Road Mortality Effects on the Turtle Population at St. Lawrence Islands National Park

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Abstract

Road mortality in turtles along the St. Lawrence River has been witnessed in the Thousand Island Ecosystem (TIE) for many years. Only recently have we learned that annual additive mortality rates of 2% is more than most turtle species can absorb while maintaining positive population growth rates (Gibbs and Shriver, 2002; Brooks, 2003). As the population growth rate here is already negative, road mortality could be having a huge influence on the recovery of the turtle population. Utilizing the Gibbs/Shriver model, and the parameters applicable to the Park, the calculations were repeated using data from this area in order to determine the estimated annual percent road mortality of turtles. It was discovered that for large bodied turtle, such as the Snapping Turtle (Chelydra serpentina), *annual mortality due to road deaths was approximately 25%. Likewise, annual road mortality for land turtles, such as the Blanding's* (Emydoidea blandingii), *was at least 50% and for small-bodied turtles such as the Painted* (Chrysemys picta), *the mortality estimate was 5%.*

Introduction

At St. Lawrence Islands National Park (SLINP), turtle populations being examined include the following species: Land turtle – Blanding's (*Emydoidea blandingii*), Large-Bodied – Snapping (*Chelydra serpentina*) and Small-Bodied – Painted (*Chrysemys picta*). Also present in this area and the Thousand Island Ecosystem (TIE) in general are the Common Map (*Graptemys geographica*) and Stinkpot Turtles (*Sternotherus odoratus*). Additionally, it is believed that the Spotted turtle (*Clemmys gluttata*) is extirpated from this area.

The loss of turtles is of major concern. While the population decreases due to road mortality, combined with other factors, including predation of nests and habitat fragmentation, the number of reproductive adults can decrease to a point where there is little chance of successful breeding. Additionally, a healthy population of turtles can only withstand 2% mortality a year when the population growth rate is zero (Brooks, 2003).

Several other factors contribute to the importance of managing the adult turtle population. Adult snapping turtles do not reached sexual maturity for about 18 years, and can live for up to 100 years. Also, with a 1% hatchling survival rate, assuming half of the hatchlings are female, it would take 200 eggs and 18 years to add one viable reproductive female to a population (Kawartha Turtle Trauma Centre, 2002). Adult snapping turtles reproduce for their entire lives as soon as maturity is reached. Thus, a death of an 18-year old adult female would not only cause a decline in the adult population, but could also eliminate u| to 82 future clutches that she would otherwise naturally contribute to the populatior Additionally, turtles do not compensate for a decrease in their population by producin more eggs or having an increased juvenile survival rate. Thus, only the reproductiv adults contribute to the overall survival of the population (Brooks, 2002).

Hypothesis

Road mortality will be found to have a significant (>2% annual road mortality) effect or the turtle populations at SLINP.

Methods

The annual road-associated mortality charts in turtles for land, large-bodied pond, and small-bodied pond turtles were obtained from the report by Gibbs and Shriver (2002). On these charts, isoclines which solved for the same level of mortality among different combinations of road density and traffic volume have been given and allow for approximate mortality to be extrapolated. The numbers for traffic volume and road density were obtained for the TIE region and applied to the Gibbs and Shriver model. Calculations for road density were performed using Arc View GIS version 3.2 by Greg Saunders, and traffic volume during the peak period from May-August was obtained from parks of the St. Lawrence, St. Lawrence Parks Commission, and the Ministry of Transportation (MTO) in Kingston, and subsequently reduced by 20%, at the suggestion of Dr. Gibbs, to account for the peak periods during the day that turtles are active.

Results

Road density was found to be 1.73 km of road per km^2 (Saunders, 2003). Additionally, a map (Figure 1) layered with wetlands, 500 m road buffers, and roads with traffic counters was created in order to illustrate areas of special concern. The statistics for this map are included in Table 1.

This data means that for the roads, of which we have known traffic counts, 10% of the wetlands, and thus turtles existing within them, in the Thousand Islands and Leeds Counties. This is only a minimal estimate since we lack any traffic data on other roads in the area and thus the wetlands within a 500 m buffer of them. The map and statistics will be updated as more traffic data becomes available. It also became evident that any turtles existing within the St. Lawrence River, with a tendency to migrate to the north, along the bank where the Thousand Island Parkway exists, are also in peril since it runs within 500m of the shore along it's entire route.

Traffic volume was averaged from data provided by the MTO in Kingston, Ontario for the main roads in the region. Traffic ranged from a low of 474 vehicles/lane/day on Reynolds Rd. to a high of almost 23,000 vehicles/lane/day on Highway 401. The data for the 401 was excluded due to its extreme counts, which would have skewed the traffic data. The average for the main roads of which data was given was 1,501 vehicles/lane/day with a standard deviation of 753, and does not necessarily reflect the traffic flow of the entire county, but as it was the only available data it was used . This data by far surpasses the traffic volumes given on the charts in the previous study, and as such, the most extreme traffic volume values given on the chart were used in establishing estimated road mortality percentages. One must also note that the data provided by MTO was from many past years, and significant human developments in the region have occurred since the last collection.

Figure 1. *Areas of high turtle-traffic conflict (Saunders, 2003).*

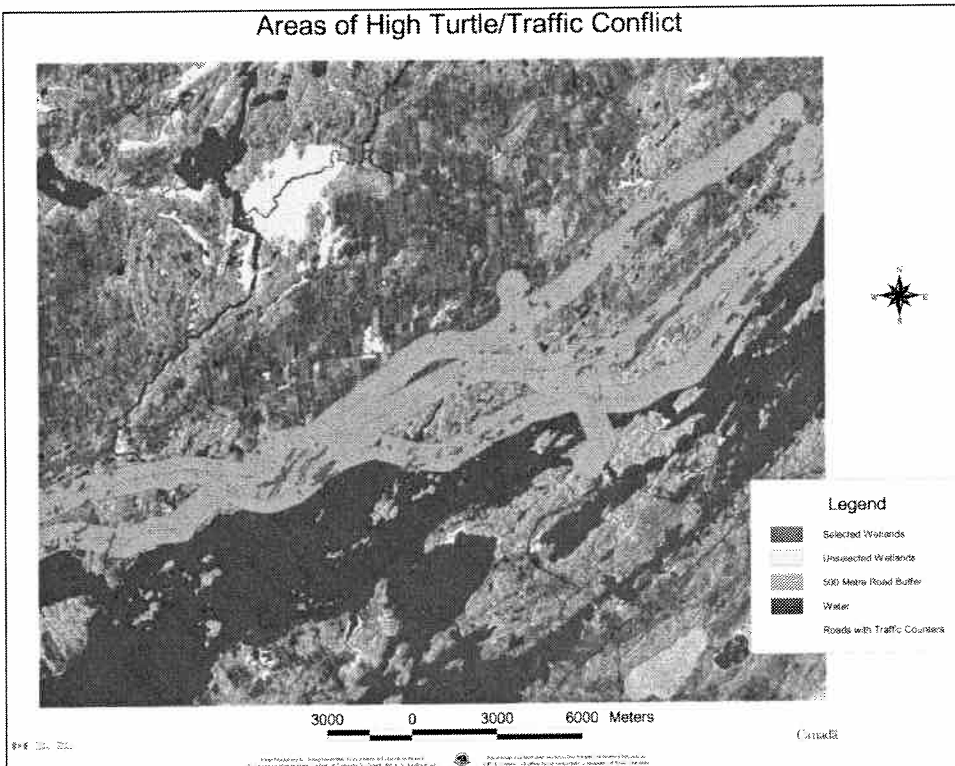

Table 1. *Statistitcs for Figure 1 – areas of high turtle-traffic conflict.*

Total Wetlands in Leeds and Thousand Islands	38,421,816.933 m^2
Wetlands selected by 500m Buffer in Leeds and Thousand Islands	3,843,272.360 m^2
Percent of wetlands with known impact due to road mortality	10%

Applying these numbers to the charts and extrapolating by eye gives us the following:

- for land-based turtles the annual road mortality was found to be at least 50%;
- for large pond turtles the annual road mortality was found to be at least 25%; and,
- for small Pond turtles the annual road mortality was found to be about 5%.

These results are disturbing as they are significantly more than the 2% loss per year tha is found to be the threshold to maintaining stable populations.

Discussion

The hypothesis that road mortality will have a significant effect on turtle populations (>2% loss per year) is true. There are several assumptions that need to be noted. First, the original study only considered turtle nesting-movements and not random wanderings, which could increase the exposures of turtles to road mortality. It was also assumed that there would not be compensation for increased road mortality in the turtle ecology such as increased nest success or juvenile survival rates.

The traffic volume was an extremely conservative averaged approximation given by studies of on/off ramp and through traffic measurements done by the Kingston, Ontario MTO office from 1995–2001. Recently, tourist volume along the Thousand Island Parkway and within the TIE has increased dramatically and could contribute to more turtle mortality, especially considering the high numbers of tour buses traveling the scenic route each summer. Additionally, traffic volume on the 401 was not considered as it was so high and would likely push the estimates to extremely skewed numbers. Another aspect that will be examined in 2003 is the sex ratio data. Dr. Gibbs has noted that in field studies it has been found that more female turtles are killed through road mortality. This may lead to skewed sex ratios in the population.

Thus, this very conservative approximation declares that there is a high degree of road mortality of turtles in SLINP. This equates to an eventual extirpation if the population numbers were stable to begin with. As they are now, the population growth rates are decreasing and several species of turtles here are COSEWIC-designated or believed to be extirpated. Given the long length of time for a turtle to reach sexual maturity and begin adding positively to a population, mitigation to protect all turtles including nests, adults, and juveniles needs to be accomplished.

Conclusion

Mitigation is necessary. Public education and signage would be the most economically feasible given the large land area within the study location. It might be worthwhile to look into increasing the number of culverts in high-mortality areas.

Acknowledgments

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