Title:
Mitigating disturbance of migrating mule deer caused by cyclists and pedestrians at a highway underpass near Vail, Colorado

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Abstract:
A wildlife underpass and associated “deer-proof” fence were constructed at Mud Springs Gulch in 1970 to reduce numbers of deer on Interstate 70 (I-70) and to facilitate their movements through a historical migration corridor. Located 6.9 km west of the Town of Vail, Colorado, the underpass is a concrete box 3.05 m high, 3.05 m wide, and 30.5 m long. In July 1997, the Town of Vail completed a recreation path paralleling I-70 between the highway and Gore Creek. Deer move through the underpass from north to south during spring migration. Deer approaching the underpass from the north can clearly see vehicles on the highway and humans on the recreation path. Part of the path is an elevated bridge at the south end of the underpass. Deer exiting the south end of the underpass must travel under the bridge, and if humans are present they are visible and very close to the deer. Concern arose that people on the path would inhibit deer from using the underpass. The Town of Vail funded and participated in a study to address this concern. During spring and early summer, 1998-2000, we studied deer use of the underpass and human use of the path to ascertain potential impacts and develop mitigation. Beginning in 1998, we monitored the underpass during spring migration with the recreation path closed to humans to determine temporal patterns of deer use and observe deer behavior. We used remote sensing devices, track

counts, and an observer hidden in a blind recorded deer behavior and passages through the underpass during daylight hours. Although the underpass had been in service for 27 years, deer appeared reluctant to enter it, and most approached and retreated several times before passing through. Results indicated that most deer used the underpass during early morning daylight hours (range 0600-0900 h, mode 0726 h), a likely peak time period for commuter cyclist traffic. Deer were observed to flee the tunnel entrance area due to vehicular traffic and presence of trespassing cyclists and pedestrians on the path. Thus, deer already agitated by vehicular traffic on the highway were further disturbed by humans on the path. We designed and conducted a control-treatment experiment in 1999 to evaluate efficacy of using a visual barrier to screen humans on the path from view of deer approaching the north entrance of the underpass. Observations extended from 11 May to 4 July and methods were similar except that visual observations were between 0500 h and 0900 h daily. The Town of Vail constructed a moveable curtain (91.44 m long and 2.44 m high) to serve as a visual barrier between the recreation path and the hillside used by deer approaching the tunnel. We regulated bicycle traffic to arrive at the underpass while deer were closely approaching the north entrance of the tunnel (using volunteer cyclists in radio contact with an observer in the blind). Experimental treatment consisted of alternating 3-day periods with the visual barrier in place and removed. Starting treatment was randomly assigned and 12 days were monitored for each treatment. Sixtyfive percent more deer crossed through the underpass when the visual barrier was in place (38) than when it was not (23). Fewer deer appeared disturbed by cyclists when the curtain was in place (16% of 136 deer) than when it was removed (30% of 125 deer). In 2000, the Town of Vail installed temporary visual barriers on both sides of the path prior to deer spring migration. The path was open to public use and we again monitored responses of deer during the same time ICOET 2001 Proceedings 628 A Time for Action period as in 1999 to verify efficacy of the visual barriers (continuously in place in 2000). In 68 occasions involving deer approaching the north entrance to the underpass when humans were nearby on the path, only 1 of 130 deer appeared disturbed. In 11 occasions when deer were exiting the south end of the underpass while humans were present, only 2 of 20 deer appeared to be frightened and one of these cases involved a pedestrian that stopped on the bridge to look over the barrier. We concluded that visual barriers should greatly reduce disturbance to migrating deer caused by humans on the recreation path and recommendation that solid (versus fabric) barriers be installed for long-term mitigation.

MITIGATING DISTURBANCE OF MIGRATING MULE DEER CAUSED BY CYCLISTS AND PEDESTRIANS AT A HIGHWAY UNDERPASS NEAR VAIL, COLORADO

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Note: The authors intend to publish results of the study abstracted below in a peer-reviewed journal. Publishing complete results herein would preclude journal publication so the authors provide the following abstract in lieu of a full paper.

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period as in 1999 to verify efficacy of the visual barriers (continuously in place in 2000). In 68 occasions involving deer approaching the north entrance to the underpass when humans were nearby on the path, only 1 of 130 deer appeared disturbed. In 11 occasions when deer were exiting the south end of the underpass while humans were present, only 2 of 20 deer appeared to be frightened and one of these cases involved a pedestrian that stopped on the bridge to look over the barrier. We concluded that visual barriers should greatly reduce disturbance to migrating deer caused by humans on the recreation path and recommendation that solid (versus fabric) barriers be installed for long-term mitigation.

Biographical Sketch: Greg Phillips received his Ph.D. degree in Wildlife Biology in 1998 from Colorado State University. Previous education includes a M.S. degree in Wood Science and Technology, also from Colorado State University, and a B.S. degree in Natural Resources from the University of Michigan. Dr. Phillips specializes in population ecology, experimental design, and quantitative methods for evaluating and mitigating effects of human activities on vertebrate populations. He is experienced in stochastic population modeling (spreadsheet and SAS programming) to project population trajectories, assess population viability, and estimate effects of management and mitigation actions. Greg's skills also include developing field surveys to estimate population parameters (e.g., survival, fecundity, and growth rates), population size and density, spatial use, dispersal, and migration. He has advanced training and experience with state-of-the-art wildlife computer software and general statistical software.

Representative projects include designing and implementing a study to estimate avian collision mortality rates and efficacy of wire-marking techniques to reduce mortality at electric power lines; participating as an analyst in region-wide meta-analysis of northern spotted owl demographic data; projecting and contrasting responses of pronghorn populations with and without coyote control; estimating effect of human-induced disturbance on reproductive success of elk; and evaluating effectiveness of screening humans on a recreation path from the view of migrating mule deer to enhance deer security and use of a highway underpass.