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Author
Griffin, Kathleen

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Use of Low Fencing with Aluminum Flashing as a Barrier for Turtles

Kathleen Griffin (Phone: 406-544-9937, Email: kathleen.griffin@umontana.edu), Wildlife Biology Program, University of Montana, Missoula, MT 59812

Abstract: I examined the effects of road mortality on a population of western painted turtles (*Chrysemys picta belli*) in west-central Montana; these turtles make up the majority of road mortalities in a section of highway that bisects the Ninepipes National Wildlife Refuge. The objective of my barrier fencing experiment was to determine whether turtles were able to breach fencing designed to direct turtles towards crossing structures and thereby keep them off the road. I constructed 45.7-cm-high turtle enclosures out of 2- by 5-cm fencing with and without 10- or 15-cm-high flashing attached at the top. Turtles were placed in the enclosures, and behavior was observed for one hour. Of 124 turtles, only four (3.2%) were able to climb to the flashing. No turtles climbed over the flashing within the time allowed. In enclosures without flashing, two (3.8%) were able to breach the fencing. The results of this experiment will help in the design of appropriate barriers to keep turtles off the road and direct them towards crossing structures.

Introduction

In northwestern Montana, U.S. Highway 93 has been slated for capacity and reconstruction improvements along a 90-km (56-mile) section. An approximately 7-km (4.3-mile) portion of this highway bisects a prairie pothole ecosystem that currently supports a variety and abundance of wildlife. One species, the western painted turtle (*Chrysemys picta belli*), comprises the majority of wildlife road mortalities in this area. Through a cooperative agreement involving the Montana Department of Transportation (MDT), the Federal Highway Administration (FHWA), and the Confederated Salish and Kootenai tribes (CSKT), a series of wildlife mitigation measures involving wildlife crossing structures and other design features will be implemented to decrease the amount of road mortality and fragmentation that currently exists (FHWA, MDT, and CSKT 2000).

A variety of barrier and fencing designs have been used in wildlife-highway interaction projects to keep wildlife off roadways and direct them towards wildlife crossing structures. Because barriers and fencing are likely to increase the fragmentation effects of highways, the use of culverts and other crossing structures are important in maintaining connectivity (Yanes et al. 1995, Boarman and Sazaki 1996, Evink 2002). Amphibians and reptiles are potentially less amenable to mitigation using crossing structures and barriers. This is a consequence of the limited movements by many species and the low potential for learning compared with large animals (Rudolf 2000). However, movements through the culverts by at least a few individuals should be sufficient to maintain genetic exchange while at the same time significantly decreasing wildlife road mortality (Barichivich and Dodd 2002). Various turtle species are known to use culverts as crossing structures (Foresman 2004, Pelletier 2005, Walsh 2005).

Rails and curved pipes have been used as barriers for amphibians and reptiles (Frey and Niederstraßer 2000, Bank et al. 2002, Puky and Vogel 2003), as have concrete walls (Barichivich and Dodd 2002), guardrails (Barichivich and Dodd 2002), and fencing (Banks et al. 2002, Evink 2002). Herpetofauna can be directed by drift fences, which have been very effective in directing movements especially during capture sessions (Gibbons 1990, Morreale 1984). Ruby et al. (1994) compared behavioral responses of captive desert tortoises to various barriers and fences. They found tortoises responded differently to the different barrier types. Tortoises were also observed attempting to climb those barriers constructed of wood (Ruby et al. 1994). While anecdotal evidence exists that some turtle species (including painted turtles) are good climbers, no one has examined barrier fencing can be breached.

My objective was to determine if aluminum flashing at the top of a wire fence would be sufficient to stop western painted turtles from climbing over barrier fencing. The particular fencing type in combination with aluminum flashing was used to represent a potentially low-cost alternative for use as barrier and directional fencing at crossing structures.

Methods

The enclosure trials were conducted at various ponds within Mission Valley, Montana (T20N, R20W, Sections 24-26). All trials were conducted during activity periods of turtles (1335 – 1800 Mountain Daylight Time) between July 4 and 11, 2004, and May 26 and 30, 2005.

Eight circular enclosures were built of 2.5x5-cm (1x2-in) welded wire. The enclosures were 61 cm (24 in) in diameter and 45.7 cm (18 in) high with an open top and bottom. On the inside top of each enclosure either 10 cm (4 in) or 15 cm (6 in) of aluminum flashing (#68-010) was attached flush with the top of the enclosure. Four enclosures of each type were made for a total of eight enclosures. Because of the different flashing widths, the distance from the ground to the bottom of the flashing was different for the two types of enclosures. Therefore, the enclosures with 10 cm (4 in) of flashing had 35.6 cm (14 in) of exposed wire, and the enclosures with 15 cm (6 in) of flashing had 30.5 cm (12 in) of exposed wire. For the 2005 trials, the flashing was removed making the enclosures 45.7 cm (18 in) of fencing.

The enclosures were placed at the edge of a pond so that the substrate was always dried mud. Enclosures were placed such that the interior was bare or had little vegetation, and no food, water, or shelter was provided. Trials were conducted with wild-caught, naïve animals that had no known previous experience with enclosures. Each trial began by randomly assigning two turtles to each enclosure and placing the turtles in the center of the enclosure.

A total of 177 turtles were used for the trials. Each trial lasted one hour, during which turtle behavior was noted. Each time a turtle attempted to climb the fencing, the highest level it reached was recorded. A turtle was considered to have reached that level if at least one claw held onto the rung of wire. If a turtle fell onto its back, it was left alone to see if it could right itself. If after one minute the turtle was unable to right itself, it was turned over by the observer.

Trials were run simultaneously in all eight enclosures, and observational data were collected during the entire hour period. Crew members were responsible for observations in two enclosures at a time. Enclosures were placed within 0.5 meter of each other to aid in observations.

Data were analyzed using chi-square analysis to test for differences in distribution of the highest height reached by gender.

Results

Turtles spent a majority of the time walking the perimeter of the enclosures. Only one turtle, an adult, settled down and made no further explorations after one initial attempt at climbing the fence. Some turtles attempted to extend their head and feet through the wire, but none continued to push for periods greater than three minutes. No turtles became stuck in the fencing. The presence of another turtle in the enclosure did not appear to alter behavior. Occasionally, turtles crawled over each other while exploring the enclosure and occasionally stood on the back of another in an attempt to climb. Heights reached while aided by another turtle were not recorded because under natural conditions it is unlikely that turtles will be at the same place along the fence.

Males and females climbed to similar heights in the enclosures with 10 cm (4 in) flashing ($X^2 = 7.527$, $P > 0.05$) and in enclosures with 15 cm (6 in) flashing ($X^2 = 4.944$, $P > 0.05$); therefore, gender was pooled in subsequent analyses.

All (N = 177) turtles reached at least the 10-cm (4-in) level. This could have been obtained by some turtles while keeping one hind foot on the ground. In enclosures with flashing, 82 percent (N = 124) attempted to climb the fencing (climbing was defined as reaching 15 cm [6 in] which meant that at least both front feet were off the ground). No turtles were able to breach the flashing in any enclosure; however, two adult turtles in both the 10-cm (4-in) and 15-cm (6-in) flashing enclosures reached the flashing (3.6% and 3.8%, respectively). All turtles that were able to touch the flashing fell to the ground. All turtles, except one, were able to right themselves within a matter of one minute. In enclosures without flashing, 75 percent (N = 53) of the turtles attempted to climb, and 3.8 percent were able to breach the fencing.

Digging behavior was only observed three times during the trials, and in no instance was the turtle able to breach the fence.

Discussion

Turtles are known to make seasonal movements (Sexton 1959, Gibbons 1990), and given urban development today they are likely to encounter roadways during these movements. Turtles are susceptible to road mortality due to their slow movements; therefore, fencing is an important issue. With the increase in the use of barrier fencing to direct wildlife towards crossing structures, it is important to determine what methods or designs are most effective. One commonly held belief is that turtles are good climbers and, thus, potentially able to breach fencing that is designed to keep them off the roadway.

I found that although turtles were able to climb wire fencing, it is unlikely that many, if any, turtles are able to breach even relatively low fencing if aluminum flashing is attached at the top. Digging behavior may not have been an issue during this experiment; however, longer confinement may have been needed in order for digging behavior to begin. This information can be helpful for agencies, such as transportation departments, in deciding what types of barrier fencing to use.

There are some potential problems associated with fencing. Overall, depending on the fence type, fencing can be expensive to build, maintenance costs can be high, and aesthetics of wire fencing may be an issue. For turtles, if the mesh sizes are too large, hatchlings and juveniles can pass through or get stuck in the openings. Therefore, smaller mesh attached to the bottom of larger mesh fences is necessary (Evink 2002). Fencing should be buried to minimize the chance of turtles breaching the fencing by digging. The type, dimensions, and materials used for barrier fencing should be dictated by the needs of the species of most concern in the project area.

In general, more studies are needed to find the most effective and low cost fencing so that a system of crossing structures and barriers will likely be successfully implemented and maintained. Some specific questions that need to be addressed include whether and how far turtles will follow fencing, and if there are specific conditions that cause turtles to turn away from fencing rather than travel along them.

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Biographical Sketch: Kathleen Griffin is currently a Ph.D. candidate in the Wildlife Biology Program, College of Forestry and Conservation, University of Montana, in Missoula, MT. Her current research focuses on population dynamics and movements of freshwater turtles in Montana.

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