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Incidence of Intentional Vehicle–Reptile Collisions

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The impact of vehicles on certain reptile species is well documented and population consequences of associated mortality from collisions with vehicles can be significant. Whether such collisions by motor vehicle drivers are intentional has been speculated on but not studied. The authors documented the response of motor vehicle drivers to a fake turtle, fake snake, an item frequently found on the road (i.e., disposable cup), and an inconspicuous control. Response was documented as a hit, miss, or rescue. Using log-linear analysis the study found evidence that reptile decoys were hit at a higher rate than by chance with approximately 2.7% of motorists intentionally hitting them. These results may be used to improve vehicle–reptile collision probability models and demonstrate the need for highly effective mitigation measures to prevent reptile access to roadways with moderate to heavy traffic volumes.

Keywords Long Point, road mortality, reptile, snake, turtle, vehicle, wetland

Introduction

Although a broad range of wildlife is variously affected by roads (Foreman & Alexander, 1998; Trombulak & Frissell, 2000) some species of reptiles appear to be especially vulnerable to vehicle collisions because of their vagility, behavior, and life-history strategies of late sexual maturity and low reproductive and recruitment rates (Haxton, 2000; Enge & Wood, 2002). With more roads, increased vehicle speeds, and traffic volume, reptile death from vehicle collisions is an increasing problem that has been implicated in local and wide-scale population declines of some reptile species and populations (Rosen & Lowe,

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1994; Haxton, 2000; Gibbs & Shriver, 2002; von Seckendorff Hoff & Marlow, 2002) and shifts in population structure (Gibbs & Steen, 2005).

Reptiles may frequently cross roads as they forage, disperse from natal sites, migrate between seasonal habitats, and undertake movements associated with reproduction (Bernardino & Dalrymple, 1992; Joyal, McCullough, & Hunter, 2001), but roads also attract reptiles as well. For example, female turtles use gravel shoulders for nesting, making them and their hatchlings susceptible to road mortality (Aresco, 2005; Gibbs & Steen, 2005). Some species use paved roads as thermoregulation sites and as movement corridors, exposing them to obvious peril (Ashley & Robinson, 1996). Mortalities are particularly common when roads are constructed through or near important wetland habitats (Ashley & Robinson, 1996; Bernardino & Dalrymple, 1992).

When encountering reptiles on the road only those animals in the direct pathway of vehicles cause drivers to make evasive maneuvers to avoid collisions. Reptiles on the edge of the pavement, in the middle of the lane, or on the center line, usually do not cause drivers to make evasive maneuvers. Yet in a study of road mortality in southern Ontario, Ashley and Robinson (1996) observed that many reptile road-kills appeared to occur on routinely non-traveled portions of the roadway (i.e., that portion of the road that tires do not usually pass over) causing them to suspect that animals were being deliberately run over. If certain motorists do in fact intentionally hit reptiles then populations may be at an even greater risk than previously estimated. Models developed to determine population persistence in the presence of vehicular mortality that do not account for driver behavior (e.g., Gibbs & Shriver, 2002; Roe, Gibson, & Kingsbury, 2006) may underestimate the effect of road mortality on reptile populations. The purpose of this study was to determine if drivers run over reptiles at frequencies greater than would be expected to occur by chance.

Methods

We conducted this study along a 3.6 km causeway constructed to provide road access from the north shore of Lake Erie, Ontario to the Long Point peninsula. The causeway is paved, 7 m wide with 1 m gravel shoulders and a posted speed limit of 70 km/hour. Bordering the causeway to the west is the Big Creek National Wildlife Area (BCNWA) and to the east, Long Point Bay. The BCNWA is part of a 1,200 ha wetland identified as a Ramsar site, recognizing it as a wetland of international importance The wetland is also a component of the United Nations World Biosphere Reserve program of UNESCO. These wetlands support 10 species of reptiles including three turtle (spotted turtle, *Clemmys guttata*, Blanding's turtle *Emydoidea blandingi* and map turtle *Graptemys geographica*) and two snake species (Eastern fox snake *Elaphe gloydi* and Eastern hognose snake *Heterodon platyrhinos*) listed by the Committee on the Status of Endangered Wildlife in Canada (RENEW 2004).

Responses by drivers to reptiles on the road may be categorized as those taken to (a) avoid a collision, (b) intentionally strike an animal that would not be run over in the normal course of travel, (c) rescue the animal or, (d) no change in direction/behavior. Because placing the treatment directly in the line of traffic or in the center of the lane so that the driver would have to either cross the center line with his or her left tires or enter the shoulder of the road with the right tires to intentionally strike the treatment may jeopardize driver safety, we placed treatments in the center of the road between the painted dashed lines. To observe driver behavior toward objects on the road we used two wildlife decoys (turtle, snake), a disposable cup, and a biodegradable grease marker (Figure 1). The turtle was plastic, approximately 20 cm $\times$ 15 cm, and painted to resemble a small snapping turtle (*Chelydra serpentina*) which are often seen on the causeway. The snake was rubber, 100 cm

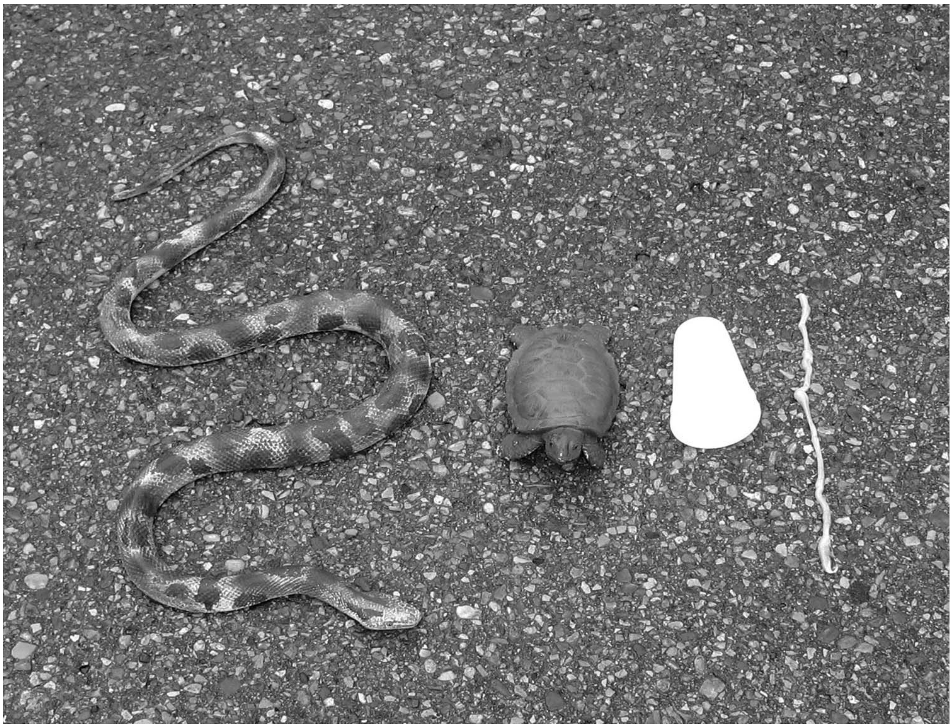

Figure 1. Picture of decoy snake, decoy turtle, Styrofoam cup, and grease control line that were individually placed on the center line of the road to determine incidence of intentional vehicle strikes.

long and 3 cm wide and slightly coiled. It resembled an Eastern fox snake, which also is occasionally seen on the causeway. To determine driver behavior toward a common inanimate object on the road we used a white disposable cup. It was taped to the road to prevent it from moving with each passing vehicle and we replaced it each time it was struck by a vehicle. For a control, we used a biodegradable grease line spread across the center line of the road but not visible to passing motorists. To determine the number of vehicles that were inadvertently driving over the center line of the highway we checked for tire marks left in the grease when we suspected a vehicle had driven over the center line.

We conducted the study between July and October 2005 at three different sites along the causeway. Each site had clear lines of vision for drivers and allowed concealment of observers. Treatment order and site order were chosen randomly without replacement each day of the study, with daily observations lasting from 1 to 4 hours between 8 am and 4 pm. We placed treatments on the road for approximately 15 minute intervals to allow a large enough sample of vehicles to pass the treatment while minimizing the number of times individual cars passed the treatment more than once. To prevent second party bias, we recorded only vehicles traveling by themselves (>250 meters from another vehicle) and made our observations from a discrete location approximately 20 meters from the road. We included in the study the first 500 vehicles that passed by each treatment and met the spacing parameters. We did not count those vehicles traveling close to other vehicles because we thought they would be less likely to intentionally hit something on the road due to safety reasons and possible social pressures. For each vehicle that met the spacing requirements, we recorded the gender of the driver and whether the vehicle hit, missed or rescued (stopped to remove the animal from the road) the treatment. We also recorded the elapsed time between each "hit."

We performed log-linear analysis using SAS/Statistical Software (Statistical Analysis System Institute, Rel 6.12 Cary NC: SAS Institute, 1997) to compare observed and expected frequencies, associations and interactions among variables. We considered statistical significance $p \leq 0.05$. To determine the incidence of intentional hits we subtracted the percentage of vehicles that ran over the control (grease line) from the percentage of vehicles that hit the reptile decoys.

Results

We observed 3,015 cars pass by our treatments, of which 66% (n = 2,000) met our spacing requirements. Composition of drivers was 1,592 males and 408 females. Log-linear analysis indicated a 3-way interaction (χ^2 = 2376.17, df = 8, p = < 0.0001) between treatment, gender and fate. Reptile treatments were hit at higher frequencies than either the cup or control (Table 1).

Male drivers (n = 803) hit reptile decoys more often (n = 50) than female drivers (n = 197, 3). Drivers were 2.4 times more likely to hit the snake than the control and 1.9 times more likely to hit the snake than the cup. Similarly, drivers were 1.7 and 1.4 times more likely to hit the turtle than the control or cup, respectively. This resulted in 5.3% of observed drivers hitting reptile decoys whereas 2.6% inadvertently ran over the control. Mean minutes per strike for each treatment were: 10.5 (*SD* 11.4) snake; 16.1 (*SD* 18.8) turtle; 18.3 cup (*SD* 12.4); and, 21.6 (*SD* 28.9) control. Thirty-three drivers stopped to rescue reptile decoys from the road with male and female drivers stopping at a similar rate (3.4% and 3.0%, respectively).

Discussion

Imitation reptiles were struck by vehicles at a greater rate than would be expected by chance suggesting some drivers in our study, about 2.7% intentionally targeted reptiles on the road. Models developed to predict vehicle mortality impacts on reptile populations (e.g., Gibbs & Shriver, 2002; turtles; Roe et al., 2006, snakes; both adapted from Hels & Buchwald, 2001) may underestimate the actual rate of vehicle collisions because the equation:

$$\text{road mortality} = 1 - (1 - P_{\text{killed}})^{\text{n crossings}}$$

Table 1

Response by motor vehicle drivers passing reptile decoys and controls placed on the center of a two-lane highway

	Hit		Miss		Rescue	
	Male	Female	Male	Female	Male	Female
Control	12	1	385	102	0	0
Cup	16	0	376	108	0	0
Turtle	20	2	361	101	11	5
Snake	30	1	365	87	16	1
Total	78	4	1487	398	27	6

n = 500 passes/treatment.

where $P_{killed,}$ (the probability of being killed during a road crossing) = $1 - e^{-Na/v}$ and, where *N* is traffic volume (vehicles/minute), *a* is width of kill zone (m), and *v* is animal velocity (m/min) does not account for the intentionality of some collisions. We suggest the inclusion of an intentionality factor (*i*) be added where *i* = the percent of passing motorists that intentionally hit reptiles when they are on the road. Although *i* is a small percentage of the total drivers, given moderate to heavy traffic volumes, intentional hits could be a significant component of the total road mortality experienced by a population. We suspect *i* is not regionally constant and may need to be determined for other geographic areas.

The original equation as noted by Gibbs and Shriver (2002) and Roe et al. (2006) also suffers in that *v* does not account for behavioral responses of reptiles when a road is encountered but assumes the animal continues to cross the road at a constant rate of travel. This assumption would be violated if reptiles stop at the road edge, thermoregulate on the road or stop movement if a vehicle passes (pers. obs). All these behaviors would greatly increase the likelihood of collisions (Koenig, Shine, & Shea, 2001; Andrews & Gibbons, 2005). Conversely, certain species may avoid crossing roads altogether thereby reducing mortality rates. Nor does the equation account for avoidance behavior by the driver, and although untested we suspect that given the opportunity most drivers will make evasive maneuvers to miss reptiles found within the kill zone of the highway. Similarly, an avoidance factor may need to be factored into the predictive road mortality equations. We reiterate the call for further research to determine species-specific behavioral responses towards roads and passing vehicles as well as driver responses to reptiles on the road (Shine, Le Master, Wall, Langkilde, & Mason 2004) and suggest that these variables need to be incorporated into future species-specific models.

On average, 2,259 vehicles travel the Long Point causeway daily between April and October of which 80% of the traffic occurs between 0600 and 1800 hours (M. Fehrman, Ontario Ministry of Transportation, 2005 data, personal communication 15 September 2006); the hours when reptiles are most often on the road. Given that 2.7% of drivers intentionally target snakes and turtles, they could be potentially targeted about every 15 minutes, similar to our observed times. The actual rate of vehicle–reptile collisions (when reptiles are on the road) must be considerably greater than we have documented because we only accounted for those collisions that were for the most part intentional. We did not account for those accidental collisions (the basis of Gibbs & Shriver (2002) and Roe et al. (2006) equations), which invariably occur when reptiles are found on the traveled portion, or kill zone of the highway.

Traffic volume and reptile prevalence both peak at our study site between June and August further increasing the likelihood of collisions. For example, there is a 400% increase in daily traffic volume (compared to seasonal average) during the July 1st holiday weekend that coincides with high turtle activity, and consequently high road mortality. But even typical summer traffic volumes at Long Point may make the causeway essentially impassable by turtles and snakes.

Why drivers intentionally hit reptiles is not clear, but may be attributed to several social–psychological reasons. A fear of snakes is a well-known condition that Dinberg, Hansson, and Thunberg (1998) found often elicits a very rapid negative emotional response. Perhaps those drivers with a fear of snakes and a propensity to act out aggressively respond by trying to kill them. This could explain the greater rate of intentional snake kills than turtle kills in our study. That more men than women intentionally hit objects on the road may be attributable to gender-typical driving behavior. Males are more aggressive drivers than females (Henness & Wiesenthal, 1998; Krahe & Fenske, 2002;

Shinar & Compton, 2004) and more likely to engage in risk-taking behaviors (Martin, Lafont, Chiron, Gadegbeku, & Laumon, 2004) such as swerving to hit a target. This aggressiveness is perhaps played out in striking wildlife and to a lesser extent other objects on the road. Indeed, several drivers were observed speeding up and positioning their vehicles to hit the reptiles. Men and women stopped to rescue reptile decoys at a similar rate although only one female stopped to aid the snake. We assume that this gender/species bias to rescues originate from similar gender-specific mechanisms accounting for aggression and also from well-ingrained societal beliefs about turtles and snakes.

Attitudes of local residents toward certain wildlife may also have contributed to the number of intentional hits observed. For instance, many residents view snapping turtles unfavorably because they eat ducklings and other "beneficial" wildlife. Although attempts to change driver behavior with wildlife crossing signs and articles in local media has possibly increased rescues, the overall number of animals being killed on the causeway has not changed considerably (pers. obs.) and public awareness campaigns will not likely influence decision making by many drivers that intentionally hit reptiles.

Because even minimal additional adult mortality could be detrimental to reptile populations exhibiting a life history pattern of late sexual maturity and low reproductive and recruitment rates (e.g., turtles; Brooks, Brown, & Galbraith, 1991; Congdon, Dunham, & van Loben Sels, 1994; some snakes: Reed & Shine 2202, Blouin-Demers & Whitehead, 2002) mitigation measures to protect susceptible populations need to be highly effective. This can probably only be achieved through engineering and re-engineering of roadways in such a manner that prevents reptiles from crawling onto the road surface (Jaeger & Fahrig, 2004). A system of wildlife barriers and underpasses along areas of high reptile use may be the only means to prevent intentional and accidental reptile deaths and maintain populations in areas where there is a substantial network of roads or high traffic volumes.

References

Andrews, K. M., & Gibbons, J. W. (2005). How do highways influence snake movement? Behavioral responses to roads and vehicles. *Copeia, 4,* 772–782.

Aresco, M. J. (2005). The effect of sex-specific terrestrial movements and roads on the sex ratio of freshwater turtles. *Biological Conservation, 123,* 37–44.

Ashley, E. P., & Robinson, J. T. (1996). Road mortality of amphibians, reptiles and other wildlife on Long Point causeway, Lake Erie, Ontario. *Canadian Field Naturalist, 110*, 403–412.

Bernardino, F. S., & Dalrymple, G. H. (1992). Seasonal activity and road mortality of the snakes of the Pa-hay-okee wetlands of Everglades National Park, USA. *Biological Conservation, 62*, 71–75.

Blouin-Demers, G., & Whitehead, P. J. (2002). Implications of movement patterns for gene flow in black rat snakes (Elaphe obsoleta). *Canadian Journal of Zoology, 80*, 1162–1172.

Brooks, R. J., Brown G. P., & Galbraith, D. A. (1991). Effects of a sudden increase in the natural mortality of adults on a population of the Common Snapping Turtle (*Chelydra serpentina*). *Canadian Journal of Zoology, 69,* 1314–1320.

Congdon, J. D., Dunham, A. E., & van Loben Sels, R. C. (1994). Demographics of common snapping turtles: Implications for conservation and management of long-lived organisms. *American Zoologist, 34*, 397–408.

Dinberg, U., Hansson, G., & Thunberg, M. (1998). Fear of snakes and facial reactions: A case of rapid emotional responding. *Journal of Psychology, 39*, 75–80.

Enge, K. M., & Wood, K. N. (2002). A pedestrian road survey of an upland snake community in Florida. *Southeastern Naturalist, 1*, 365–380.

Foreman, R. T. T., & Alexander, L. E. (1998). Roads and their major ecological effects. *Annual Review of Ecology and Systematics, 29*, 207–231.

Gibbs, J. P., & Shriver, W. G. (2002). Estimating the effects of road mortality on turtle populations. *Conservation Biology, 16,* 1647–1652.

Gibbs, J. P., & Steen, D. A. (2005). Trends in sex ratios of turtles in the United States: Implications of road mortality. *Conservation Biology, 19*, 522–556.

Haxton, T. (2000). Road mortality of Snapping Turtles *Cheldra serpentina,* in Central Ontario during the nesting period. *Canadian Field Naturalist, 114,* 106–110.

Hels, T., & Buchwald, E. (2001). The effect of road kills on amphibian populations. *Biological Conservation, 99,* 331–340.

Henness, D. A., & Wiesenthal, D. L. (1998). Gender driver aggression and driver violence: An applied evaluation. *Sex Roles, 44*, 661–676.

Jaeger, J. A., & Fahrig, L. (2004). Effects of road fencing on population persistence. *Conservation Biology, 18*, 1651–1657.

Joyal, L. A., McCullough, M., & Hunter, M. L. (2001). Landscape ecology approaches to wetland species conservation: a case study of two turtle species in southern Maine. *Conservation Biology, 15,* 1755–1762.

Koenig, J., Shine, R., & Shea, G. (2001). The ecology of an Australian icon: How do blue-tongued lizards (Tiligua scincoides) survive in suburbia? *Wildlife Research, 28,* 214–227.

Krahe, B., & Fenske, I. (2002). Predicting aggressive driving behavior: The role of macho personality, age and power of car. *Aggressive Behavior, 28,* 21–29.

Martin, J. L., Lafont, S., Chiron, M., Gadegbeku, B., & Laumon, B. (2004). Differences between males and females in traffic accidents risk in France. *Revue d' Epidemiologie et de Sante Publique, 52*, 368–375.

Reed, R. N. & Shine, R. (2002). Lying in wait for extinction: Ecological correlates of conservation status among Australian Elapid. *Conservation Biology, 16*, 451–461.

RENEW. 2004. Recovery of Nationally Endangered Wildlife in Canada, Annual Report No. 14. Ottawa, Ontario. 36 pp.

Roe, J. H., Gibson, J., & Kingsbury, B. A. (2006). Beyond the wetland border: Estimating the impacts of roads for two species of water snakes. *Biological Conservation, 130*, 161–168.

Rosen, P. C., & Lowe, C. H. (1994). Highway mortality of snakes in the Sonoran Desert of southern Arizona. *Biological Conservation, 68*, 143–148.

Shinar, D., & Compton, R. (2004). Aggressive driving: An observational study of driver, vehicle, and situational variables. *Accident Analysis and Prevention, 3*, 429–437.

Shine, R., LeMaster, M., Wall, M., Langkilde, T., & Mason, R. (2004). Why did the snake cross the road? Effects of roads on movement and location of mates by Garter Snakes (*Thamnophis sirtalis parietalis*). Ecology and Society. Retrieved 5 October 2006 from http://www.ecology and society.org/vol9/iss1 (accessed October 2006)

Trombulak, S. C., & Frissell, C. A. (2000). Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology, 14,* 18–30.

von Seckendorff Hoff, K., & Marlow, R. W. (2002). Impacts of vehicle road traffic on desert tortoise populations with consideration of conservation of tortoise habitat in southern Nevada. *Chelonian Conservation and Biology, 4,* 449–456.