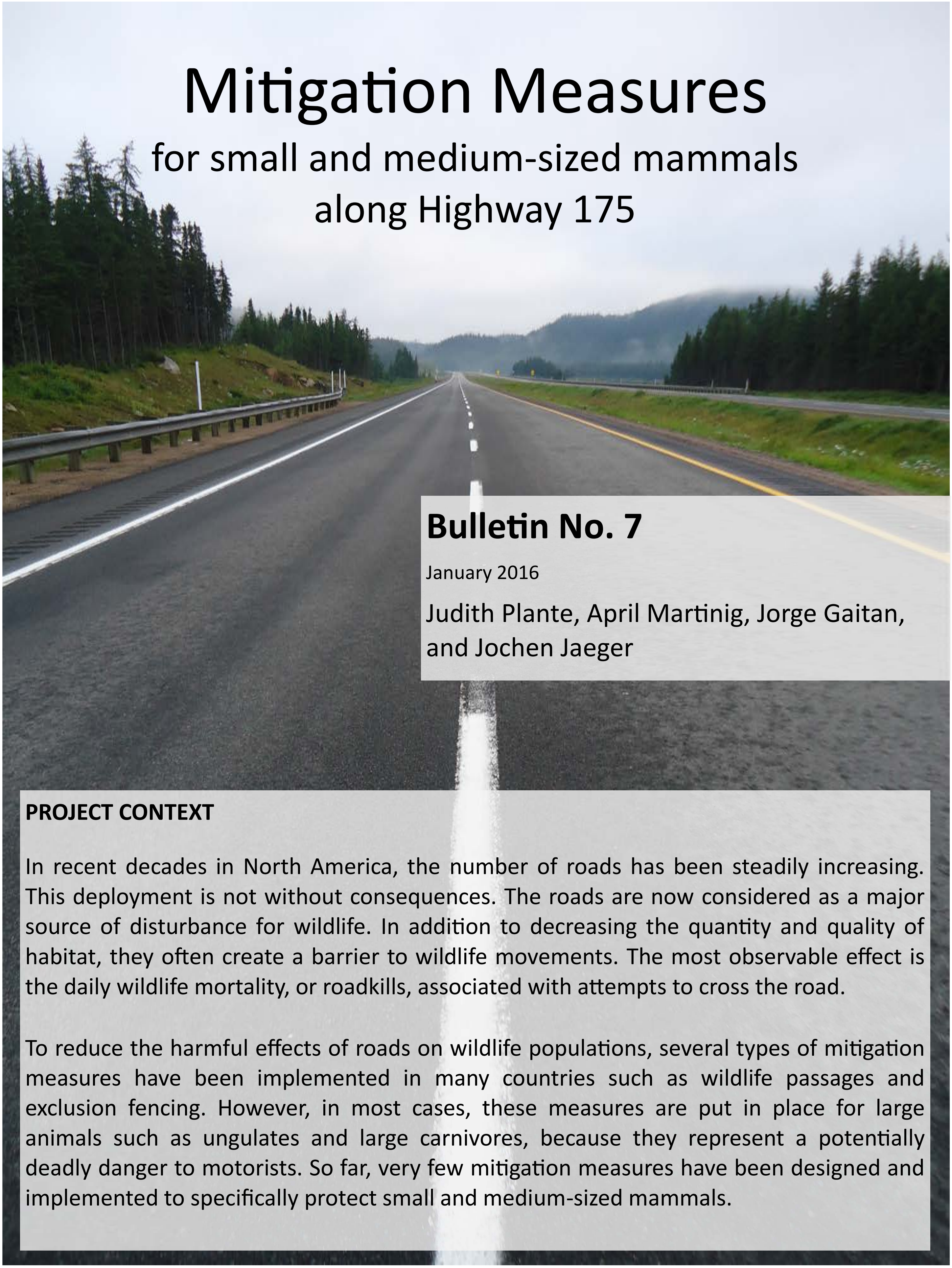

Mitigation Measures

for small and medium-sized mammals along Highway 175

Bulletin No. 7

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PROJECT CONTEXT

In recent decades in North America, the number of roads has been steadily increasing. This deployment is not without consequences. The roads are now considered as a major source of disturbance for wildlife. In addition to decreasing the quantity and quality of habitat, they often create a barrier to wildlife movements. The most observable effect is the daily wildlife mortality, or roadkills, associated with attempts to cross the road.

To reduce the harmful effects of roads on wildlife populations, several types of mitigation measures have been implemented in many countries such as wildlife passages and exclusion fencing. However, in most cases, these measures are put in place for large animals such as ungulates and large carnivores, because they represent a potentially deadly danger to motorists. So far, very few mitigation measures have been designed and implemented to specifically protect small and medium-sized mammals.

HIGHWAY 175

Between 2006 and 2012, the width of HWY 175 making the connection between Quebec City and the Saguenay region was increased from two lanes to four lanes. During the widening work, the Ministry of Transport of Quebec took the opportunity to add under the road 33 wildlife passages specifically designed for small and medium-sized mammals. Small fauna fences were also added on each side of the passages. This is the first mitigation project of this magnitude in Quebec. The implementation of these mitigation measures is primarily intended to restore connectivity between the two sides of the road in addition to reducing road mortality of small and medium-sized wildlife. This research project provides an important opportunity to learn about the effectiveness of such mitigation measures for Quebec and other provinces and even countries and to identify possibilities for improvements.

PROJECT OBJECTIVES:

1. To characterize the locations and rates of vehicle collisions with small to medium-sized mammals and to evaluate the difference in the frequency of highway-related mortality between areas of the highway with mitigation measures and areas without;

2. To determine passageway effectiveness for small and medium-sized mammals;

3. To assess if the mitigation measures allow movement and gene flow across the highway, with a focus on the American marten (*Martes americana*).

Fig. 1. American marten (*Martes americana*) being released .

Fig. 2. Woodchuck (*Marmota monax*) in a wildlife passage.

OBJECTIVE 1: Characterisation of roadkill locations

During the entire monitoring project (2012-15), 890 mammals were found dead along Highway 175 between kilometers 75 and 144. The North American porcupine was the most represented species with 374 mortalities. Micromammals such as voles, shrews, and mice were second with 221 mortalities. The details for the four years are presented in figure 3. Note that the number of mortality surveys varies between of the summers. In 2012, 90 surveys were done and in 2013, 81 surveys were conducted. In 2014 and 2015, 72 and 63 surveys were done, respectively.

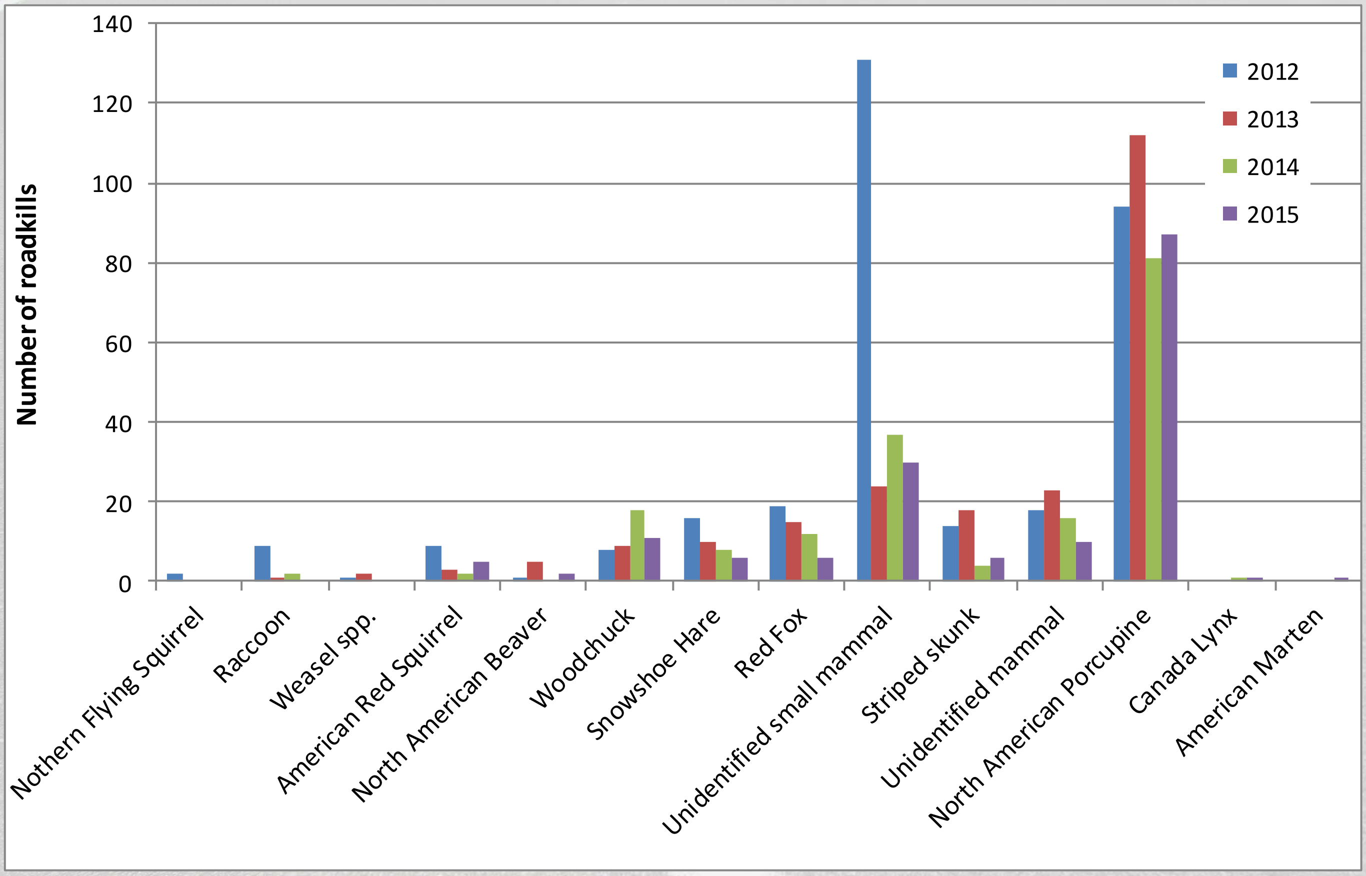

Figure 3. Observed roadkills fom June to October 2012 and 2013, and from June to September 2014 and 2015. Micromammals and Weasels have been grouped.

An exhaustive analysis of the results will be available in Judith Plante's MSc thesis in summer 2016.

Fig. 4. Striped Skunk (*Mephitis mephitis*)

Fig. 5. North American porcupine (*Erethizon dorsatum*)

Fig. 6. American Red Squirrel (*Tamiasciurus hudsonicus*)

Fig. 7. Snowshoe hare (*Lepus americanus*)

OBJECTIVE 2: Monitoring the use of wildlife passages using cameras

For information about the passages being monitored please refer to Bulletins 1 - 6. M.Sc. student April R. Martinig recorded 215,372 photos over the study period, 43% of which were of mammals. She documented 13,489 independent observations representing at least 18 faunal species or groups (Figure 10). Three types of observations were distinguished based on the ability to determine if an observed animal simply explored a passage and then left or if it moved through the entire passage: The majority of events were unknown (it was not possible to determine if it was a full passage or an exploration) (59%), followed by explorations (28%), and then complete crossings (13%) (Figure 8). Pipe culverts had the largest number of complete crossings (Figure 9).

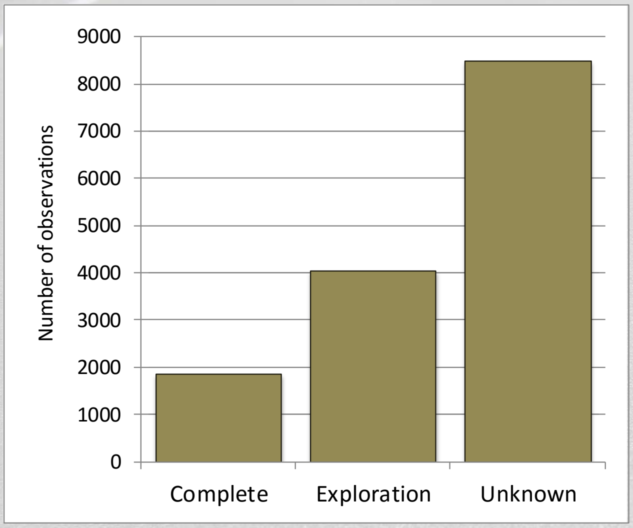

Figure 8. Number of observations classified by crossing type (complete, exploration, or unknown).

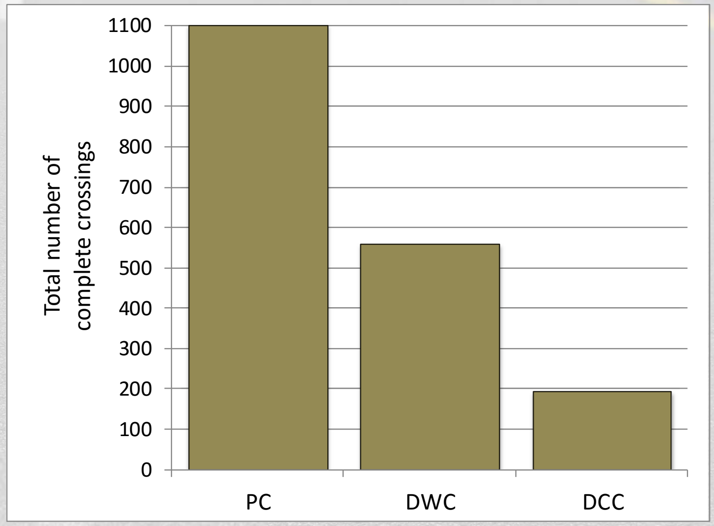

Figure 9. Number of complete crossings by type of passage (PC: pipe culvert (n=6), DWC: box culvert with wooden ledge (n=4), DCC: box culvert with concrete ledge (n=7)).

What passages are found by small and medium-sized mammals:
Discovery (complete passages, explorations, and unknown observations combined, because in all three cases the animal was observed inside the passage)

Passage discovery was expected to depend on certain factors. Of these, only some had an effect on discovery rate.

1) distance to cover - no effect on discoveries
2) presence of artificial light - no effect on discoveries
3) species-specific traits - no effect on discoveries
4) location of passage - passages further north were discovered more
5) passage type - micromammals discovered pipe culverts more and red squirrels discovered wooden ledge culverts more than the other passage types

What passages are used by small and medium-sized mammals: Success (complete crossing observed)

Once an individual discovered the passage, successful complete passage use (while counting all unknown observations as failures) was thought to depend on other variables. (For more information about this approach, please refer to Bulletin 5.)

1) passage type - pipe culverts were only crossed more for woodchucks than other passage types
2) passage openness - the more open a passage, the more it was crossed for all species combined and by woodchucks and weasels in particular
3) number of passage segments - segmented passages (with an opening in the center) were crossed less by all species combined and by woodchucks, micromammals, mink, and weasels in particular
4) species-specific traits - no effect on usage

OBJECTIVE 2: Monitoring the use of wildlife passages using cameras

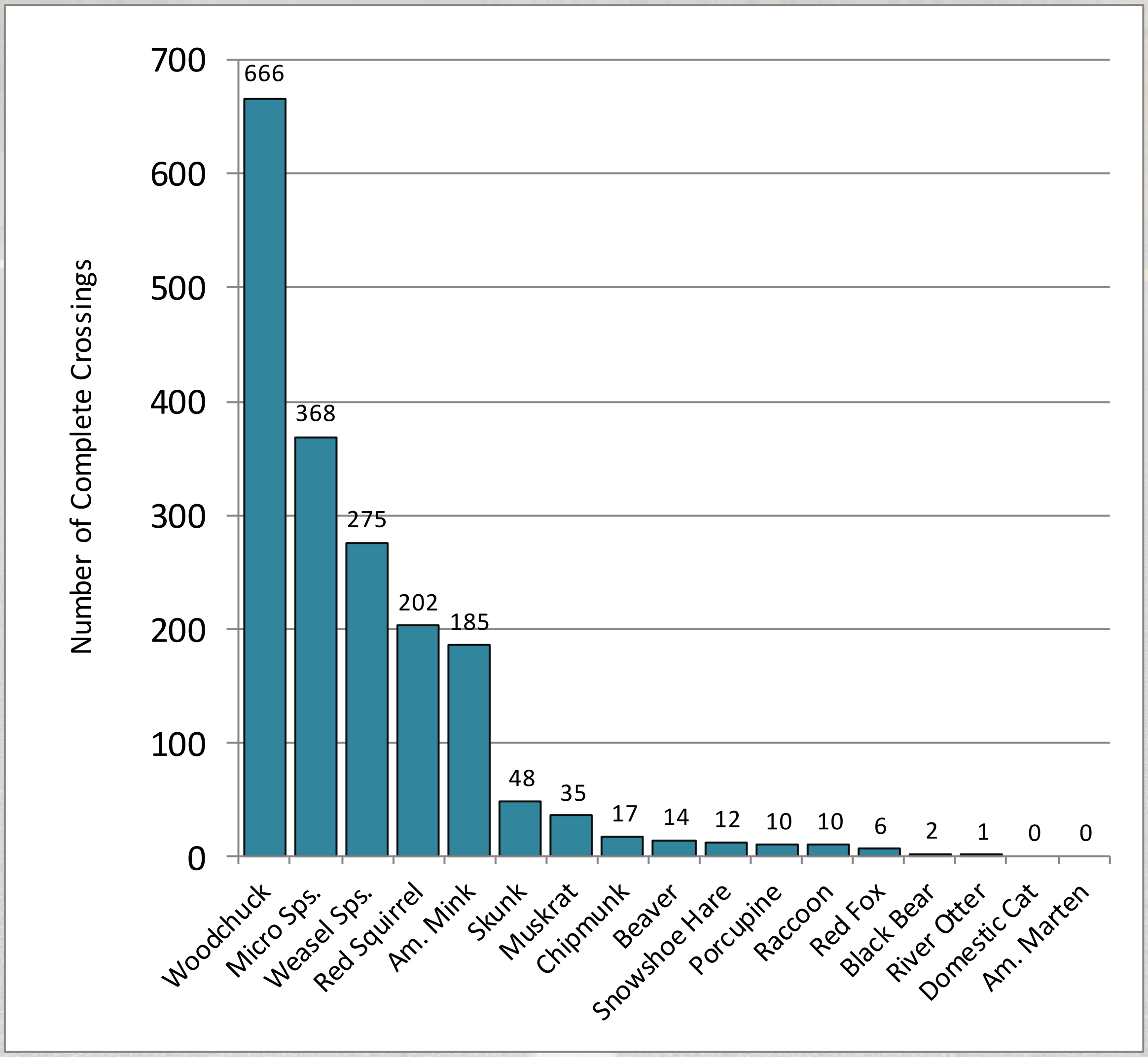

Figure 10. Number of complete crossings for each species observed in the wildlife passages. Numbers above bars indicate column totals.

Stay tuned for a more detailed analysis of the results in April R. Martinig's thesis in winter 2016.

Fig. 11. Red Fox (*Vulpes vulpes*)

Fig. 12. North American porcupine (*Erethizon dorsatum*)

Fig. 13. Raccoon (*Procyon lotor*)

OBJECTIVE 3: To assess if the mitigation measures allow movement and gene flow across the highway, with a focus on the American marten (*Martes americana*).

Radio telemetry study

A radio telemetry study was carried out to characterize the ranging behaviour of American martens in the study area and to identify the influence of the road on this behaviour. Animals were fitted with VHF collars on **HWY 175** (mitigated 4-lane HWY) and a control highway without mitigation measures with only 2-lanes (**HWY 381**). These collars allowed the researchers to triangulate their position remotely on a regular basis, allowing for the estimation of home range (HR) and activity patterns. If an animal's home range and activity overlaps with the road it can be inferred that the road is not an important barrier for that individual. The positioning of the animal locations relative to the road also provides information on the effect of the road presence on the animals.

Fig. 14. Recaptured marten (*Martes americana*) inside a trap with its ear tag visible.

Radio telemetry results

Our analysis of the activity patterns along the HWY is still underway, but so far we found that the tracked animals kept their HR on one side of HWY 381 with 64% of the martens making a few round trips to the opposite side of the road. In contrast, on HWY 175 round trips were not observed; two martens (12% of the sample) crossed and established a new HR on the opposite side, and two other martens (12% of the sample) were found dead on the opposite side of the road. On HWY 175 the martens with activity patterns close to the HWY generally limited their movements close to the road, unlike the results observed in the 2-lane road (HWY 381) where martens were observed crossing the road. Our study suggests that the widened highway represents a more significant barrier for martens than a 2-lane highway.

Fig. 15. Anesthetized marten (*Martes americana*) with its VHF collar visible.

Fig. 16. Releasable marten (*Martes americana*) drinking water from a syringe in early July 2015.

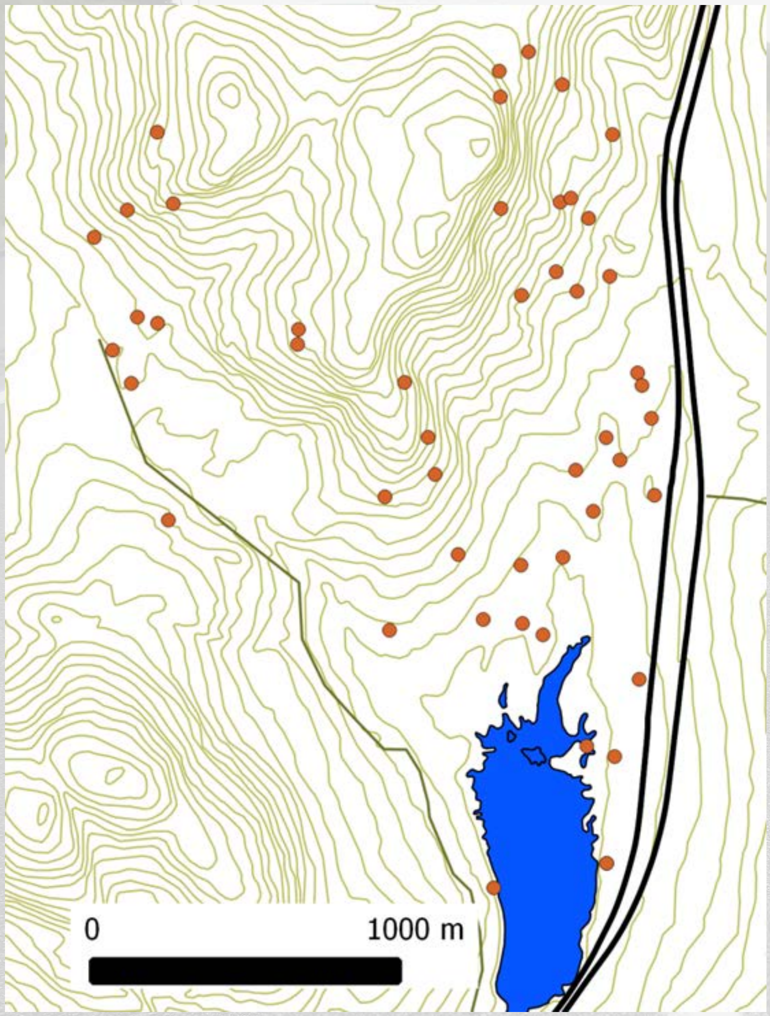

Figure 17:

Locations of a marten along HWY 175. The continuous lines represent the HWY 175. Note that the marten stops its movements on the edge of the HWY. This marten clearly showed road avoidance during the time it was tracked. It did approach the road on many occasions, but its movements and distribution indicate that the road represented a barrier.

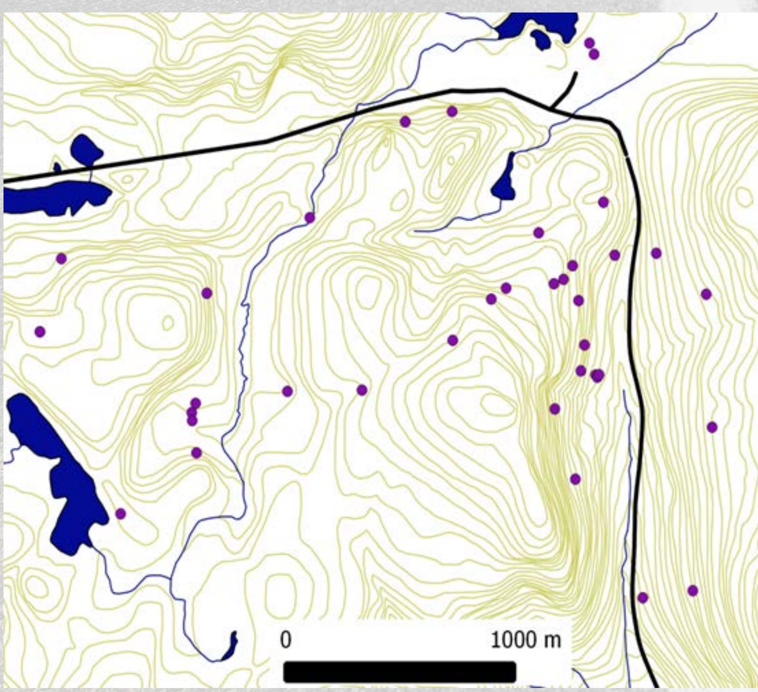

Figure 18:

Locations of a marten along HWY 381. The continuous lines represent the HWY 381. The marten was located on both sides of the HWY, with most locations on the west side. In contrast to the martens from HWY 175, the marten crossed the 2 lane road on several occasions. Its HR is located on the west side of the road, but with eventual crossings to the other side. We have evidence that they use the culverts in these locations, but they may also cross the road at ground level.

PARTNERSHIP

To put this project into place, the Ministère des Transports du Québec (MTQ) brought together a team of scientific researchers, which presently includes: **Martin Lafrance**, Direction de la Capitale-Nationale of the MTQ; **Dr. Jochen Jaeger**, Concordia University; **Judith Plante**, MSc student in Geography, Planning and Environment at Concordia University; **April Martinig**, MSc student in Biology at Concordia University; **Dr. André Desrochers**, Laval University; **Katrina Bélanger-Smith**, MSc student in Biology at Concordia University; **Jorge Gaitan-Camacho**, research associate at Concordia University (since September 2014); **Dr. Marianne Cheveau**, researcher at the Ministère des Forêts, de la Faune et des Parcs du Québec; **Sarah Sherman Quirion**, field technician at the Ministère des Forêts, de la Faune et des Parcs du Québec; **Éric Alain**, Ministère des Transports du Québec; **Héloïse Bastien**, Ministère des Forêts, de la Faune et des Parcs du Québec; **Dr. Pierre Blanchette**, Ministère des Forêts, de la Faune et des Parcs du Québec; **Sylvain Boucher**, Réserve faunique des Laurentides, Sépaq; **Michel Michaud**, Ministère des Transports du Québec; **Julie Boucher**, Ministère des Transports du Québec; **Yves Leblanc**, AECOM Consultants Inc.; **Dr. Anthony Clevenger** (WTI - Montana State University), **Dr. Jeff Bowman** (Trent University), **Dr. Paul J. Wilson** (Trent University), and various other personnel: Rodrigo Lima, Robby Marrotte, Aurélie Lagueux-Beloin, Daphnée Gariépie, Benjamin Larue, Simon Tapper, Bre-Anne Breton, Carling Dewar, Dylan Robinson, Carlos Zambrano, Simon Tapper, Stephen Macfarlane, Amy Jones, Mary-Helen Paspaliaris, Sandra Anastasio, Kenzie Azmi, Emily Kerr, Tanya Barr, Josephine Cheng, Melanie Down, Joey O'Connor, Sarah Courtemanche, Bertrand Charry, Megan Deslauriers, Valérie Hayot-Sasson, and Gregor Pachmann.

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You can find more information about this project in our previous news bulletins:

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