Evaluating passage use for smaller mammals in Canada
Or colloquially: Why did the mammal cross the road?
April Martinig
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Thank you!
Research Questions
Introduction
Transportation agencies have begun constructing wildlife passages in an attempt to offset the ecological consequences.
Most studies focus on large mammals.
Introduction
Roads
Fragmentation
Ecological effects
Habitat loss
Barrier to movement
Reduced gene flow
Limited access to resources
Prezi

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Roads

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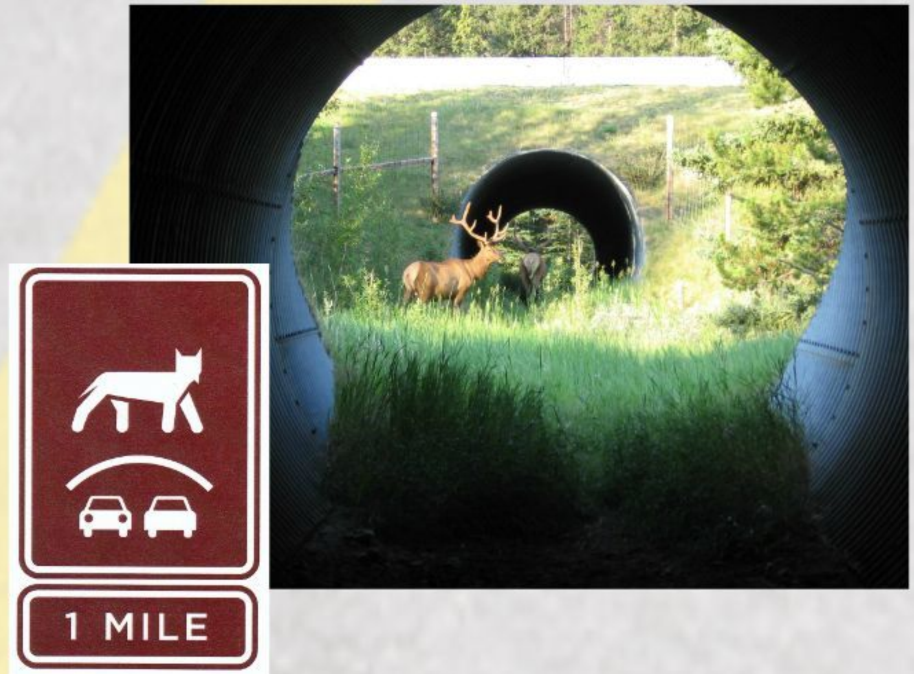
Introduction

Transportation agencies have begun **constructing wildlife passages** in an attempt to offset the ecological consequences.



Most studies focus on large mammals.

Few have examined the effects on smaller mammals at a multispecies level.

Research Questions

(1) **Does crossing success differ** between passages and if so, what environmental and structural characteristics best explain these differences?

(2) Does crossing success **differ by species**?

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Factors

Crossing success should decrease with:

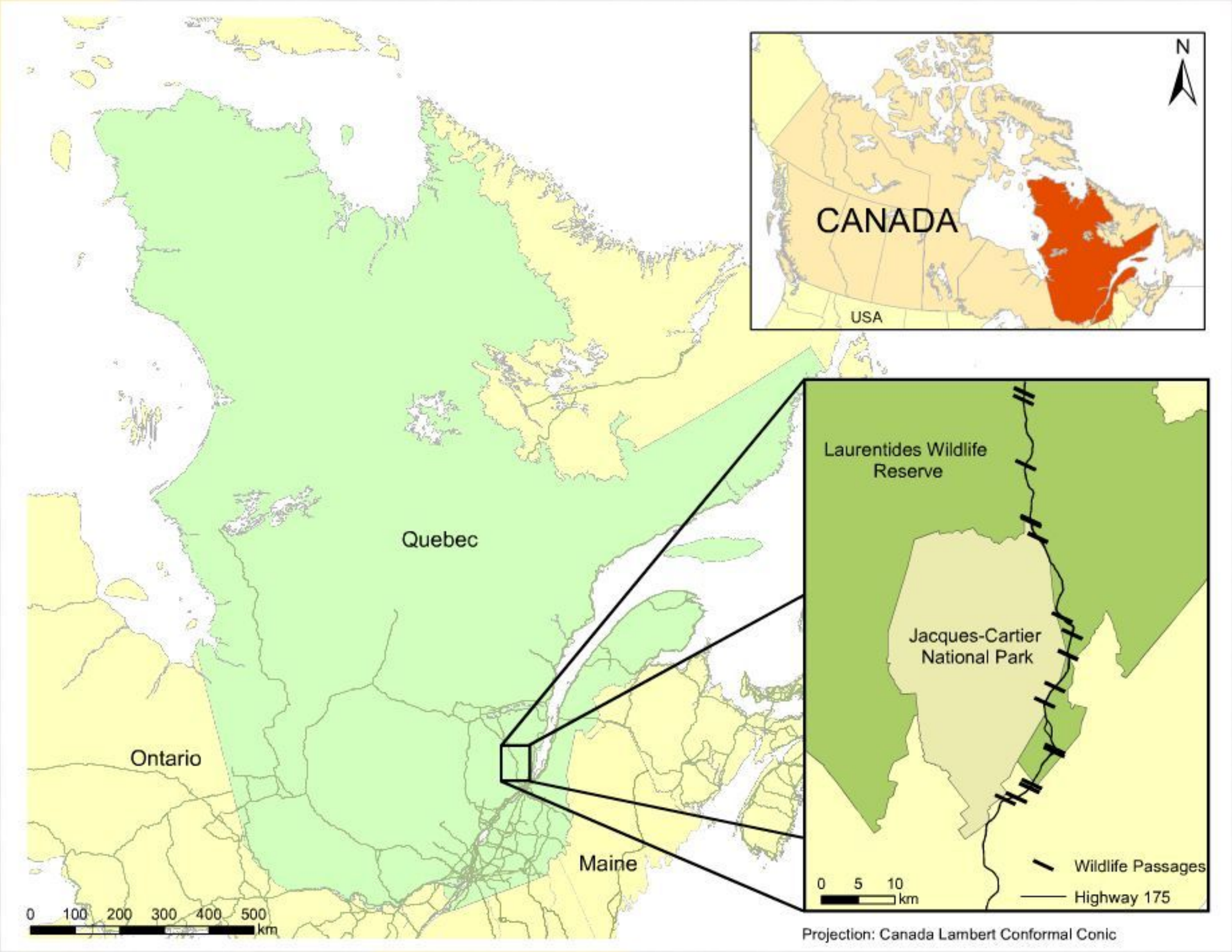
- **limited cover**
- **artificial light**
- **open median**
- **openness**

Objective

To provide targeted **management recommendations** for future development projects that intend to incorporate small fauna passages into the infrastructure design process.

Methods

- Highway 175
- Laurentides Wildlife Reserve
- forest dominated
- between Québec City and Saguenay
- 17 passages
- remotely triggered cameras
- monitored year round (2012 to 2014)



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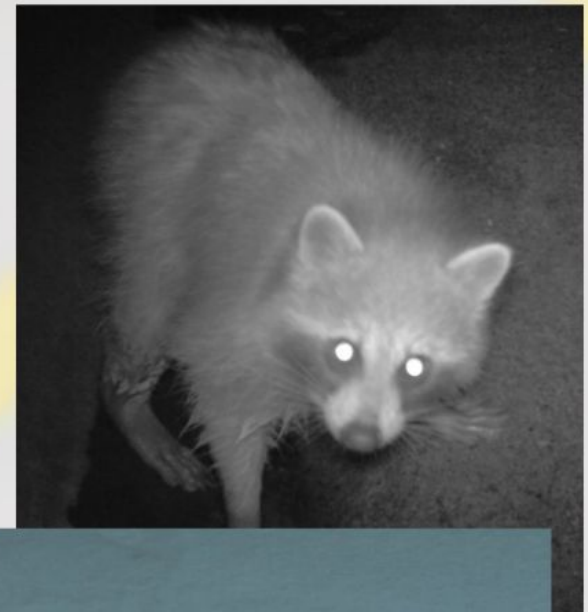
Passage Types

(a) Pipe culvert (PC) (n=6)
(b) Box culvert with dry concrete ledge (DCC) (n=7)
(c) Box culvert with dry wooden ledge (DWC) (n=4)

Statistical Methods and Models

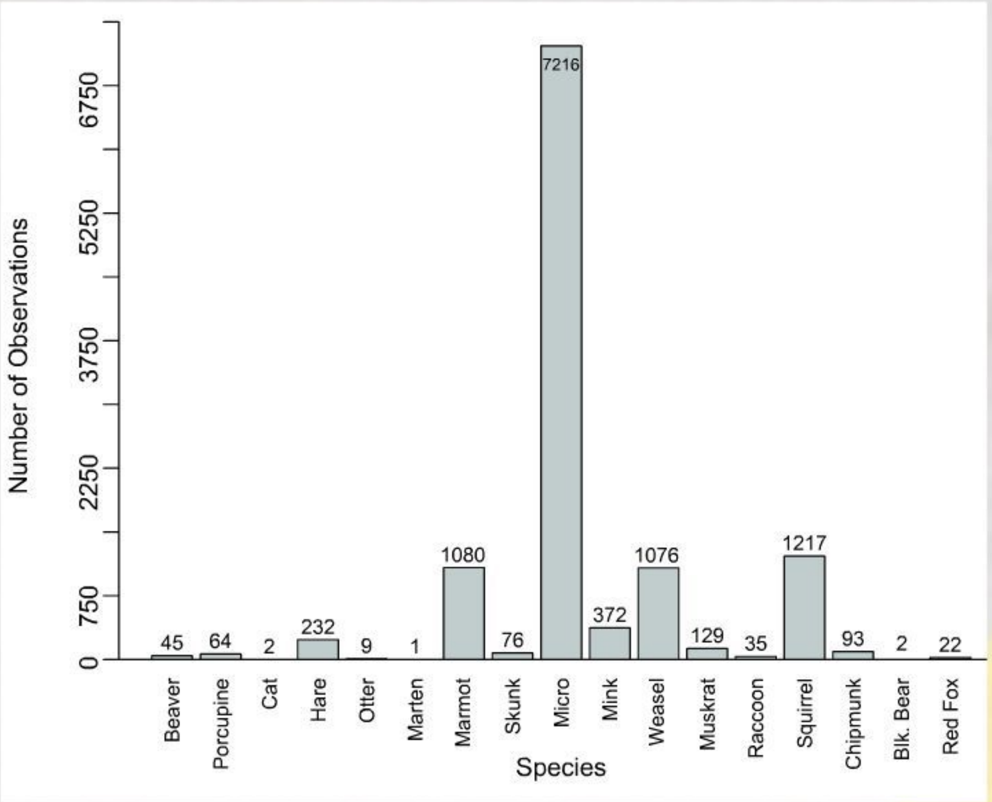


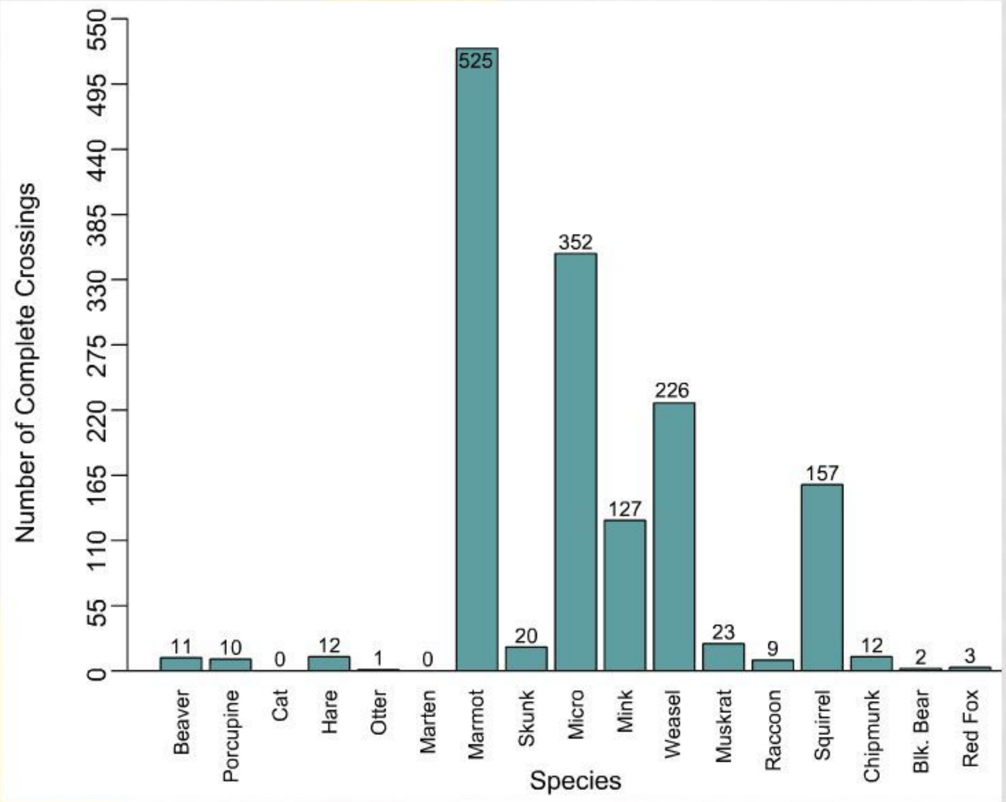
- generalized linear mixed model
- binary data
- success (coded as a 1) or failure (coded as a 0) of each event
- fixed effects
- random effect (passage id)

- generated three models:
  - (a) a model ignoring species
  - (b) a model including species
  - (c) species specific models
    - micromammals
    - weasels

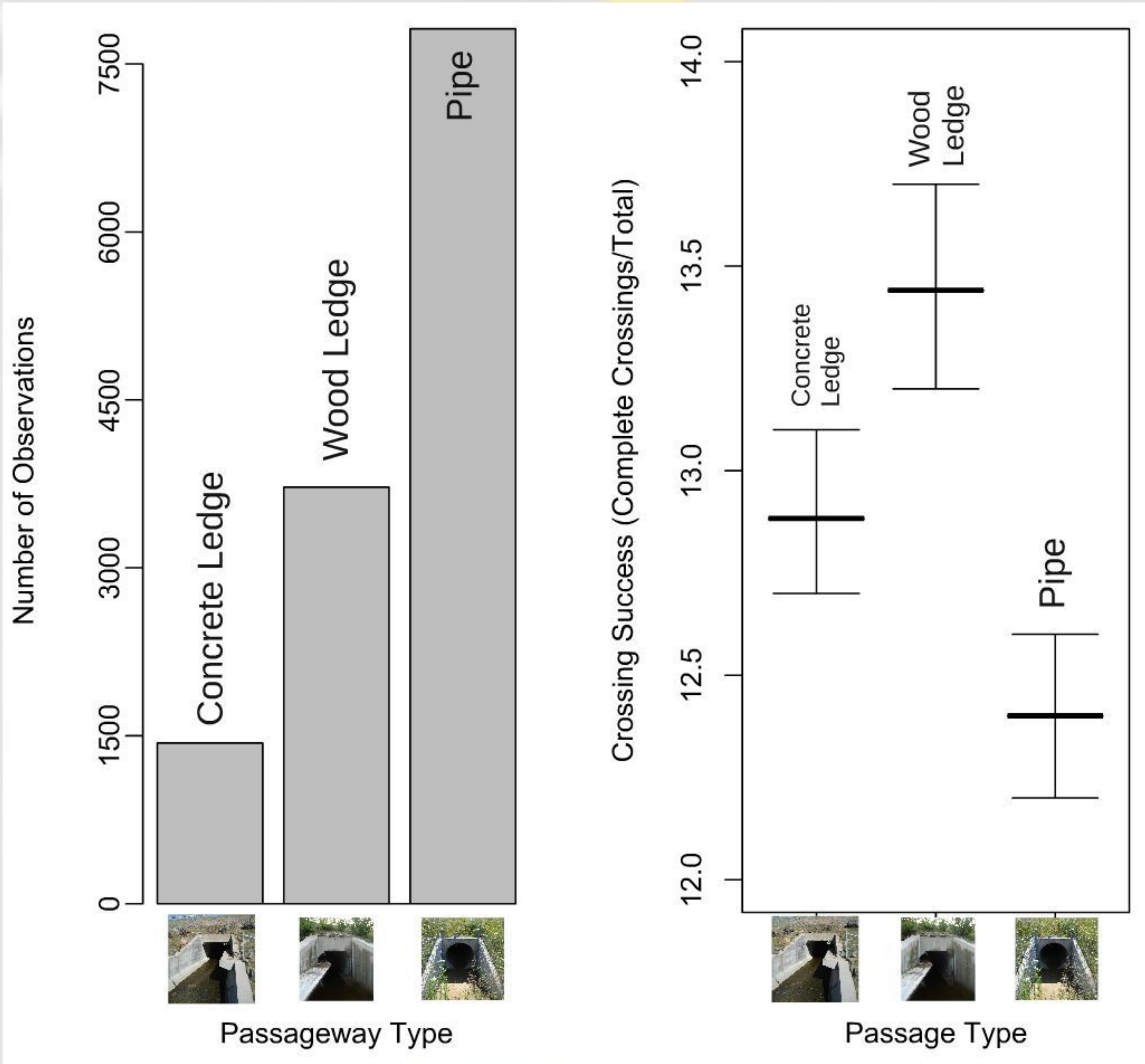
Results

- Total photos: 176,197
- Total independent events: 15,097
- Total species observed: 18 species
  - micromammals grouped as one taxa





Pipe culverts were significantly **less likely** to be crossed.



Passages were significantly **less likely** to be crossed if the structure:

- had an **open median** (with the exception of weasels)
- had a **low openness ratio**
- was located at **higher latitudes**

Micro-mammals were the only species where artificial light had a significant (negative) effect on crossing success.

Discussion

- crossing success of smaller mammals is a function of the environmental and structural characteristics associated with the monitored passages

- smaller mammals have been found to avoid using passages that **limit their visibility** or expose them to **areas of human activity**, hence:
  - pipe culverts (which have a lower openness ratio) were not favoured, nor were passages where artificial light was present

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Discussion

- **segmented passages** have the advantage of a higher openness ratio, but this comes at the cost of **interrupting the animal's movement** across the highway
- passages at **higher latitudes** experienced significantly less crossings
  - this may be due to the **presence of wildlife fencing** at lower latitudes that may have helped direct animals towards the passages

Conclusions

This study highlights how agencies can engineer more effective wildlife passages by minimizing the barrier effect of the structures themselves.

Université Concordia University

Transports Québec

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Model Without Species

GLOBAL MODEL				
Variables	Beta	Standard Error	Z-value	P-value
Passage Type (DWC)	-0.064	0.48	-0.14	0.89
Passage Type (PC) ⭐	-0.71	0.35	-2.01	0.044*
Openness	1.15	1.22	0.95	0.34
Median ⭐	-1.03	0.38	-2.69	0.0072*
Distance to Cover	-0.46	1.40	-0.32	0.75
Artificial Light	-0.48	0.56	-0.87	0.39
Location (km)	1.04	0.75	1.39	0.16

*Denotes a significant p-value at the 5% level of significance.

Model With Species

GLOBAL SPECIES MODEL

Variables	Beta	Standard Error	Z-value	P-value
Passage Type (DWC)	-0.34	0.44	-0.77	0.44
Passage Type (PC)	-0.25	0.31	-0.80	0.43
Openness	2.43	0.96	2.53	0.011*
Median	-1.20	0.37	-3.25	0.0011*
Distance to Cover	-2.10	1.12	-1.87	0.062
Artificial Light	-0.20	0.45	-0.46	0.65
Location (km)	-1.46	0.66	-2.22	0.027*
Species (MICRO)	-3.85	0.27	-14.40	<0.001*
Species (MUVI)	-0.67	0.29	-2.32	0.020*
Species (MUXX)	-1.73	0.23	-7.57	<0.001*
Species (ONZI)	-1.10	0.29	-3.73	<0.001*
Species (TAHU)	-3.28	0.48	-6.78	<0.001*

*Denotes a significant p-value at the 5% level of significance.

Species-Specific Model for Micromammals

SPECIES-SPECIFIC MODEL FOR MICROMAMMALS

Variables	Beta	Standard Error	Z-value	P-value
Passage Type (DWC)	-0.22	1.47	-0.15	0.88
Passage Type (PC)	0.44	0.91	0.49	0.63
Openness	5.02	3.04	1.65	0.099
Median ★	-2.79	1.21	-2.30	0.022*
Distance to Cover	3.12	3.41	0.92	0.36
Artificial Light ★	-2.00	0.96	-2.08	0.038*
Location (km) ★	-2.74	1.06	-2.60	0.0095*

*Denotes a significant p-value at the 5% level of significance.

Species-Specific Model for Weasels

SPECIES-SPECIFIC MODEL FOR WEASELS

Variables	Beta	Standard Error	Z-value	P-value
Passage Type (DWC)	-0.56	0.64	-0.88	0.38
Passage Type (PC)	-1.37	0.63	-2.16	0.031*
Openness	2.77	2.55	1.08	0.28
Median	-0.73	0.61	-1.21	0.23
Distance to Cover	-1.96	2.62	-0.75	0.45
Artificial Light	1.81	1.09	1.66	0.097
Location (km)	-0.42	1.48	-0.29	0.77

*Denotes a significant p-value at the 5% level of significance.

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