# River otters and Roadways

## Identifying factors leading to otter-vehicle collisions

## INTRODUCTION

Habitat fragmentation caused by roadways has detrimental effects on ecosystems and wildlife populations [4]. One of the major effects suffered by wildlife is animal–vehicle collisions. Collisions also have an economic impact on people with the historic cost In the United States being $8 billion per year [1]. A mitigation tool against animal-vehicle collisions is the use of wildlife crossings. Wildlife crossing structures are defined as overpasses and underpasses placed across roadways that allow animals to safely cross [2]. These structures have been shown to reduce animal-vehicle collisions [3] as well as; reduce habitat fragmentation, increases gene flow between populations, and reduce economic impacts to societies associated with animal-vehicle collisions [4].

In east central Florida a species being affected by this conflict is the river otter (*Lontra canadensis*). River otters can be found throughout the entire state of Florida except for the Florida Keys. An aquatic mammal they require both land and water habitats to survive and can be used as a sentinel species to assess habitat quality. The conservation status of the river otter is unknown in Florida as a population study has not been preformed since the 1980's [5].

To help combat otter-vehicle collisions in the area this research project, through a partnership with Hubbs-SeaWorld Research, is analyzing what abiotic factors contribute to otters being hit by cars along roadways from 2016-2019. This data can be used to identify locations to implement wildlife crossings and as a tool to scale this analysis to other regions in the state. An additional benefit is that wildlife crossings are often used by multiple species and will therefore improving the overall health and connectivity of the local ecosystem.

## METHODS

In order to investigate what factors are affecting the probability of otter-vehicle collisions along roadways in east central Florida an Ordinary Least Squares (OLS) linear regression was performed.

1. Possible independent variables were identified as; roadway speed limits, median width, number of lanes per roadway, surrounding land use, and distance of the roadway to waterbodies
2. Otter-vehicle collision locations were provided by Hubbs-SeaWorld Research Institute
3. A fishnet was created over the study area and clipped to roadways
4. Zonal statistics was used to identify land use for the surrounding areas along roadways
5. All the data was spatially joined to the fishnet
5. An OLS linear regression was preformed upon each independent variable

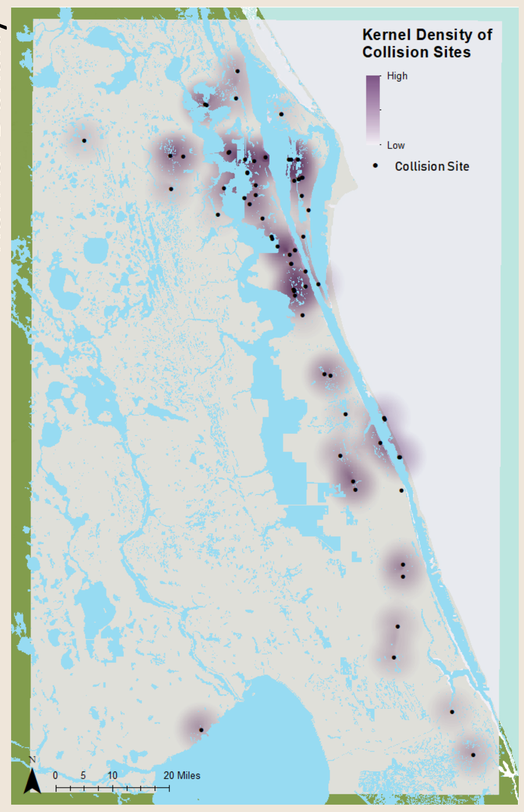

| Variable | Reason for Importance | OLS Results |
|---|---|---|
| Number of Lanes | This coincides with the width of a roadway. Larger roadways may correlate with an increased risk of crossing. | $p = 0.942$<br>$R^2 = 0.000000$ |
| Speed limit | Higher speed limits provide the public with less time to brake for a passing otter possibly increasing the risk of a collision. | $p < 0.000$<br>$R^2 = 0.000433$ |
| Width of median | Medians are a portion of the road where otters could avoid a collision while crossing a roadway. Larger medians could assist otters. | $p = 0.239$<br>$R^2 = 0.000036$ |
| Distance to waterbodies | Otters are aquatic mammals that require waterbodies within their habitats. Presence of nearby water bodies could mean a higher population of otters or the need for a otter to cross a roadway to access a waterbody. | $p = 0.045$<br>$R^2 = 0.000104$ |
| Surrounding land use | Different land uses will influence whether an animal is in the area or needs to cross a roadway to gain access to a different type of habitat. | $p < 0.000$<br>$R^2 = 0.001855$ |

## RESULTS

The OLS linear regression identified some of the variables as significant for explaining why an otter-vehicle collision occurred at the specified geographical locations. The $R^2$ and p-values of all the independent variables are provided in the table along with a brief explanation of why these variables were chosen for analysis. The significant variables are highlighted below along with a kernel density display of all the otter-vehicle collision sites.

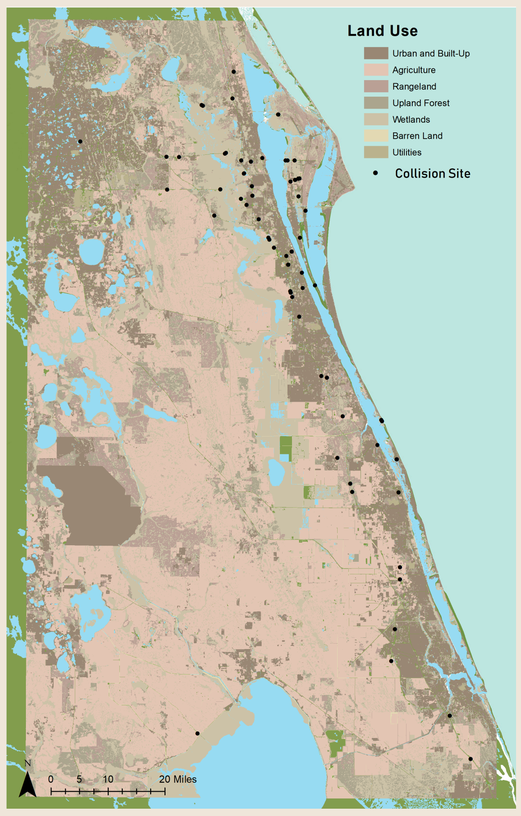
Focusing resources on high problem areas would be beneficial. The kernel density tool was used to illustrate high concentrations of collision sites within the study area.

Kernel Density



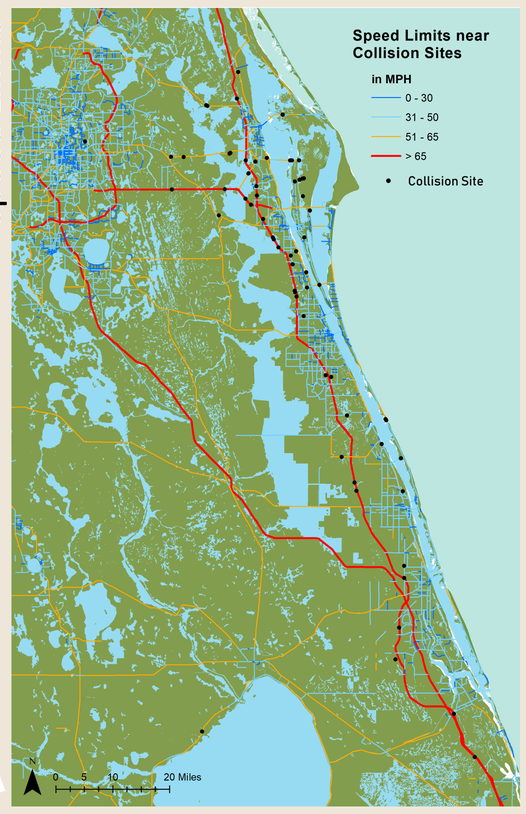

The type of land use surrounding roads was found to be significant. The most common land type adjacent to collision sites was wetlands.

Land Use



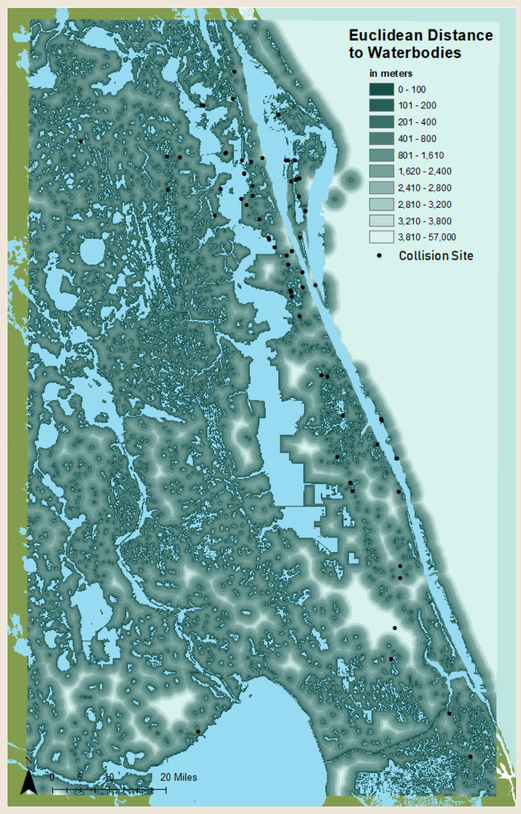

Roadway speed limits was found to be significant for otter-vehicle collisions. This map demonstrates current speed limits for the study area.

Speed Limits




The roads proximity to waterbodies was found to be significant. Euclidean distance to waterbodies shows most of the study area and collision sites lie within close proximity to a water body.

Euclidean Distance




## CONCLUSIONS

This project concludes that the location of otter-vehicle collisions can be explained by certain abiotic factors including the roads distance to waterbodies, the speed limit of the road, and the surrounding land use in the area. Mitigating habitat fragmentation with wildlife crossings is a beneficial tool when crossings are appropriately placed. In order to improve habitat fragmentation and reduce the amount of otters being struck and killed by cars, wildlife crossings can be implemented at the locations with the correlating features found to be significant. Further research and additional data points of otter-vehicle collision sites would improve upon this analysis.

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**Literature Cited:** [1]Executive Summary - Wildlife-Vehicle Collision Reduction Study: Report To Congress, August 2008 - FHWA-HRT-08-034. (n.d.). Retrieved April 29, 2019, from https://www.fhwa.dot.gov/publications/research/safety/08034/exec.cfm
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**Data Sources:** Florida Fish and Wildlife Conservation Commission (2015), Florida Department of Environmental Protection (2019), MyFlorida Open Data Portal (2003), M drive–Tufts Data Lab, Florida Department of Transportation (2019), Hubbs SeaWorld Research Institute (2019)

**Projection:** NAD 1983 UTM Zone 17N