Improving Turtle Road Mortality Sampling Methods in Hennepin County

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Abstract

Turtle road mortality is an increasing threat to turtle populations in North America, and around the world. In Minnesota specifically, more than 700 turtles were killed by vehicles among 30 sites over the past three years. Hennepin county in particular has an urban landscape with wetlands that are often bisected by roads. Previous research has shown that proximity of a road to water, vegetative coverage, traffic volume, and time of year all contribute to turtle road mortality. Our goal was to find an optimal sampling method to reduce bias in turtle road mortality research in Hennepin County. I conducted 45 surveys, spanning 90 hours of survey time along 1,350 road miles from May through August 2021. The sample size was small but suggestive. Most dead turtles were within 100 meters of water and were more likely to be found on roads with higher traffic volume. Living turtles were more likely to be found on roads with lower traffic volume. Better understanding of turtle road mortality will come from monitoring roads with high traffic volume (≥5,000 cars/day) that are within 100 meters of water.

Introduction

Road mortality is one of the largest threats to freshwater turtle populations in North America (Gibbs and Shiver 2002). This impact is exacerbated by increased road development, which leads to habitat fragmentation, causing more turtles to cross roads, increasing mortality (Santoro 2020). Turtles are especially vulnerable to road mortality because they are relatively slow-moving, and sometimes bask on roads for thermoregulation (Langen et al. 2009). Small increases in mortality can have a large impact on a turtle population. Congdon (1994) found that just a 10% decrease in adult mortality led to a 50% decrease in the turtle population. High rates of road mortality are leaving some turtle populations on the verge of extirpation (Piczak 2019). Decreasing turtle populations has ecosystem significance because turtles play critical roles in trophic structures, mineral cycling, seed dispersal, and soil dynamics (Lovich 2018).

Mitigation measures are needed to decrease turtle road mortality. Without mitigation efforts, turtles and other herpetofauna are likely to decline in areas with extensive road networks (Langen et al. 2009). Effective placement or road mitigation measures relies on identifying “hot-spots” where turtles are most vulnerable, most often achieved through road surveys (Garrah et al. 2015; Langen 2009). Several authors have tested designs for turtle road mortality surveys (Langen et al. 2012; Garrah et al. 2015) but there has been no such work in Minnesota, specifically Hennepin county. Hennepin County offers an optimal landscape for turtle road mortality surveys because it is urban, yet has many wetlands that are bisected by roads.

This work aims to increase effectiveness of turtle road mortality surveys in Hennepin County, advancing our ability to implement mitigation measures. Surveys were conducted May through August 2021, in correspondence with turtles' most active season. The design is based on the expectation turtles will be found on roads closer to water, especially roads that bisect water, and that road mortality will increase with higher traffic volume. Although hatchlings are subject to road mortality, they are most active in late summer and early fall (Farmer & Brooks 2012), so I expected find fewer hatchlings than adults and adolescents. Further, I expected most turtles to be found in May, the nesting season (Sack et al. 2017). The results of this project will complement other work assessing effectiveness of mitigation measures such as aquatic culverts, underpasses, turtle crossing signs, and U-shaped fences for turtle road mortality.

Methods

I conducted 45 hour-long surveys from May through August 2021. Surveys covered 1,350 road miles in Hennepin County. This time frame aligns with peak turtle activity (Farmer and Brooks 2012), and increased of road mortality (Sack *et al.* 2017). Surveys were conducted every other day to minimize bias (Santos 2011). Survey routes varied widely in habitat fragmentation, urbanization and wetland abundance. During each survey, both dead and living turtles were recorded. All surveys had a common origin, routes from the origin were randomized each time. Search area included the road, curb and verges. For each animal located, I determined (where possible) species, age, sex, and removed them from the road. Traffic volume was taken from the Annual Average Daily Traffic Volume (AADT) map from the Minnesota Department of Transportation.

Results

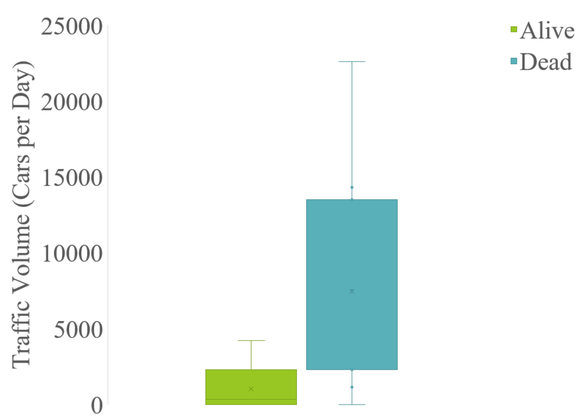

Figure 1 Traffic volume where living (green) and dead (teal) turtles were found. Dead turtles usually occurred with higher traffic volumes, and results were more variable than living turtles.

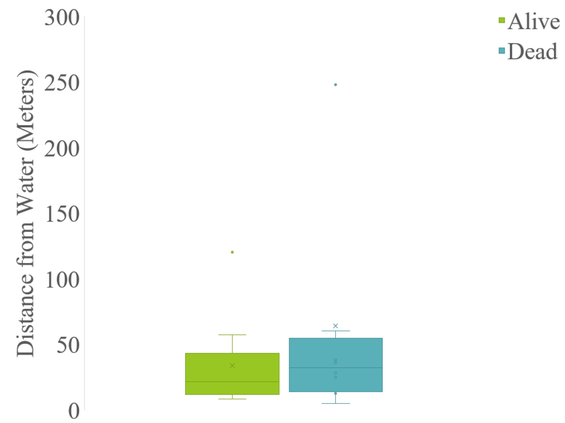

Figure 2 Distance (meters) from water for each living (green) and dead (teal) turtle found. Turtles were more likely to be found within 100 meters of water. Distance to water was slightly more variable for dead turtles

Discussion

I conducted 45 turtle road mortality surveys over the Summer of 2021 and found 21 turtles in total, 9 alive and 12 dead. I found that dead turtles were more common on roads with traffic volumes >5,000 vehicles/day. Proximity to water was important: 18 of 21 turtles were found within 100 meters of a body of water. I expected to find most turtles in May and fewer as the season progressed; however, turtle observations peaked in June. Contrary to expectations. hatchlings were common, especially in May and June, and were found dead more often than adults (85.7% vs. 38.5%). The large incidence of hatchlings may reflect human behavior; people may try to avoid adults but not see the hatchlings. Dead turtles were more common on roads with higher traffic volume (>5,000 vehicles/day); living turtles were more likely to be found on roads with lower traffic volume.

One of the primary limitations of this study is that I surveyed one active season. The sample size (21 turtles) was small, making it difficult to detect significant influences. A larger sample (i.e. multiple years, more road miles) would increase our power to detect influences.

Optimal mortality surveys are an integral part of effective mitigation. Based on our results and limitations, we recommend that Minnesota turtle road mortality work involve multiple years, be focused on roads with traffic volumes of 5,000-15,000 vehicles/day, and roads within 100 m of a water body.

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