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ROAD MORTALITY HOT SPOTS OF TURTLES: A THREE-YEAR MINISTRY OF TRANSPORTATION STUDY IN BRANT COUNTY, ONTARIO

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ABSTRACT

Road mortality has a significant depressive effect on turtle populations in southern Ontario and mitigation measures to reduce turtle road mortality are therefore increasingly being incorporated into road construction projects in the province. This has included the installation of "ecopassages" beneath roadways which enable turtles and other animals to safely move between habitats. These measures are most effective if they are installed at locations with frequent turtle movement and high road mortality rates. We conducted a detailed multi-seasonal survey of turtle road mortality in order to identify mortality "hot spots" along a 4.85 km stretch of highway in Brant County, Ontario. In total, 122 unique observations of dead turtles of two species (midland painted turtle [*Chrysemys picta marginata*] and snapping turtle [*Chelydra serpentina*]) were made. Spatial statistical analysis of mortality data using geographic information system (GIS) software was then used to identify mortality hot spots. These hot spots are being used to determine appropriate locations for installing ecopassages and other mitigation measures to reduce turtle mortality along this stretch of highway.

Keywords: wildlife road mortality, turtles, ecopassages, wildlife culverts, geographic information systems

EXECUTIVE SUMMARY

It is well-known that road mortality has a depressive effect on populations of many wildlife taxa, including turtles (Fahrig and Rytwinski 2009). Mitigating road mortality of turtles is therefore an important conservation consideration in regions with high road density and fragmented natural habitats (Gunson et al. 2012). In Ontario, there is growing interest amongst transportation management agencies in the installation of "ecopassages" which allow wildlife to safely travel across roadways. Construction of ecopassages is increasingly being included in highway reconstruction projects in the province (Dorland et al. 2014).

To maximize the conservation value of ecopassages, they should be installed at locations which reflect a high frequency of turtle movement across roadways or a high rate of turtle road mortality (Dorland et al. 2014). One approach to determining optimal locations for installing ecopassages is to identify mortality "hot spots": locations which exhibit a significantly higher density of road mortality than the mean density along a particular road segment.

In 2013 and 2015, in cooperation with the Ontario Ministry of Transportation, we completed multi-seasonal surveys of turtle road mortality along a 4.85 km stretch of Highway 24 in Brant County. This highway segment is in close proximity to provincially significant wetlands which support turtle populations. The study area was walked in its

entirety thrice-weekly during peak turtle activity periods, and the locations of dead turtles observed on the roadway or road shoulders were documented. A similar survey of the same stretch of highway was conducted in 2014 by Stantec (2015) and their data was incorporated into our analysis. In total, 122 dead turtles were documented along this stretch of highway. This dataset was analyzed using ESRI ArcGIS v. 10.3.2 in order to identify mortality hot spots which would be addressed by mitigation measures including ecopassages, fencing, and potentially the creation of off-site nesting habitat.

Simple visual interpretation of mortality data without the use of spatial analysis is an ineffective method for identifying mortality hot spots. Observers were found to have difficulty pinpointing hot spots with confidence regardless of whether the data was represented as points or as a density coverage. We therefore sought to identify statistically significant hot spots using two spatial analysis methods. The first method used an Optimized Hot Spot Analysis (OHSA) to aggregate nearby mortality incidents into a set of weighted points. The second method used a "Moving Window" Analysis (MWA) to assign a spatial weight to each individual incident point. We then used the Getis and Ord (1992) *G* statistic to identify statistically significant hot spots. Both OHSA and MWA identified the same hot spots with high confidence (*p* less than 0.05) (Figure 1). However, OHSA was found to be more conservative whereas MWA is more likely to capture subtle variations in the data. MWA is therefore the more appropriate method to use for small datasets.

The mortality hot spots identified in our study area represent optimal locations for installing ecopassages for turtles. Our results demonstrate that spatial statistics can be used in combination with field observations to determine where mortality mitigation measures can be implemented most effectively.

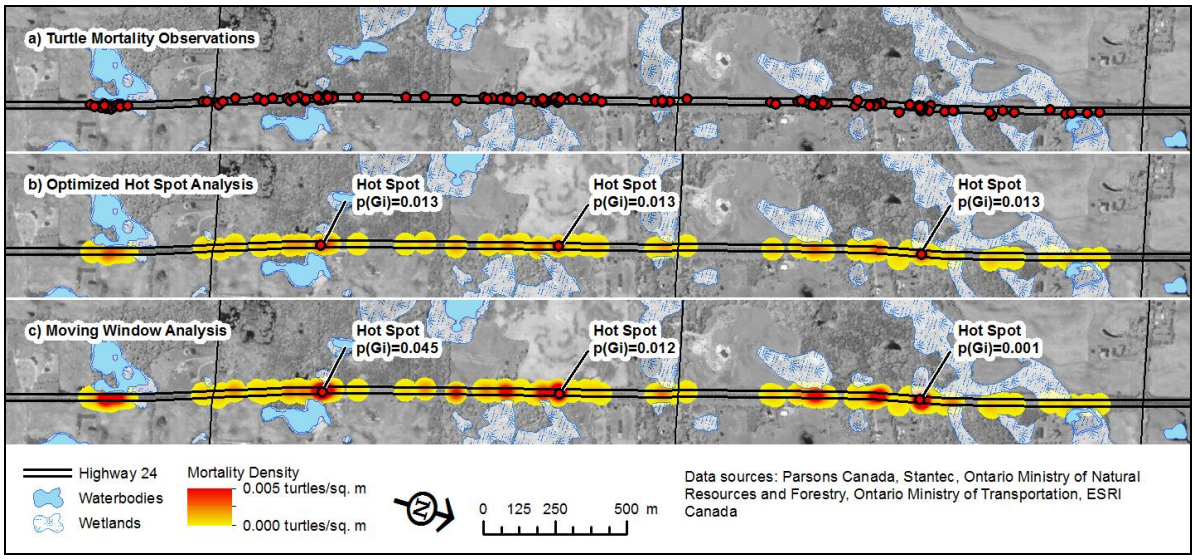

Figure 1: Outcomes of two spatial analysis methods for identifying turtle road mortality hot spots.

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