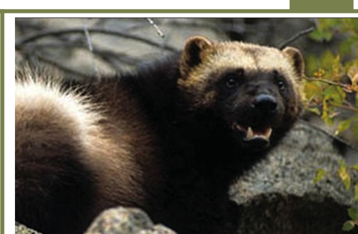
Trans-Canada Highway Wildlife Monitoring and Research
Annual Report 2012-2013

Prepared by the Western Transportation Institute at Montana State University and the Miistakis Institute

May 2013



A Report of the **Wildlife and Transportation Research in the Rocky Mountains** *Project*

This document should be cited as:

Clevenger, AP, D Duke, R Haddock, R Ament. 2013. Trans-Canada Highway Wildlife and Monitoring Research, Annual Report 2012-13. Prepared for Parks Canada Agency, Radium Hot Springs, British Columbia.

Contents

PROJECT OVERVIEW

Expanding highways and increasing vehicle traffic have been identified as one of the most severe human-caused impacts to the ecological integrity of the Rocky Mountain cordillera. The Trans-Canada Highway (TCH) in the Canadian Rocky Mountains has long been recognized as a lethal barrier to wildlife and a potential fracture zone for population connectivity in the Yellowstone-to-Yukon region. After more than 30 years of mitigating sections of the TCH in Banff National Park, monitoring and research has demonstrated habitat connectivity is essentially restored across those sections of this major transportation corridor. However, the combined effects of an additional 30 kilometers of twinned TCH in Banff National Park with more lanes for traffic threatens to fragment and isolate trans-boundary populations of wide-ranging, fragmentation-sensitive species residing in the very heart of the Canadian Rocky Mountains. Numerous wildlife crossing structures along the 30 km of new highway construction are designed to mitigate these impacts by enhancing connectivity and linking habitats of key wildlife species over time. Thus, monitoring populations of wide-ranging species, such as lynx and wolverine, has been identified as a critical management objective in Banff and Yoho National Parks.

The purpose of the Project is to create and implement a wildlife monitoring and research plan to guide the monitoring of the TCH Phase 3B Project's goals and objectives – reducing wildlife-vehicle collisions and improving habitat connectivity and genetic interchange for key species. A work plan was developed to adequately meet the requirements of both wildlife crossing structure-specific monitoring, as well as the broad, landscape-based ecological objectives. The following summarizes the Project activities for Year 4.

Two full-time employees worked for the TCH Wildlife Research and Monitoring Project in 2012-13: Project leader Tony Clevenger, and research associate Mirjam Barrueto. Ben Dorsey assisted in field and with GIS analysis on a part-time basis. During the winter field season, research assistants Barb Bertch, Ben Dorsey, Cathy Gill, and Heather Slivinski worked intermittently and shared two full-time positions. Rich Klafki, Reg Bunyan, Dan Rafla, Blair Fyten, Wayne Shibley, Cal Sime and others volunteered regularly assisting with the wolverine survey. More than 100 people inquired about volunteering with Wolverine Watch and eventually 56 citizen scientists were involved assisting set up and checking hair traps as part of WolverineWatch.org. The volunteers assisted a total of 178 volunteer-days and 1424 hours working on the project.

I. PROJECT DEVELOPMENT AND IMPLEMENTATION

1. Monitoring occurrence and rate of wildlife-vehicle collisions

PCA staff and the Project research team continue to collect wildlife-vehicle collision data. A power analysis will be conducted on the pre-mitigation wildlife-vehicle collision data to determine the amount of post-mitigation collision data required to detect statistically significant changes in collision rates between pre- and post-mitigation on Phase 3B.

2. Monitoring wildlife crossing structures

Monitoring of the wildlife crossing structures on Phases 1, 2, 3A and 3B (completed sections) continues.

All of the constructed crossing structures built by the end of 2011 have remote cameras operating. There are currently 49 cameras being used to monitor 39 wildlife crossing structures.

Methods

All crossing structures are visited every 2-3 weeks to change batteries and download images from camera memory cards. Three volunteers assist us with the crossing checks, typically doing a large portion of the crossings, while we do what they are unable to complete. Photos are classified using Microsoft Access software and our project's customized image classification form that inputs wildlife crossing data directly into our Access database. The image classification allows us to quantify (1) baseline data on species passage/avoidance at the wildlife crossing structures and (2) species behaviour and response to crossing structures types of same design on new and old sections of highway.

We have 4-5 volunteers regularly assisting us photo-classify the crossing structure photos. At the time of writing, there are no backlogged photos waiting to be photo-classified; all our photo data have been inputted into our database.

During this year (Q2 & Q3) we spent a significant amount of time reconciling data in our long-term database obtained from two detection methods (track pads, cameras) during a period where they overlap in data collection at the crossings between 2005 and 2010. During this overlap period, we collected movement data at the crossing structures from track pads, but also cameras at a subset of those crossing structures where we had them in place. From 2005 to 2010, we incrementally began to use more cameras at the crossing structures. By November 2010, all crossing structures had cameras in place; therefore we stopped collecting data using track pads. As a result of this overlap, and before we could perform any multivariate analysis of the crossing data planned for our final report, we needed to reconcile data obtained from the two field methods, i.e., determine which method gave the most accurate number of crossings for a given species.

The work led to significantly more time investment, some discoveries of missing data (not photo-classified) and also duplicate data that were in the database. We worked with Parks Canada's Tao Gui, an MS Access and database expert, and with Ben Dorsey to resolve this problem. We were also assisted by Adam Ford (project research associate that managed database from 2007-09).

From this comprehensive and time-consuming effort, which included numerous checks and rechecks of the data in our database, we discovered that the "Grand Total" of wildlife crossings by large mammals was significantly lower than the estimated 200,000+ crossings we've reported up until now - approximately 80,000 fewer crossings. We revisited annual reports and their general summaries from 2008 forward. We checked, double-checked, and triple-checked tables and previous Access database queries to try and discover where this discrepancy came from.

The inflated number of total crossings we found was attributable to over-calculated white-tailed deer counts during the preparation of the 2009 Final Report to Parks Canada (Clevenger et al. 2009). In preparing the query, the white-tailed deer counts were erroneously multiplied by 3. The crossing amounts for all the other mammal species, however, were not affected in any way.

For this annual report we summarize movement of wildlife at the Banff crossing structures by TCH construction phase during two periods: (1) the fiscal year period using exclusive remote camera monitoring from April 1, 2012 to March 31, 2013, and (2) the entire 16+ year period since T Clevenger's monitoring began at the wildlife crossings in November 1996.

Results

Fiscal Year 2012-13

Phase 1 and 2

During the last fiscal year, 1 April 2012 to 31 March 2013, a total of 7560 passages were detected by mammals coyote-sized and larger and humans at the nine Phase 1 and 2 wildlife underpasses (Table 1.a.) Excluding humans, a total of 6526 crossings by large mammals were recorded. Elk were the most frequently detected species at the wildlife underpasses the last fiscal year, accounting for 54 percent of all detected wildlife crossings (n=3555). Deer passage was nearly as frequent as elk, accounting for 34 percent of all detected wildlife crossings (n=2226). The proportion of bighorn sheep detected was significantly lower and detected only 158 times; moose were detected only 12 times. Among large carnivores, wolves used the underpasses 165 times, slightly less than coyotes that used the underpasses 249 times. Among other carnivores, grizzly bears used the crossing structures 80 times; black bears 76 times, and surprisingly cougars only twice. Human use continues to be relatively high compared to wildlife use; ranking third overall with slightly more than 1034 passes recorded. Human use is consistent with past records at about 13 percent of total use of underpasses and continues to be concentrated at Buffalo underpass primarily, but with substantial use also at Edith, Vermilion and Powerhouse underpasses. Carnivores accounted for 9% of the detected animal crossings.

Phase 3A

Monitoring of Phase 3A documented 2898 passages by wildlife and humans. Excluding humans, there were a total of 2715 detected crossings by large mammals (Table 1.b.). Deer were most frequently detected using the crossings structures (n= 2102 times, 77 percent of crossings detected by all large mammals). Second to deer, wolves accounted for 9 percent of crossings detected by all large mammals (n= 244). Surprisingly, elk used the passages less than wolves (n= 123). Elk accounted for only 5 percent of crossings detected by all large mammals. Moose used the crossings 36 times and primarily used the two wildlife overpasses; however Massive and Sawback underpasses were used 5 times each. Unlike most years where use was concentrated at the two overpasses, however, this fiscal year moose were found using all five structure types and a variety of structures (n=6). This may be a reflection of new individuals in the area and their willingness to use different design types. Large carnivore use combined accounted for 17 percent of large mammal crossings. Grizzly bears used crossing structures 99 times, black bears 42 times, wolves 244 times, coyotes 48 times, and cougars only 14 times. Compared to wildlife use, human use was low (n= 183 crossings; 6% of total), but more than double from the year before.

Phase 3B

Monitoring of Phase 3B detected 1648 passages by wildlife and humans (Table 1.c.). Excluding humans, there were a total of 1324 crossings by large mammals. Human use along Phase 3B was relatively high at several structures due to landscaping activity during spring 2012. Again, deer were most frequently detected using the crossings structures (n=906, 68 percent of all wildlife crossings). Second, elk were found to use the crossings structures 185 times (14%). Use of crossings structures by moose (n=52) was concentrated at the Island and Storm "secondary" underpass. Among carnivores, grizzly bears used the structures 62 times, wolves 50 times, black bears 34 times, coyotes 30 times and cougars not a single crossing recorded. Carnivores accounted for 14% of the detected animal crossings.

All Wildlife Crossing Structures

During the 2012-13 fiscal year, a total of 12,106 detections by mammals and humans were recorded at the Phase 1, 2, 3A and 3B crossing structures. Excluding humans, there were 10,565 crossings by large mammals. Deer accounted for over 49 percent of all wildlife use (n=5234), while elk accounted for 36 percent of all wildlife use (n=3863). The proportion of large carnivore detections was 12 percent, wolves ranking first, coyotes second, and grizzly bears third (Table 1.c.).

Total monitoring period – 1996-2013

Phase 1 & 2

Long-term monitoring began in November 1996 and was focused the first year solely on Phase 1 and 2 wildlife underpasses. Since November 1996, there have been a total of 125,709 detections of 10 species of large mammals and humans at the underpasses (Table 2.a.). Excluding human use, large mammals were recorded a total of 103,048 times. Elk were detected 44 percent of all recorded passes (n=45,401) followed by deer (n=40,226) and bighorn sheep (n= 4946). Among large carnivores, coyotes were detected using the crossings 5272 times, wolves 4273 times, cougars 1222 times, black bears 1159 times, and grizzly bears 460 times. Human use continues to be high on this phase and ranks third overall with nearly 22,661 passes recorded since 1996. Carnivores accounted for 12% of the detected animal crossings.

Phase 3A

Monitoring of Phase 3A wildlife crossing structures began soon after their completion and installation of the wildlife fence in November 1997. Since then there have been 39,401 passages by wildlife and humans detected at 13 Phase 3A crossing structures (Table 2.b.). Excluding humans, there have been a total of 37,063 detected crossings by large mammals. Deer were most frequently detected using the crossings structures (n=25,273, 68 percent of all large mammal crossings). Second to deer, elk were detected using the crossing structures at only 14 percent of all large mammal crossings (n= 5119). Among carnivores, coyotes used the structures 2817 times, wolves 2052 times, grizzly bears 694 times, cougars 391 times and black bears 380 times. Human use continues to be low, a fraction of the use on Phases 1 and 2 (n= 2338 crossings vs. 22,661 crossings). Carnivores accounted for 17% of the detected animal crossings.

Phase 3B

A total of 18 Phase 3B wildlife crossing structures have been monitored since 2007, including the Piran culvert which is being replaced by a large span (primary) underpass in 2013. Since 2007, we have documented 4352 passages by wildlife and humans at these crossings structures (Table 2.c.). Excluding humans, there have been a total of 2836 detected crossings by large mammals. Human use was frequently detected using the crossing structures (n=1516), and much of this is construction workers and landscapers. Similar to Phase 1, 2, and 3A, deer were most frequently detected using the crossings among the large mammals (n=1805, 64 percent of all large mammal crossings). Again, similar to Phase 1, 2, and 3A elk were second to deer (n=464, 16 percent of all large mammal crossings). Among the carnivores, coyotes used the structures 141 times, grizzly bears and wolves 127 times each, and black bears 46 times. Cougars have not yet been detected using the Phase 3B crossings.

All Wildlife Crossing Structures

A total of 169,462 detections by mammals and humans have been recorded at the Phase 1, 2, 3A and 3B crossings structures (Table 2.c.). Excluding humans, there were 142,947 crossings by large mammals. Consistent with the latest summary of wildlife crossing use (Clevenger et al. 2009), deer made up 47 percent of all crossings detected, while elk were only detected 36 percent of the time (Table 2.c.). The proportion of large carnivore detections was 13 percent, coyotes ranking first, wolves second, cougars third, followed by black bears and grizzly bears (Table 2.c.).

3. Monitoring culverts as crossing structures

This fiscal year we completed monitoring small and medium sized mammal use of the new Phase 3B culverts. A total of 27 culverts were identified last fiscal year for sampling during winter. This fiscal year we re-initiated culvert monitoring from June through September. Due to frequent rain and water flow at many of the culverts we monitored during winter, we ended up monitoring a small subset (n=12) culverts during the summer. Monitoring of observed mammal passage use at culverts follows the same methods used during winter in Year 3. Track plates were set out and left to collect prints of passing mammals during 2-week periods and then collected, brought into the wildlife lab and data collected off the track plates.

Expected passage frequencies during summer were obtained from measures of relative abundance of each species in the vicinity of each culvert. Enclosed track-plate boxes were used for medium-sized mammals (Long et al. 2008, Noninvasive survey methods for carnivores. Island Press, Washington, DC). Track-plates (100 cm x 35 cm) were sooted with a kerosene flame and white contact paper was taped to the centre section covering one-third of the track-plate length. Plates were placed in enclosed triangular-shaped boxes made of black coroplast measuring 32 cm at the base, 34 cm at the apex. No baits were used, however a drop of anise oil was used on lateral edge of each track-plate to act as a lure for herbivore and carnivore species. Track-plates were set out for 14 days in the vicinity of each culvert and species' presence was recorded.

Our sampling design was based on a 100 m grid centered at the culvert entrance. The highway frontage site was located along the habitat edge (forest/open) and behind the wildlife exclusion fence. The rear site was located 100 m behind the habitat edge. When the rear site encountered a major river or disturbed habitat we located the site at less than 100 m. Track tubes were used for detecting small mammals (Nams and Gillis 2003; J Mammal. 84, 1374-80).

We paired enclosed track plates with track tubes to test whether there was a preference by small mammals for one design over the other. We randomized placement of enclosed track plates on each side of the culverts. We collected data on species expected occurrence during 2, 14-day sampling sessions. Culverts were monitored for observed passage use at 7-10 day intervals.

For the final report, we will be analyzing the data obtained from observed and expected passage use in an information theoretic approach using explanatory variables that describe culvert attributes and adjacent habitat characteristics.

4. Wolverine response to the TCH and Phase 3B mitigation

Noninvasive survey

The research and monitoring plan addresses how roads (TCH, Hwy 93) and other man-made and natural barriers influence wolverine movement and gene flow. The survey area was delineated by creating a 30 km buffer around the TCH from Castle Junction (Banff NP) to the west boundary of Yoho NP. The area encompasses approximately 6000 km2 and was overlaid with a 12 x 12 km grid. One hair sampling site was placed in each grid cell. In cells that overlapped the TCH we placed an additional sampling site in attempts to genetically detect movement of individuals traversing the TCH. Sampling sites were baited with a whole beaver carcass nailed to a tree and secured with baling wire. Barbed wire was wrapped from the carcass down to ground level. A commercial trapping lure was hung on a cloth high in the air to disperse the lure in the area. Sampling sites were accessed on skis in nearly all cases. All sites but a few were in Class 1 avalanche terrain (Simple). Visitor safety is notified before we attempt to visit sites in Class 2 (Challenging) terrain.

In the latter part of Q3 (mid-December 2012) and during all Q4 fieldwork was conducted by setting out hair traps to genetically sample the wolverine population and checking the hair traps at 30-day intervals. A total of 51 hair traps were set out.

The visitation rate to the hair trap sites increased during the three sampling sessions, similar to what was what we found in winter 2010-11 (Table 3). However, this winter we had double the visitation rate the first session (31% vs 61%) compared to our first year. This season session one had a percent visitation rate of 61% (31 of 51 sites), 72% of the sites (37 of 51 sites) were visited in session two, while 82% (42 of 51 sites) of the sites were visited by wolverines during the third and final session; however, there is one final check required at Tak Falls.

Similar to our first year, six sites yielded no wolverine visits (Brewster, Hawk Cr, Hoodoos, Ottertail-Float, Stephen Cr, BC West Gate), however, they were not the same sites.

In March 2013, we set up an additional 13 sites on the periphery of our study grid in attempts to collect genetic data from individuals less likely to be 'captured' within our core study area. Nine sites were set up in Kootenay NP and south in BC Crown Land (Cross River_BayMag, Cross River_Corral, Hector Gorge, Kootenay Xing, Dolly Varden, Pitts, Creek, Settlers South, Symonds Creek, Paul Creek), while 4 sites were set up north of Bow Summit off Hwy 93 North (Peyto, Mistaya, Epaulette Creek, Warden Lake). Sites were checked two times at 3-week intervals. As of May 2, none of the southern periphery sites had visits from wolverines, while 3 of the 4 sites north (Peyto, Mistaya, Epaulette Creek) had received at least one visit.

WolverineWatch (WW)

Our research project has several objectives relating to collecting systematic data from noninvasive genetic surveys of wolverines in the Canadian Rockies, raising awareness of their conservation status, and recruiting citizen scientists to assist with field data collection during winter 2012-13.

One of the most noteworthy achievements in this project has been attracting the interest of more than 100 potential volunteers to assist with the wolverine research via Wolverine Watch. After a flurry of media attention (radio, print media, twitter) in November 2012, we received more than 100 inquiries of people wishing to assist as citizen scientists.

After careful review and selection of only qualified applicants, we used this winter over 50 citizen scientists to assist our field staff carry out fieldwork. Volunteers mainly came from the Banff-Bow Valley and Calgary, however some from as far Edmonton, Quebec and western British Columbia. Below are the numbers of volunteers and time-effort for this winter until April 9th. There may be more volunteer hours than this, as some staff forgot to note some days when volunteers assisted.

Number of volunteers: 56
Number of volunteer days: 178
Number of volunteer hours: 1424. (This is based on 8hrs per day - this is an average, some days were longer, some shorter, and some sites were multi-day trips)

<u>As a comparison</u>:
Number of staff days: 246
Number of staff hours: 1968

5. Monitoring harlequin duck movements at Moraine Creek

During Q2 we monitored harlequin duck movements on Moraine Creek. Monitoring began earlier than the previous two years, starting in 3 June until 14 July. A total of 18 volunteers participated (usually in pairs) by spending evenings from 7p-1030p at the Moraine Creek underpass and watching for any hens flying up and down stream.

For the third year in a row, no harlequin ducks were observed at Moraine Creek. Given the diminished harlequin duck population in the Bow Valley and our inability to detect harlequins on Moraine Creek, we will not continue with this task in Year 5.

6. Baseline data collection along TCH in Yoho National Park

Data on road mortalities on this section are being collected by LLYK staff, as well as any observations of wildlife crossing/approaching the TCH. Some road surveys snowtracking animals were conducted this fiscal year, but we have not contacted the LLYK Field Unit yet about the number of surveys and findings.

7. Texas gate monitoring

A total of 14 Texas gates and Electro-mats are potentially monitored during the year: Highway 93 N junction-Niblock, Whitehorn Avenue North and South (Lk Louise), Km 69 entrance to borrow pit, Castle Camp-93S, Sunshine Road, 5-Mile Bridge South, 5-Mile Bridge North, Norquay North, Norquay South, Banff Industrial Compound, Minnewanka interchange North, Mannix Pit, and Minnewanka interchange South.

Some of the conventional Texas gates will not be monitored since they are not likely problematic for wildlife intrusions due to the regularity and high volume of traffic, e.g., Minnewanka South, Norquay South, Whitehorn South.

During we have monitored the following Texas gates and Electro-mats:

- Highway 93N-Niblock (Texas Gate and Electro-mat)
- Sunshine (Texas gate)
- 5-Mile North (Texas gate)
- 5-Mile South (Texas gate)
- Banff Industrial Compound (Texas gate)

Remote cameras were placed at gates and Electro-mats that are most likely to have wildlife visits and possible intrusions, thus maximizing data collection to help determine the efficacy of the gates and mats. To maximize the number of wildlife photographed at the gates and mats we configured the cameras to operate 24-hrs per day. This results in a large amount of photographs to review. Currently we are uploading camera data to folders on the park server. The preliminary results of Texas gate monitoring are shown in Table 4.

8. TCH mitigation design and technical assistance

T Clevenger met with Ryan Syme of Highway Service Centre June 21, 2012 and others (Parks Canada: Hal Morrison, Saundi Stevens; Cross-Tek: Richard Lampham; AECOM: Roger Lofgren) to discuss operational issues with the electro-mats located at Niblock (93N) and Km 69 borrow pit. Problems were encountered with low voltage and gaps between jersey barriers and electro-mats that would allow relatively easy access for wildlife to bypass or pass over the electromats. Agreement was made to install a new energizer, boosting the voltage to at least 9000 V and setup a lighting system that would flash if voltage was low. We were given a voltage meter to test the mats' voltage during our visits to check the cameras. The Highway Service Centre agreed they would get the 3B contractor to move the jersey barriers up against the mat to block easy passage.

In August, T Clevenger discussed with Ryan Syme of Highway Service Centre recommended placement and width of E-mats for the Whitehorn and 93South/1X connector at Castle Jct.

Research Technology Transfer and Communications

1. Journal articles

Publications - submitted

McKelvey, K.S., K.B. Aubry, N.J. Anderson, A.P. Clevenger, J.P. Copeland, K.S. Heinemeyer, R.M. Inman, J. Squires, J.S. Waller, K. Pilgrim, M.K. Schwartz. Submitted. Recovery of wolverines in the Western United States : Recent extirpation and re-colonization or range retraction and expansion ? Journal of Wildlife Management.

Sawaya, M, S Kalinowski, AP Clevenger. Submitted. Gene flow at wildlife crossing structures in Banff National Park. *Molecular Ecology*.

Gunson, K., A.P. Clevenger, A.T. Ford, B. Chruszcz, C. Mata, F. Caryl. Submitted. The influence of analytical scale and landscape on factors explaining ungulate-vehicle collisions in a forested mountain ecosystem. *Journal of Applied Ecology*

Ford, AT, AP Clevenger. Submitted. Permeability of culverts and highway exclusion fencing for small mammal movement. *Transportation Research Part D: Transport and Environment*.

Clevenger, AP, A Kociolek. Submitted. Potential impacts of highway median barriers on wildlife: State of practice and gap analysis. *Environmental Management*.

Publications – accepted

Clevenger, AP. Accepted. Mitigating highways with wildlife passages: Guidelines for planning, design and assessments. *Revista de Biología Tropical*.

Ascensao, F., AP Clevenger, C Grilo, J Filipe, M Santos-Reis. In press. Highway verges as habitat providers for small mammals in agrosilvopastoral environments. *Biodiversity and Conservation*.

Sawaya, M, AP Clevenger, S Kalinowski. In press. Wildlife crossing structures connect Ursid populations in Banff National Park. *Conservation Biology*.

Clevenger, AP. 2012. Mitigating continental scale bottlenecks: How small-scale highway mitigation has large-scale impacts. *Ecological Restoration 30:300-307.*

2. Presentations

Alberta Junior Forest Wardens. 10 April 2012. Presentation about wolverines and research project, Airdrie, AB. (T Clevenger)

"Wolverines: The "rock stars" of the animal world", a presentation about wolverine conservation and the citizen-science based program Wolverine Watch was made by T Clevenger at the following venues:

- *Le Relais, Lake O'Hara visitor centre*, Aug. 15, 2012.
- *Le Relais, Lake O'Hara visitor centre*, Aug. 29, 2012.

"Impacts of highways on wildlife", a presentation made by T Clevenger at the *16th Mesoamerican Congress on Conservation Biology* at the Universidad Nacional de Panama in Panama City on 21 September 2012.

Southern Rockies Mapping Workshop, Fernie, B.C. 19 November 2012. " *Conservation large landscapes, one highway at a time*". T Clevenger presentation.

Nature Conservancy Canada, Calgary Chapter. 21 November 2012. "*Mitigating highway impacts on wildlife populations*". T Clevenger presentation.

3. Tech Transfer and Training

T Clevenger and professors from Central American universities taught a one-day course on 22 September 2012, "International workshop on impacts of human infrastructure on wildlife in Latin America". The course was taught at the Universidad Nacional de Panama and was attended by graduate students and practitioners.

T Clevenger traveled to Mongolia with WTI group where they have been contracted to assist in the planning and design of 16 wildlife underpasses on a 100 km section of the Oyu Tolgoi-Gashuun highway for Oyu Tolgoi LLC. The highway is located in the Gobi Desert and will fragment habitat for the endangered nomadic and migratory ungulates (Khulan, Black-tailed gazelle, Mongolian gazelle, Argali). February 2013.

4. Media and other

Sciences et Vie Découvertes (French childrens natural history and science magazine) – June 2012. "En Route!". Photos and text about the Banff TCH mitigation.

Wyoming Dept of Education, Educational Testing Service – May 2012. Educational Testing Service requested permission to use image of Banff wildlife overpass: Title: Wildlife crossing structures in Banff, Alberta have been implemented with demonstrated success.

Pearson Science, Toronto, Ontario – May 2012. Requested permission for use of wildlife overpass photo for a textbook to be published by Pearson Canada: *Biological Science*, 2nd Canadian edition.

T Clevenger interviewed by Cristina Eisenberg on 9 October 2012, for her upcoming book, "*The Carnivore Way: A Transboundary Conservation Vision for a Changing World* " (Island Press).

Doug Chadwick visited and interviewed T Clevenger and other project staff on 2-4 March 2013, as part of National Geographic article on wolverines planned for publication in 2014.

Radio – Wolverine Watch.org

Charles Adler Show - Winnipeg-based, nationally broadcasted syndicated
CBC Alberta @Noon (Calgary based)
CBC Eye-Opener Calgary
CBC As It Happens (nationally broadcasted) - Download As It Happens for Thursday, November 22, 2012 * Viking Researcher * God Loves Caviar * Wolverine Volunteers * Aleppo Hospital * Fontana: Councillor * Rafah Border * Brad Wall on Refugee Health * Pakistan Shia Attacks
CBC Kamloops - Daybreak Kamloops - 23 Nov 2012
CHQR 77 Calgary radio - 23 Nov 2012

Newspapers

"Banff overpasses lead the way for change" – Banff Crag & Canyon, July 11, 2012
http://highwaywilding.org/files/banff_cragg.pdf
Calgary Herald front page online, 22 Nov 2012 -
http://www.calgaryherald.com/technology/Wolverine+study+offers+unique+volunteer+opportunity/7592199/story.html
Rocky Mountain Outlook, 22 Nov 2012 -
http://www.rmoutlook.com/article/20121122/RMO0801/311229999/-1/rmo0801/wolverine-watch-part-2-seeks-volunteers
Vancouver Sun 22 Nov 2012 -
http://www.vancouversun.com/technology/Wolverine+study+offers+unique+volunteer+oppor

tunity/7594672/story.html

Websites

A Moment of Science (AMOS) – June 2012."When you get an itch…" Radio interlude about bear rub trees and use of rub trees to obtain important information on bear population genetics and crossing structure use. - AMOS is produced out of Indiana University, and syndicated on stations around the world. The goal of AMOS is to present wild and wonderful tidbits of scientific information to the listening public through attention-grabbing (and concise!) radio interludes--each program only lasts one and a half minutes. More information about AMOS is available at the following website: www.amomentofscience.org

Alberta Land-Use Knowledge Network - http://www.landusekn.ca/news/wolverine-study-offers-unique-volunteer-opportunity

The Wolverine Blog - https://egulo.wordpress.com/tag/alberta/

MuckRack - http://muckrack.com/link/B5hc/volunteers-wanted-for-wolverine-research

Montanans for Safe Wildlife Passage – May 2012. Requested information and photos for use on their new website.

II. PROJECT MANAGEMENT, PARTNERSHIP COORDINATION, AND FUNDRAISING

Project management

Since the inception of the project the Miistakis Institute has provided project management for the project. These responsibilities include:

- Coordination of all project partners
- Regular updates to Parks Canada
- Financial management
- Preparation and management of all sub-contractor grants and invoices
- Lead all correspondence with project funders
- Prepare all reporting documents

During 2012/13, Miistakis coordinated 15 team meetings and the annual Steering Committee meeting held in Banff on March 14 2013. The 2013/2014 workplan and budget were approved at this Steering Committee meeting.

Partnership Coordination

The larger partnership, including Parks Canada, Miistakis Institute, Western Transportation Institute, Woodcock Foundation and the Wilburforce Foundation enables the investment of each partner to be leveraged. As well, it facilitates the creation of other projects deemed important and relevant by the Steering Committee to be created.

The role of maintaining the existing partnership, as well as being vigilant for worthwhile opportunities to expand the partnership, is shared by the Western Transportation Institute (WTI) and the Miistakis Institute (MIR).

Fundraising

The primary sources of funding for the Project are Parks Canada Agency, the Western Transportation Institute and the Woodcock Foundation, who have each committed significant multi-year support. Beyond that, a number of philanthropic foundations have made year-to-year contributions, and a number have been, and will be, courted on an on-going basis. The committed funding is largely directed at the research and monitoring activity, leaving the communications and outreach activities as the main area in need of foundation support.

Throughout the year, MIR and WTI met to discuss education and outreach strategy for the Project and potential funding opportunities. Granting organizations and programs were identified and proposals were prepared according to schedules.

Project staff made presentations, exchanged information and/or held meetings with private foundation trustees or officers and corporate staff throughout the year to develop relationships, increase awareness of the project, establish philanthropic interest, and determine whether the Highway Wilding project aligned with their strategic direction and giving programs.

Throughout 2012/2013 funding was sought from the following:

- National Geographic Society – FUNDED ($10,000)
- Disney Wildlife Conservation Fund – FUNDED ($10,000)
- Christine Stevens Wildlife Fund – NOT FUNDED
- Arctos and Bird (Edmonton Community Foundation) – FUNDED ($75,000)
- Fairmont Hotels – NOT FUNDED
- Petridish.org – NOT FUNDED
- Wilburforce Foundation – NOT FUNDED
- Calgary Foundation – FUNDED ($5,000)
- Patagonia – FUNDED ($7,600)
- Banff Community Foundation – NOT FUNDED
- TransAlta – NOT FUNDED
- Enterprise – NOT FUNDED
- Brewster – NOT FUNDED
- Canadian Mountain Holidays – NOT FUNDED

Contributions were also received from:

- Bow Valley Naturalists ($5,000)
- Private Donation ($5,000)

V. COMMUNICATIONS AND TECHNOLOGY TRANSFER

Communications efforts for the fiscal year 2012-2013 were focused primarily on the Highway Wilding documentary. The Highway Wilding film has been submitted to the Banff Mountain Film Festival for 2012 and it is currently on tour with the Banff Mountain Film Festival World Tour. Highway Wilding has been submitted to several other film festivals including: Jackson Hole, New Zealand Mountain Festival, Crested Butte, and Japan Wildlife Film Festival. Leanne Allison is pursuing a network broadcast deal for the film.

We have worked with a curriculum developer to create a curriculum guide to accompany the Highway Wilding film. It is freely available online:
http://highwaywilding.org/files/Highway%20Wilding%20Curriculum%20Guide.pdf.
Additionally, a film trailer has been created for Highway Wilding. It can be viewed here:
http://www.youtube.com/watch?v=UvrBQGRnDpA

Highway Wilding was screened for Town of Canmore councilors, staff and other interested individuals including the Biosphere Institute of the Bow Valley and Alberta Parks and Protected Areas on March 19, 2013. Tony, Leanne and Rachelle were present for the screening and a Q and A session following the screening.

Additionally, communications efforts were focused on the creation of an infographic for Highway Wilding. The intent of the infographic is to dispel some of the myths associated with highway mitigation for wildlife. The infographic can be viewed here:
http://www.rockies.ca/files/HW_InfographicScreenVersion.pdf

A significant amount of media interest was generated by the photo of the lynx using the overpass. We continue to receive requests for the use of this iconic image. Additionally, we attempted to use the wave of media attention around the lynx image to raise our profile on Twitter (@Highway Wilding). There are currently, 161 Highway Wilding followers on Twitter.

Parks Canada interpretive staff used images of the wildlife crossing structures in their interpretive programming. Six hundred and thirty people attended this program offered by Parks Canada.

Dr. Tony Clevenger and Mirjam Barrueto continue to make excellent blog postings to the Highway Wilding blog.

We successfully applied to chair a session on highway mitigation for wildlife at the International Association of Impact Assessment 2013 conference held in Calgary in May 2013. A description of the IAIA session follows:

The topic of this session centres on the principle that ecological connectivity is a fundamental principle in the conservation of wildlife, ecosystems and biodiversity. Roads, their associated infrastructure and vehicular traffic have profound impacts on wildlife connectivity. Transportation infrastructure can be an obvious mortality source either by way of direct vehicle collision or through facilitation of human access and permanent presence. Both movement restriction and mortality increase the potential for population fracture and isolation. The resulting loss of gene flow and the potential for inbreeding depression is a concern, but one that can be alleviated by even small measures of successful movement and breeding. Of much greater concern are the demographic effects of isolation including the loss of potential immigration, augmentation, and recolonization opportunities. Connectivity across highways requires consideration for specific movement options as well as landscape management for habitat effectiveness and security.

Environmental assessment as part of highway upgrades, twinning and maintenance requires specific mitigation to address wildlife movement and mortality. This session will focus on successful highway mitigation in Banff National Park and the Trans-Canada Highway (TCH) corridor in the Bow Valley and will specifically outline the various mitigation options including fencing, underpasses, overpasses and gates. The cost-effectiveness of highway mitigation will also be presented drawing from examples along Highway 3 in southern Alberta and the Bow Valley along the TCH. The objective of this session is to provide practitioners with examples of successful mitigation and cost effective measures.

VI. FINANCIAL SUMMARY

Financial Framework

The entire financial picture for the Project does not rest with one organization's internal finances. Although the Miistakis Institute is ultimately responsible for the funding management, there are several relationships which must be tracked, many of which are "external" to the Miistakis Institute. They include:

- PCA grant to the Miistakis Institute
- PCA direct expenditures on behalf of the Project
- Philanthropic grants to Miistakis on behalf of the Project
- Philanthropic grants to WTI on behalf of the Project
- WTI direct expenditures on behalf of the Project

Each of these is represented in the financial tracking undertaken by Miistakis.

Tracking of Parks Canada Agency Financial Information

The contributions to the Project by the Parks Canada Agency represent another level of complexity, some – but not all – of which is tracked by the Miistakis Institute. Funding from PCA comes from three sources: the Highway Service Centre (HSC), the Banff Field Unit (Banff), and the Lake Louise, Yoho, Kootenay Field Unit (LLYK).

What Miistakis does track is the targeted revenues and associated expenditures from the HSC, and collectively from the Field Units. What Miistakis is not accountable for are:
Reconciling the relative amounts from the two Field Units, Banff vs. LLYK.

Table 1.a. Data summary from wildlife crossing structure monitoring using remote cameras, April 1, 2012 to March 31, 2013. Phase 1 and 2.

CS	grizzly bear	black bear	bear spp	wolf	cougar	coyote	moose	elk	deer	bighorn sheep	wolverine	lynx	human	TOTAL	total no humans
EAST GATE	0	7	0	5	0	2	4	218	349	0	0	0	2	587	585
CARROT	2	5	0	1	0	6	0	45	124	0	0	0	20	203	183
MORRISON COULEE	1	12	0	38	0	10	0	96	256	0	0	0	6	419	413
DUTHIL	3	12	0	33	0	10	0	561	528	0	0	0	10	1157	1147
POWERHOUSE	1	31	0	2	0	33	0	145	65	0	0	0	76	353	277
BUFFALO	3	2	0	0	0	145	0	1768	211	0	0	0	719	2848	2129
VERMILION	5	2	0	0	0	3	0	319	115	158	0	0	86	688	602
EDITH	9	4	0	15	2	36	4	221	386	0	0	0	100	777	677
HEALY	56	1	3	71	0	4	4	182	192	0	0	0	15	528	513
TOTAL	80	76	3	165	2	249	12	3555	2226	158	0	0	1034	7560	6526

Table 1.b. Data summary from wildlife crossing structure monitoring using remote cameras, April 1, 2012 to March 31, 2013. Phase 3A.

CS	grizzly bear	black bear	bear spp	wolf	cougar	coyote	moose	elk	deer	bighorn sheep	wolverine	lynx	human	TOTAL	total no humans
WOLVERINE OP	32	8	2	23	13	7	6	11	681	0	0	1	70	854	784
WOLVERINE UP	1	1	0	1	0	2	0	12	74	0	0	0	28	119	91
BOURGEAU	1	2	0	3	0	3	0	0	0	0	0	0	0	9	9
WOLVERINE CREEK	11	2	0	20	1	1	1	5	104	0	0	0	11	156	145
MASSIVE	3	3	0	13	0	7	5	38	91	0	0	0	7	167	160
SAWBACK	7	1	0	3	0	4	5	3	36	0	0	0	0	59	59
PILOT	0	3	0	2	0	1	0	0	28	0	0	0	15	49	34
REDEARTH UP	7	0	0	11	0	11	0	0	4	0	0	0	1	1413	33
REDEARTH OP	18	10	0	60	0	4	14	13	780	0	0	1	12	912	900
REDEARTH CREEK	3	2	1	31	0	2	0	3	30	0	0	0	7	79	72
COPPER	2	4	0	5	0	1	0	2	101	0	0	0	9	124	115
JOHNSTON	6	5	0	52	0	3	0	0	14	0	0	0	7	87	80
CASTLE UP	8	1	2	20	0	2	5	36	159	0	0	0	16	249	233
TOTAL	99	42	5	244	14	48	36	123	2102	0	0	2	183	2898	2715

Table 1.c. Data summary from wildlife crossing structure monitoring using remote cameras, April 1, 2012 to March 31, 2013. Phase 3B.

CS	grizzly bear	black bear	bear spp	wolf	cougar	coyote	moose	elk	deer	bighorn sheep	wolverine	lynx	human	TOTAL	total no humans
CASTLE OP	20	0	1	33	0	6	2	17	241	0	0	1	71	392	321
BOOM	2	0	1	2	0	1	0	10	0	0	0	0	15	31	16
STORM	3	3	0	0	0	0	12	52	66	0	0	0	61	197	136
PANORAMA OP	2	2	0	1	0	1	0	14	117	0	0	0	57	194	137
QUADRA	0	0	0	0	0	0	0	2	2	0	0	0	3	7	4
TAYLOR	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0
MITELLA	0	0	0	0	0	0	1	3	0	0	0	0	14	18	4
BAKER	1	0	0	0	0	0	4	0	3	0	0	0	0	8	8
FAY	0	0	0	0	0	0	2	1	5	0	0	0	2	10	8
BABEL	0	0	0	0	0	1	2	0	1	0	0	0	0	4	4
CONSOLATION	0	0	0	0	0	0	0	0	11	0	0	0	13	24	11
MORAINE	3	1	0	0	0	0	0	0	5	0	0	0	2	11	9
TEMPLE OP	11	1	0	7	0	4	2	6	111	0	0	0	63	205	142
TEMPLE UP	4	0	0	0	0	3	3	0	26	0	0	0	1	37	36
ISLAND	7	4	0	3	0	4	23	41	148	0	0	0	7	237	230
BOW	7	6	0	1	0	4	0	27	55	0	0	0	4	104	100
LAKE LOUISE OP	2	17	2	3	0	6	1	12	115	0	0	0	7	165	158
Piran															
TOTAL	62	34	4	50	0	30	52	185	906	0	0	1	324	1648	1324
GRAND TOTAL	241	152	12	459	16	327	100	3863	5234	158	0	3	1541	12106	10565

Table 2.a. Data summary from wildlife crossing structure monitoring, November 7, 1996 to March 31, 2013. Phase 1 and 2.

CS	Grizzly Bear	Black Bear	Bear Sp	Wolf	Cougar	Coyote	Moose	Elk	Deer	Sheep	Wolv-erine	Lynx	Human	Total
East	8	73	2	188	166	376	5	3335	8018	9	0	0	51	12231
Carrot	4	85	0	152	113	235	0	792	951	9	0	0	248	2589
MC	4	165	0	300	115	243	0	1381	4909	18	0	0	87	7222
DH	22	320	6	1417	237	338	0	5944	5319	45	0	0	140	13788
PH	12	180	5	278	125	470	2	4005	1741	30	0	0	2204	9052
Buff	7	7	0	254	45	957	0	13916	2736	53	0	0	9076	27051
V	56	71	3	249	129	826	1	5695	1945	1245	0	0	1686	11906
Edith	35	42	0	330	139	557	10	3493	4055	211	0	1	6486	15359
*5Mile	26	29	2	222	51	665	10	3553	7960	3301	0	1	2505	18325
Healy	286	187	6	883	102	605	35	3287	2592	25	0	0	178	8186
	460	**1159**	**24**	**4273**	**1222**	**5272**	**63**	**45401**	**40226**	**4946**	**0**	**2**	**22661**	**125709**

* Not monitored continuously from 1996-2013.

Table 2.b. Data summary from wildlife crossing structure monitoring, November 7, 1996 to March 31, 2013. Phase 3A.

CS	CS type	Grizzly Bear	Black Bear	Bear Sp	Wolf	Cougar	Coyote	Moose	Elk	Deer	Sheep	Wolv-erine	Lynx	Human	Total
WOP	Overpass	228	40	4	350	87	206	71	295	6553	0	1	4	823	8662
WUP	Culvert-lg	2	14	0	64	42	109	4	178	632	0	0	0	109	1154
BOURG	Culvert-med	10	57	4	37	21	141	0	7	102	0	0	0	24	403
WCR	Crk bridge	41	19	1	104	72	250	5	333	871	2	2	0	115	1814
MASS	Culvert-lg	18	14	0	84	18	260	9	375	1418	0	0	0	63	2259
SAW	Box	33	7	0	60	3	116	24	132	221	0	0	0	42	638
PILOT	Box	18	49	5	89	15	157	4	164	310	0	1	0	63	874
REUP	Box	34	35	0	123	25	251	0	227	150	0	0	0	63	2287
REOP	Overpass	225	44	9	495	15	210	100	1116	9913	0	0	4	213	12344
RECR	Creek bridge	12	20	1	178	33	162	0	240	1030	29	2	0	451	2158
COPPER	Culvert-lg	13	18	1	101	26	316	4	341	1936	8	1	0	37	2802
JOHN	Box	21	38	2	139	24	369	2	43	166	0	1	0	26	831
CASTLE	Culvert-lg	39	25	5	228	10	270	24	1668	1971	2	1	2	309	4554
		694	**380**	**32**	**2052**	**391**	**2817**	**247**	**5119**	**25273**	**41**	**9**	**10**	**2338**	**39401**

Table 2.c. Data summary from wildlife crossing structure monitoring, November 7, 1996 to March 31, 2013. Phase 3B.

CS	CS type	Grizzly Bear	Black Bear	Bear Sp	Wolf	Cougar	Coyote	Moose	Elk	Deer	Sheep	Wolv-erine	Lynx	Human	Total
COP	Overpass	20	0	1	37	0	13	3	18	302	0	0	1	89	484
BOOM	Culvert-lg	2	0	1	2	0	1	0	10	0	0	0	0	23	39
STORM	Open span-lg	6	3	0	3	0	1	17	74	84	0	0	0	80	268
POP	Overpass	2	2	0	1	0	1	0	14	169	0	0	0	83	272
QUADRA	Culvert-lg	0	0	0	0	0	0	0	2	2	0	0	0	4	8
TAYLOR	Culvert-lg	0	0	0	0	0	1	0	0	0	0	0	0	9	10
MITELLA	Culvert-med	0	0	0	0	0	0	2	3	0	0	0	0	16	21
BAKER	Culvert-lg	1	0	0	0	0	0	4	0	9	0	0	0	6	20
FAY	Culvert-lg	0	0	0	0	0	0	2	1	6	0	0	0	7	16
BABEL	Culvert-small	0	0	0	0	0	1	2	0	1	0	0	0	0	4
CONSOL	Culvert-lg	0	0	0	0	0	0	0	0	11	0	0	0	13	24
MORAINE	Creek bridge	8	4	2	25	0	12	3	3	67	0	0	1	76	201
TOP	Overpass	16	1	0	9	0	5	2	6	199	0	0	0	200	438
TUP	Culvert-lg	22	0	0	7	0	35	3	8	49	0	0	0	40	164
ISLAND	Culvert-lg	22	5	3	27	0	24	77	100	470	0	0	0	154	882
BOW	Open span	24	9	2	13	0	23	0	192	407	0	0	0	698	1368
LLOP	Overpass	2	18	2	4	0	25	3	25	141	0	0	0	74	294
PIRAN*	Culvert-lg	5	4	2	6	0	8	0	31	26	0	0	0	34	116
TOTAL PHASE IIIB		**127**	**46**	**13**	**127**	**0**	**141**	**111**	**464**	**1805**	**0**	**0**	**2**	**1516**	**4352**
GRAND TOTAL COUNTS		**1281**	**1585**	**69**	**6452**	**1613**	**8230**	**421**	**50984**	**67304**	**4987**	**9**	**14**	**26515**	**169462**

Table 3. Summary of wolverine hair trap surveys, winter 2012-13.

	Session 1	Session 2	Session 3
TOTAL PRESENCE	31	37	43
TOTAL SITES	51	51	51
% VISIT	61	73	84

Table 4. Summary of Texas gate monitoring and wildlife activity near gates, 2012-13.

Location	# days total	Coyote	Wolf	Cougar	Grizzly bear	Black Bear	Elk	Deer	Approaches *	Successful crossing*	Crossing rate **	events***	success rate****
5 Mile South	325	1	1	0	1	0	1	1	5	1	0.2	8008.2	0.003
5 Mile North	183	3	0	0	0	1	0	1	5	4	0.8	5720.8	0.022
93 N	111	0	0	0	0	0	1	0	1	0	0	16471.4	0.000
Banff Compound	40	1	0	0	0	0	0	0	1	1	1	2991.4	0.025
Castle Camp	89	0	0	0	1	0	2	0	3	1	0.33	2951.8	0.011
Sunshine 1	213	0	3	1	4	1	0	0	9	9	1	16161.2	0.042
Sunshine 2	91	2	0	0	0	1	0	0	3	3	1	23464.8	0.033

* Includes all animals.
** Crossing rate = Successful crosses/approaches.
*** Events = Number of photos/5.
**** Success rate = # successful crossings per monitored day.