e., continuous sounds at one frequency) coming from moving vehicles on roadside deer behavior. The results of this study are summarized here. The researchers stated that the frequencies of the pure tones investigated in this study were similar to those advertised by commercially available deer-deterrent whistles, such as the Hornet® Deer Whistle and the Deer Alert® Animal Warning Device. In addition to responding to manufacture claims, the researchers tested pure tones at frequencies that deer whistles had been found to produce in previous studies.

STUDY SITE

This study was conducted along two roadway segments within the Berry College Wildlife Refuge. The first roadway study segment was 280 meters long (approximately 919 feet), and was characterized by the research project team as being in a "campus-to-farm transition area" with various grasses. The second segment was 220 meters long (approximately 722 feet long), and had a roadside with lawns and trees. It was also "…bordered by several campus buildings, parking lots, and ponds." A 10 meter (approximately 33 foot) "area of influence" on each side of the roadway was used for in this experiment.

DATA COLLECTION

Overall, a total of 26 data collection observation sessions took place during April and June 2006. The deer behavior was recorded by a researcher on an elevated platform (at the center of each roadway segment) with a ThermaCAM during one time period each day (either 6 AM to 9 AM or 7 PM to 10 PM). The day and night observation time periods were alternated each day between the two roadway segments. Observations were not conducted during heavy precipitation, fog, or high winds.

The objective of the data collection sessions was to observe and categorize deer behavior (within the segment "area of influence") before and after a sound-producing vehicle was driven along the roadway. The researcher on the elevated platform, when possible, would "randomly" choose a deer that was within the segment influence area and observe it with the infrared camera. At this point, a signal would be sent to a coworker, through a two-way radio, to drive the sound-producing vehicle along the roadway study segment at 48 kph (approximately 30 miles per hour (mph)).

Professional sound equipment was used to project the pure tones from the vehicle. The authors of the article indicate that the pure tone frequencies evaluated in the research were selected based on previous research. It was noted that the documentation for many commercially available deer whistles claimed to produce similar consistent and continuous ultrasonic sounds

above 15 kHz. (It should be noted, however, that a previous study has found that at least some commercially available deer whistles actually only produced sounds between 3 and 12 kHz. Past University of Georgia research has indicated that pure ultrasonic tones, typically those over 20 kHz and similar to the range advertised by many commercial whistles, need to be projected at 45 to 60 decibels (db) in order for a deer to reliably hear them. Therefore, the researchers set a minimum projected decibel level of 70 db. The sound levels were also calibrated so that the pure tones were projected at a level that was at least 25 db higher than the decibel level of the vehicle itself. This approach resulted in pure ultrasonic tones of at least 70 db within the 10 meter (approximately 33 foot) "influence area" and at least 30 meters (approximately 98 feet) in front of the vehicle. Each deer that was observed (n = 319) was "randomly" subjected to one of six sounds. The control was no additional sound projection and the treatment conditions were transmissions at one of five pure tone frequencies between 0.28 kHz to 28 kHz (see below). The deer behavior observations with the five sound frequencies were compared to those with the control situation.

The observations were completed in the following manner. The observer categorized the deer behavior before the vehicle entered the test area (i.e., before the sound was audible) and then once again during the time period the vehicle was in the test area, as the vehicle and the deer interacted (i.e., when the sound was audible to the deer). This interaction time period is defined by the distances noted above. For each observation the behavior of the deer was categorized as passive (i.e., no movement), alert (i.e., lifted head and ear movement), active (i.e., movement away or toward roadway pavement), flight (i.e., rapid movement away from roadway pavement), or on the roadway pavement.

The changes (if any) in the behavior of an individual deer between the two observations were noted and then also assigned one of three "reaction" categories: negative (i.e., appears more likely to cause a deer-vehicle crash (DVC)), positive (i.e., appears less likely to cause a DVC), and neutral (i.e., no apparent change in the possibility of a DVC). For example, a negative reaction may have been assigned to a passive deer that became active and moved toward the roadway when the sound-producing vehicle was nearby. However, a positive reaction may have been assigned to a passive deer that became active and moved away from the roadway.

STUDY RESULTS AND CONCLUSIONS

The number of deer behavior observations for each sound and "reaction" category is noted in Table 1. The percentage of the reactions at each sound level is also shown. A total of 319 deer were observed.

Overall, the researchers concluded that there was no general change in deer behavior due to the sound projections. This conclusion appeared to based on the fact that more than half of the categorized reactions were considered neutral. These results ranged from approximately 54 to 71 percent of all reactions. These results were tested with a chi-square statistical analysis and no significant difference was found (except in one case) between the percentages of observations for a different sound in each "reaction" category. The one exception was the results from the 0.28 kHz frequency sound treatment, which appeared to have a higher than expected increase in the

Table 1. Deer Reaction Category by Sound Condition

Sound Condition	Number of Observations	Negative Reaction (Percent)	Neutral Reaction (Percent)	Positive Reaction (Percent)
Control	59	5.08	59.32	35.59
0.28 kHz	52	13.46	53.85	32.69
1 kHz	51	5.88	56.86	37.25
8 kHz	51	5.88	70.59	23.53
15 kHz	51	7.84	58.82	33.33
28 kHz	55	9.09	67.27	23.64

proportion of negative reactions. The range of percentages for the sound conditions considered was approximately 5 to 13 percent for the negative reaction category, 54 to 71 percent for the neutral reaction category, and 24 to 36 for the positive reaction category. Interestingly enough, the highest percentage of negative reactions was for the 0.28 kHz test. This sound level also produced the lowest percentage observations of neutral reactions. The highest percentage of positive reactions occurred at one kHz. Overall, there also did not appear to be any clearly discernable patterns in the observations. It was concluded by the researchers that the pure tone sounds at the frequencies tested did not appear to alter the campus based free-ranging white-tailed deer behavior in a manner that would prevent deer vehicle collisions.

DVCIR CENTER FINDINGS

This document summarizes a well-designed study of audible deer whistles or, more specifically, the sounds that they are advertised to emit. The decision to evaluate sounds similar to what the whistles are advertised to produce, rather than those they may actually produce, is probably not much of an issue. There is generally no expectation, based the limited past analyses, that these devices emit something more than advertised.

During this study deer behavior is categorized to evaluate or summarize the reactions to a sound-producing vehicle. These categorizations are clearly subjective and could have been described more specifically in the article. Also, an initial concern with the study was that it was completed on a college campus and at low speeds. This type of situation doesn't represent the typical environment of a DVC roadway. The study results related to deer reactions (or lack thereof) to the sounds evaluated may need to be considered in the context of the observation environment. Overall, the researchers concluded that there was no general change in deer behavior due to the sound projections tested.

There has been almost no previous research completed on deer whistles or sound producing devices related to DVCs (see the initial toolbox content). The conclusions of this project, however, are not surprising based on what little work had been done in the past. The completion of a similar analysis (given that this is one of the first to study this subject well), possibly along a higher speed and remote roadway (and with commercially available whistles), would be desirable.