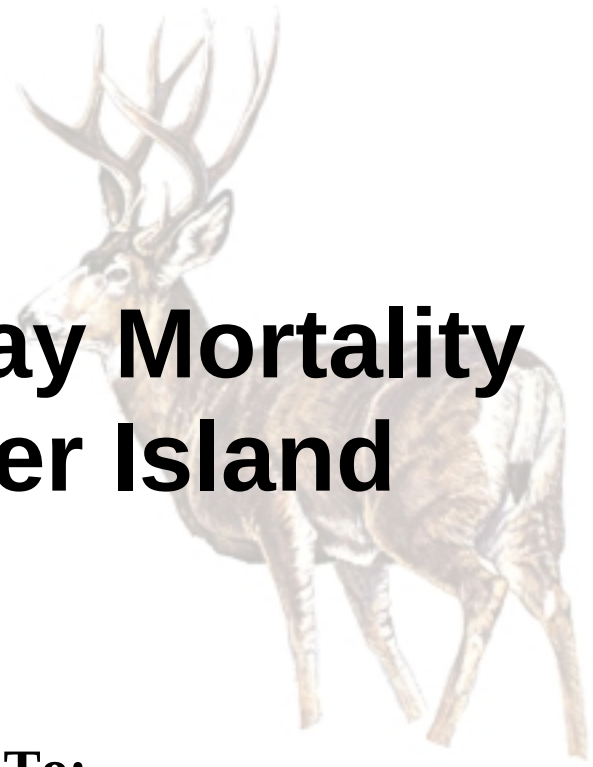


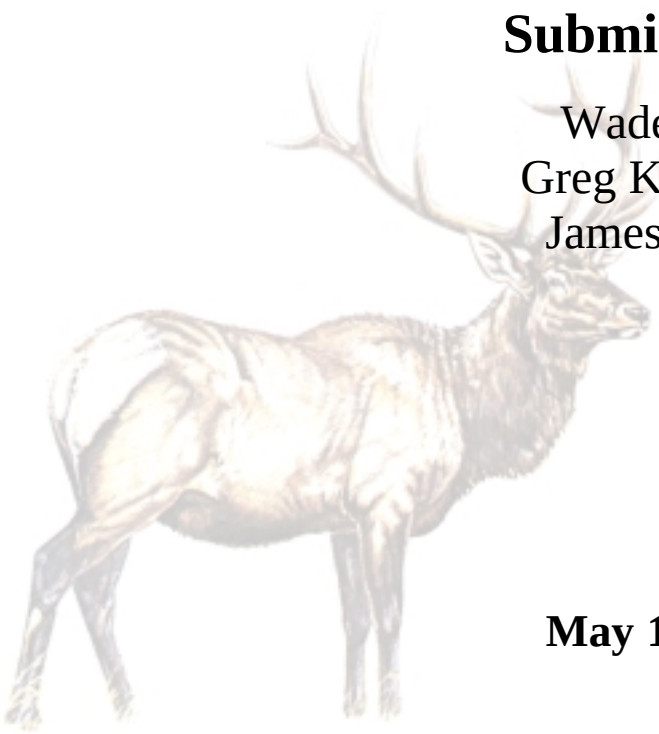
Wildlife Highway Mortality on Vancouver Island

Submitted To:

Daniel J. Catt

Submitted By:

Wade Jones
Greg Koldewijn
James Wyllie



May 10, 2000

Summary

The authors in conjunction with Keystone Wildlife Research collected baseline data (sightings and track counts) for Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*) and particularly Roosevelt Elk (*Cervus elaphus roosevelti*) both of which winter in the Union Bay area on Vancouver Island. In 1995 Keystone Wildlife Research was asked by the Ministry of Transportation and Highways to investigate the need for wildlife fencing when construction of the Inland Island Highway had begun. As sections of the highway were opened to traffic, there was a need for data regarding the number of vehicle-wildlife collisions. The Ministry of Transportation and Highways recommended installing fencing along this new section of highway. Keystone Wildlife Research was hired to determine the feasibility of installing the fencing compared to the cost of insurance claims from vehicle-wildlife collisions. The information collected throughout this study could possibly be used to determine the best and most cost effective management technique to limit the number of wildlife-vehicle collisions.

Field data were collected two weekends each month from October 1999 to February 2000. Methods used to gather field data involved driving a 30-kilometre section of the Inland Island Highway along Highway 19 between Cook Creek Road and the Cumberland interchange. Data collection involved driving along the shoulder of the highway at a speed between 40-50 km/hr. High-powered spotlight(s) were pointed out the window of the vehicle along the highway right-of-ways and out into the woods or clearcuts. When deer or elk were observed, we would stop the vehicle and use a laser range finder to determine its distance from the highway. We would take a compass bearing to its position, mark down the mileage from our start point, enter its location into a GPS unit, and enter the information onto data sheets, including the time it was seen. During this time we also participated in wildlife scare tactics with staff from Keystone Wildlife Research.

Between October 16, 1999 and February 20, 2000 twenty-seven field surveys were conducted. During these surveys 275 deer and 18 elk were observed using the highway corridor between Cook Creek Road and the Cumberland interchange. Sightings of deer and elk were relatively consistent, although during heavy rains, snow, and storms few or no animals were observed. During field surveys deer were usually seen on the east side of the highway in the morning. In the evening deer were more evenly distributed on the west and east sides. The majority of elk were observed on the east side of the highway in the morning and in the evening. Deer were observed along the entire 30-km section of highway, while elk were concentrated within a 10-15 km section north and south of McLeod Road.

While no deer or elk were observed on the road surface, tracks indicated movement of deer and elk across the highway. Spotlight and track counts made within the project area suggest higher concentrations of deer and elk in certain areas. No highway mortalities of deer or elk were witnessed within the study area during the field days, although 37 vehicle-wildlife collisions have occurred since September 25/99.

There was a noticeable reduction in the effectiveness of scare devices on deer and elk frequenting the highway over the period of the study began. It appears that the ungulates are becoming less afraid of the bangers and screechers being used. Deer were observed returning to the area they were initially scared away from.

From analyzing the data collected and through personal observations we have come up with a number of recommendations. The following are only some of the recommendations outlined in the report:

- Install a permanent wildlife deterrent device such as an ungulate exclusion fence. Field data and observations of the number of animals using the highway corridor, and tracks seen along the shoulder and crossing the highway indicate there is a need for such a device.

- Conduct further studies on the impacts of wildlife fencing on animal populations, especially once wildlife fencing is in place.

As there was no methodology for conducting spotlight counts, we recommend:

- Using a standard methodology for using the spotlights. This will help eliminate possible bias associated with inconsistent observation methods as each observer may have a different technique for using spotlights.

- Using two observation vehicles equipped with spotlights, driving one behind the other approximately 25-50m apart. Having a second vehicle will ensure that the animals missed by the first observation vehicle are recorded.

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Acknowledgements

This project would not have been possible without the support of many people all of whom contributed time and resources in order for this project to be completed.

We would like to acknowledge Keith Simpson, Senior Wildlife Biologist and owner of Keystone Wildlife Research for the time and materials he provided and also his support throughout the project.

We are also grateful to Kim Brunt, Wildlife Biologist, Ministry of Environment, Lands and Parks for providing us with essential equipment used to collect field data.

Thank you to: Joe and Keith McKay for allowing us to participate in wildlife scare tactics; Lorainne Andrusiak of Keystone Wildlife Research for providing us with additional data; Laurie Smith, Projects Coordinator, BCIT, for all her help with GPS equipment, GIS software and TRIM DATA maps; Lisa Brinkman, Municipal Planner, Comox-Strathcona Regional District for providing us with additional reports and background information. Also special thanks is extended to The Ministry of Transportation and Highways and Ms. Bigelow, Rooms Manager, Coast Westerly Hotel, Courtenay for providing us with reduced rates on our accommodations.

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1.0 Introduction

The purpose of our project was to gather field data and add to existing information to determine what management strategies could be used to limit the number of Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*) and Roosevelt Elk (*Cervus elaphus roosevelti*) highway mortalities. The objectives of the study were to:

- document dawn and dusk use of the highway right-of-way (ROW) by deer and elk
- record activities of animals using the ROW
- record the response of ungulates to scare devices
- record tracks, which indicate travel along the ROW and crossing areas for ungulates
- record signs of use by elk east and west of the highway for comparison with post fencing information.

Both the Ministry of Transportation and Highways (MOTH) and the Insurance Corporation of British Columbia (ICBC) are concerned about the number of wildlife-vehicle collisions that occur in the province. In 1997, there were 3,661 wildlife-vehicle incidents reported in British Columbia. It is estimated that for each reported incident there are approximately five unreported incidents (Sielecki, 1999). For every wildlife-vehicle collision incident ICBC spends on average $1550 (Sielecki, 1999). Not only is there a concern for wildlife but also the safety of people and the potential of human fatality as a result of wildlife-vehicle collisions.

The data presented in this report was gathered from a recently opened 30-km section of the Inland Island Highway (IIHWY) between Mud Bay and Courtenay on Vancouver Island, British Columbia (Figure 1). The study area encompasses land adjacent to the highway and extends as far as observations permit when conducting scare tactics and spotlight counts.

This report is comprised of several sections ranging from current deterrent techniques, materials and methods, results and data analysis. The report also has a section devoted to discussion, conclusions and recommendations.

1.1 Background

In 1995, Keystone Wildlife Research was awarded a contract by the MOTH to investigate the need for wildlife fencing when construction of the IIHWY had began. As sections of the highway were opened to traffic, there was a need for more data regarding the number of vehicle-wildlife collisions. MOTH had recommended single sided wildlife fencing to be installed along a 20-km section of highway. There is a resident herd of Roosevelt Elk in the study area that raises special concern regarding the potential of a human fatality during a vehicle-elk collision. As a project team we have researched other areas in British Columbia that have problems with wildlife highway mortality. One example is the Kootenay Parkway in Kootenay National Park in B.C.'s east Kootenays. In this area a study was done was to investigate and evaluate those factors of wildlife habitat, Parkway design and maintenance, and traffic volumes and composition thought to influence wildlife-vehicle collisions on the Parkway (Poll, 1989). It was discovered that traffic volume was a factor, with a greater number of ungulate-vehicle collisions occurring during higher evening traffic volumes. Other important factors were the Parkway right-of-way characteristics. The potential of a section of Parkway being a kill-site increased with a reduced visibility influenced by ditch depth, shrub encroachment, the presence of guide-rails and also reduced forest cover adjacent to the highway right-of-way (Poll, 1989).

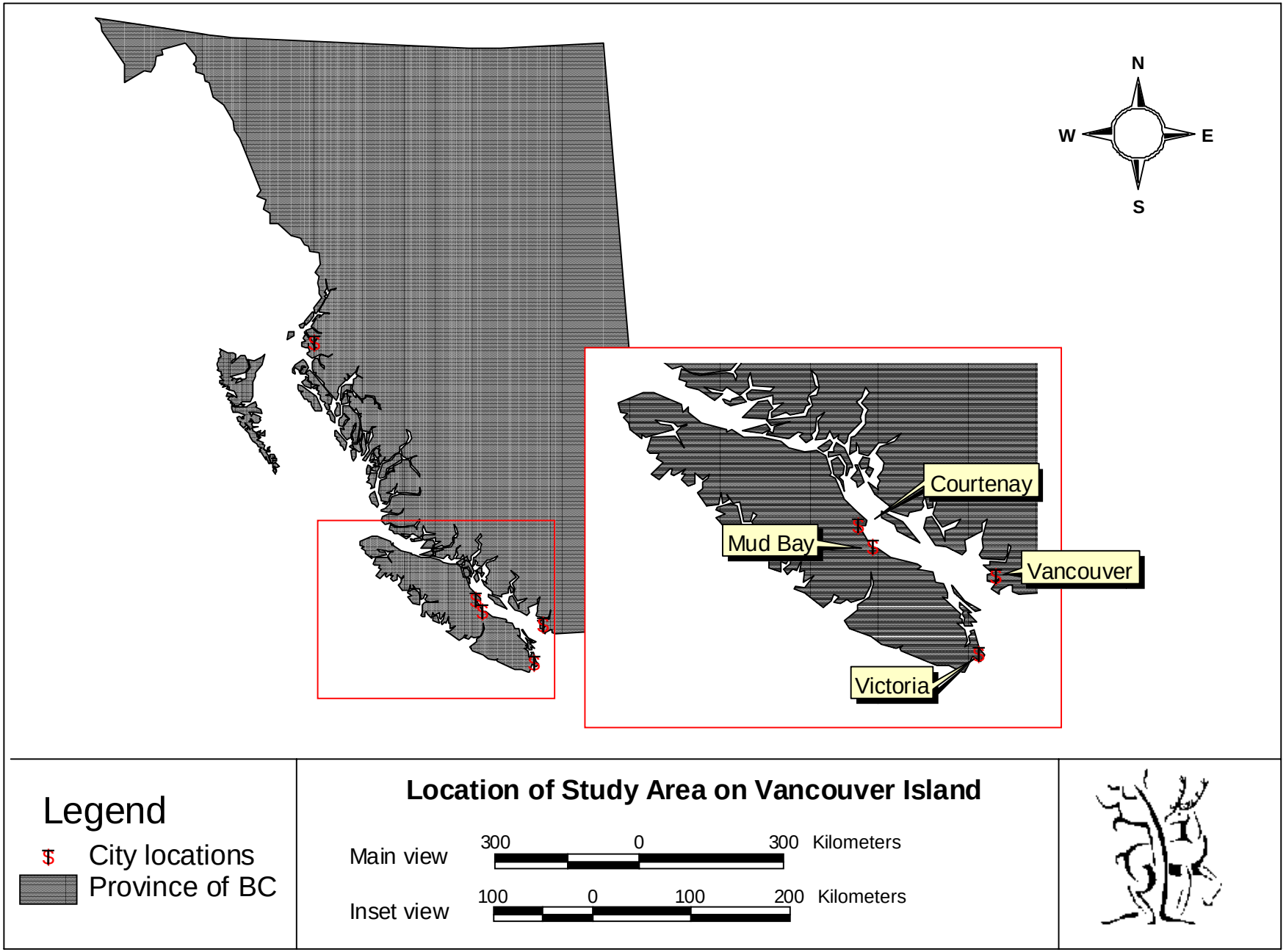

Figure 1. Location of Study Area on Vancouver Island

1.2 Purpose

The purpose of this study was to collect baseline data about Black-tailed Deer and particularly Roosevelt Elk, which winter in the Union Bay area on Vancouver Island. No data has been collected about the deer and elks movements since the IIHWY has been opened. The study was also to look at the number of Roosevelt Elk and Columbia Black-tailed Deer using the IIHWY corridor and their typical movement patterns. This information could assist in developing management techniques to limit the number of wildlife-vehicle collisions.

1.3 Current Deterrent Techniques

Several wildlife deterrent techniques are currently being used on the Mud Bay to Courtenay section of the IIHWY. Continued monitoring and evaluation is needed to determine whether or not any of the methods being used are effective in deterring wildlife from using the highway right-of-ways.

1.3.1 Reflectors

MOTH is currently using SWAREFLEX reflectors to potentially reduce the number of wildlife-vehicle collisions (Figure 1). SWAREFLEX reflectors are designed to catch the beam from a passing vehicles headlights and transfer one beam across the highway and the other beam off the highway in the opposite direction. The objective is to use the reflected light to startle or stun wildlife in order to stop or slow down the animal so they don't cross the road surface and allow vehicles to pass without incident.

Figure 2: Swareflex Reflector

1.3.2 Repellants

A relatively unique deterrent technique is the use of repellants at various locations. Repellants such as cougar and wolf scent are placed in small steel boxes. The steel boxes are affixed to three-foot high posts and are placed along the highway. The objective is to deter ungulates from crossing or occupying highway right-of-ways. Figure 2 is a photograph of one of the numerous scent stations located in the study area.

Figure 3: Scent Station Found along Highway 19

1.3.3 Scare Tactics

Morning and evening scare tactics have been conducted on the Mud Bay to Courtenay section of the IIHWY since September 22, 1999 by Keystone Wildlife Research. Scare tactics are temporary measures used to limit the use of highway right-of-ways by wildlife. Scare tactics may include the use of bear bangers, cracker shells or blanks to scare wildlife off highway right-of-ways.

2.0 Study Area

Field data were collected on a 30-kilometre section of the Inland Island Highway (Highway 19) located between the interchange at Cumberland and 12-kilometres south of the Buckley Bay interchange (Figure 3).

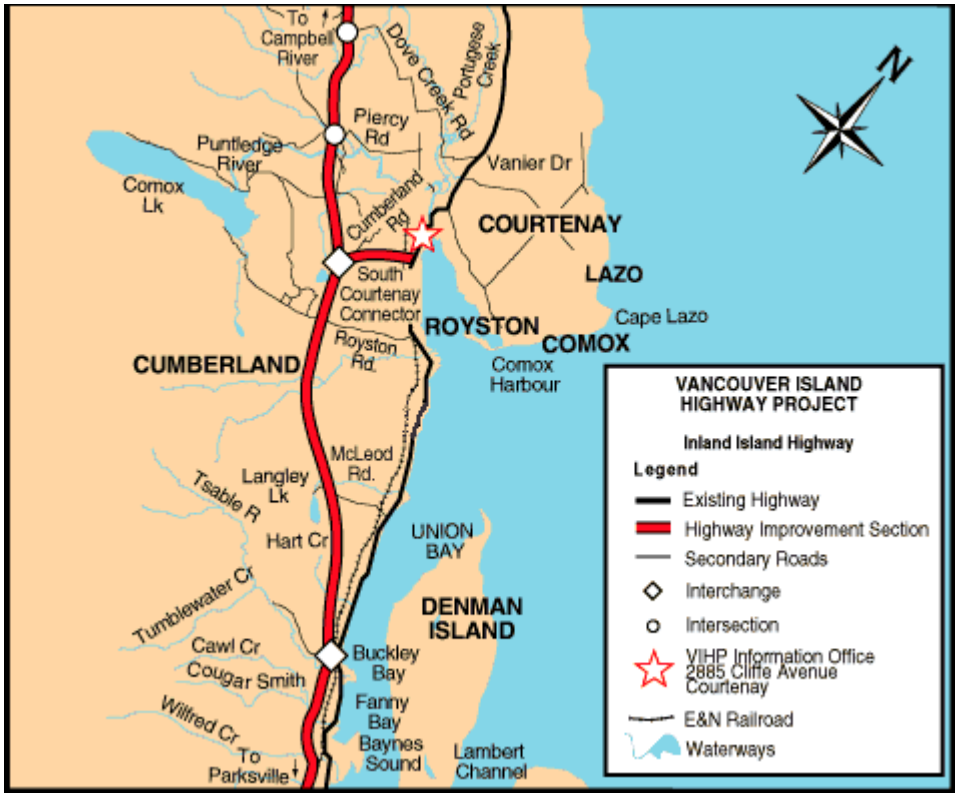

Figure 4: Location of Study Area (MOTH Web Site, 1999)

This section of highway 19 opened on September 25, 1999 with the cost of construction estimated at $138 million (MOTH Web Site, 1999). The highway in the study area has four lanes, a speed limit of 110 km/hr., large shoulders on the outside lanes and also a median dividing opposite lanes of traffic that runs the entire 30-km distance. A total of 15 bridges are found on this section including the largest bridge on Vancouver Island, the Tsable River Bridge, which is 400m long and 60m high. The majority of Highway 19 within the study area has a combination of wildlife warning signage, wildlife reflectors and also repellents used as measures to try to limit the number of wildlife-vehicle incidents occurring on the highway.

The study area is located in two primary habitat types, the Coastal Douglas Fir, and the Coastal Western Hemlock Biogeoclimatic Zones. The majority of the area ranges from recently logged early seral stage forest to mature second growth forest. Both forested and logged areas dominate the land adjacent to the highway. With the various seral stages found in the area, forage is available to both deer and elk throughout the year. The study area included land adjacent to the highway and extended as far as observations permitted, typically less than 200 metres from the highway shoulder.

3.0 Materials & Methods

Field data were collected two weekends each month on Saturday morning/evening and Sunday morning from October 1999 to February 2000. Data were collected both in the morning and evening by driving along Highway 19 at 40–50km/hr. Typically data collection would last for two hours or more until few animals were seen. During this time we participated in wildlife scare tactics and spotlight counts with staff from Keystone Wildlife Research. After morning spotlight counts were completed, elk track count surveys were performed on and off highway.

3.1 Track & Spotlight Counts

Tracks counts started on Nov. 27, 1999 and were conducted on survey days until Feb. 20, 2000. Day surveys involved on and off highway searches specifically for elk tracks and other sign such as droppings. Data collection involved driving logging roads adjacent to highway 19 and walking clearings. A handheld GPS was used to record the UTM locations of any tracks or droppings.

Morning spotlight counts started at or around 5:30a.m. and would last until it was too light for the spotlights to reflect the animals eyes, usually around 7:00a.m or 8:00a.m. The evening collection period would begin at 5:00 or 6:00p.m. and would last for approximately 2.5 to 3 hours, depending on the number of animals seen.

Each spotlight count involved driving along Highway 19 between Cook Creek Road (12-km south of the Buckley Bay interchange) and the exit to Cumberland at 40-50 km/hr. High-powered spotlight(s) were pointed out the window of the vehicle along the highway right-of-ways and out into the woods or clearcuts. When deer or elk were observed, we would stop the vehicle and use a laser rangefinder to determine its distance from the highway. We would take a compass bearing to its position, mark down the mileage from our start point, enter its location into a GPS unit, and enter the information onto data sheets, including the time it was seen. Scare devices such as, bear bangers, cracker shells or blanks would be used to scare the animal(s) off the right-of-ways. See Appendix 1 for a sample field data sheet.

Field data collected included the following:

- number of deer and elk seen along the highway
- distance of deer and elk from the highway shoulder
- sex of deer and elk
- behavior of deer and elk before and after “scare” tactics were implemented (eg.)
    - feeding
    - bedded
    - running
    - walking
    - no response.
- using a GPS to collect UTM coordinates of elk and deer locations along highway.

3.2 Field Equipment Used

Field equipment used during data collection included:

- spotlights (400,000 candle power)
- laser range finder (accurate to +/- 1 metre, up to 800 metres)
- GPS (Garmin 12 CX)
- compass
- scare devices (bangers, screechers)
- camera (SLR / Hi-8 Video)
- rotor beacon
- field data sheets.

3.3 Data Analysis

All data analyses were completed using Microsoft Excel including the tables and figures presented in section 4. After each field data session, raw data were entered into an Excel spreadsheet. Separate worksheets were used for morning and evening data. Another worksheet was used to summarize the field sessions and data collected.

4.0 Results & Discussion

During 27 scare tactic/spotlight count field surveys, 275 Columbia Black-tailed Deer and 18 Roosevelt Elk were seen along the highway. Elk have been seen in the evening and morning at various times and dates in the same general area on the east side of the highway near McLeod Road (Figure 6). The majority of Black-tailed Deer have been seen in the evening on the east and west sides of the highway. Fewer sightings of deer have occurred on the west side in the morning. No highway mortalities of deer or elk were witnessed within the study area during the field days, although Mainroad Contracting has recorded 37 vehicle-wildlife collisions within the study area from September 25, 1999 to December 31, 1999. Sightings of both ungulate species have been relatively consistent, although during heavy rains, snow and storms few or no animals were observed.

The following tables and figures are based on field data collected from October 16, 1999 – February 20, 2000.

4.1 Number & Distribution of Ungulates Observed within the Study Area

Figure 5 shows the number of deer and elk observed each month during the study. Six surveys were conducted each month except for December where 3 surveys were performed.

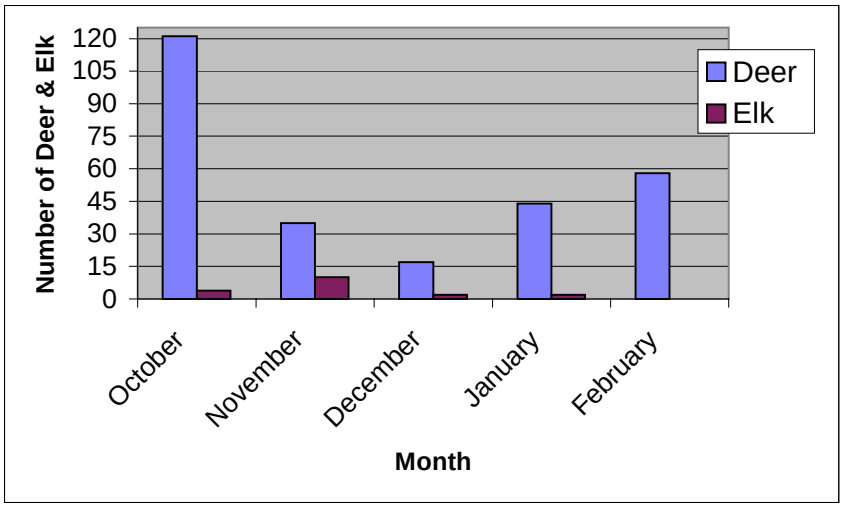

Figure 5: Number of Black-tailed Deer & Roosevelt Elk Observed within Study Area from Oct. 16, 1999 to Feb. 20, 2000

Part of the field data collection involved determining whether the animals observed were on the east or west side of the highway. Table 1 shows the percentage of deer and elk observed on the east and west side of the highway in the morning and in the evening.

Table 1: Distribution of Black-tailed Deer & Roosevelt Elk Along Highway 19 from Oct. 16, 1999 to Feb. 20, 2000

Species	Time of Day	East Side of Hwy	West Side of Hwy
Roosevelt Elk (n=18)	**Morning**	78.0%	22.0%
	Evening	89.0%	11.0%
Black-tailed Deer (n=275)	**Morning**	70.5%	29.5%
	Evening	59.9%	40.1%

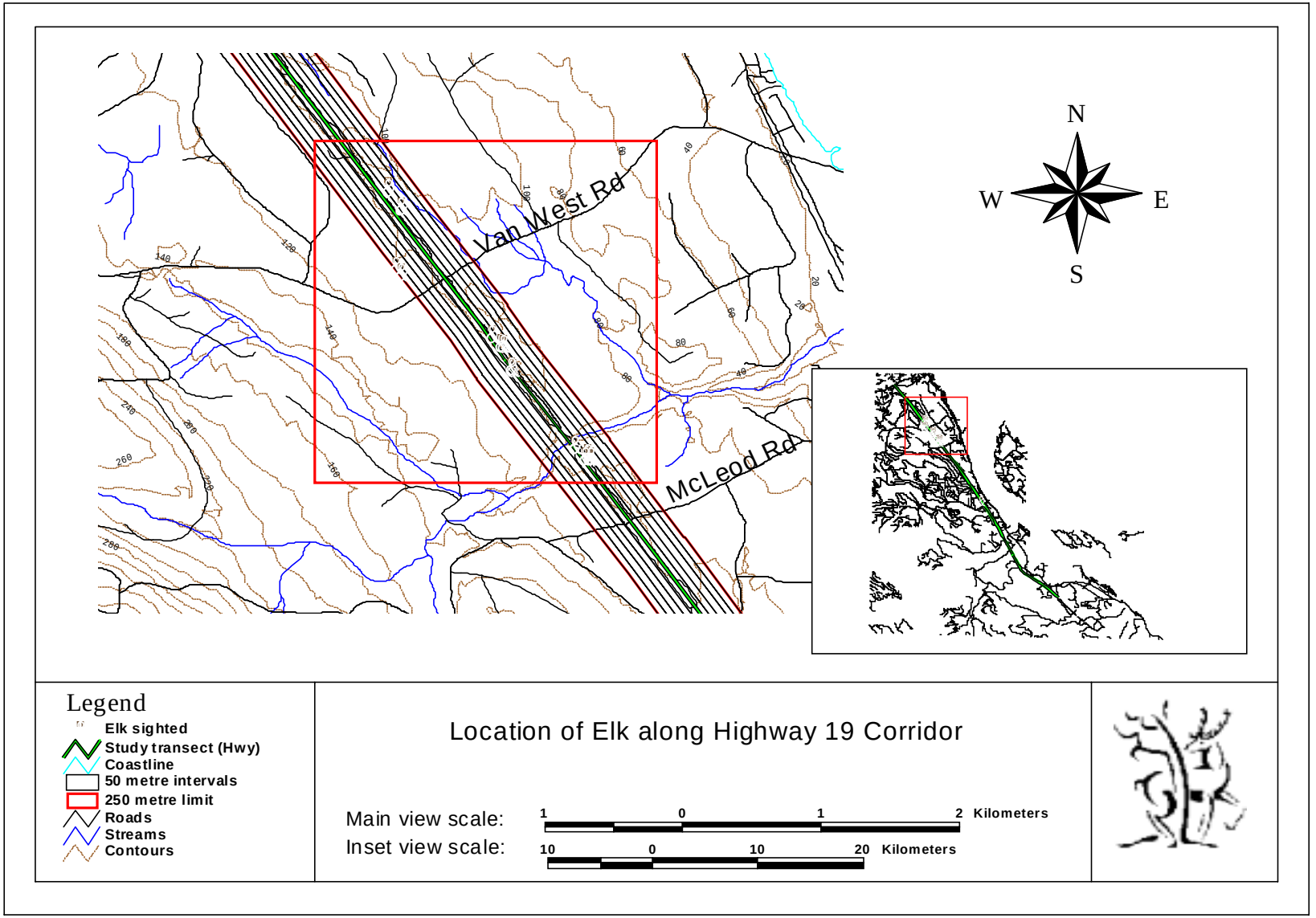

Figure 6: Locations of Elk near McLeod along Highway 19 observed from Oct. 16, 1999 to Feb. 20, 2000

4.2 Behaviour of Ungulates

While conducting scare tactics and spotlight counts the majority of the deer and elk observed were either feeding or bedded down. While no deer or elk were observed on the road surface, tracks indicate movement of deer and elk across the highway. Table 2 shows the percentage of deer and elk that were feeding or bedded down during spotlight counts.

Table 2: Behaviour of Black-tailed Deer & Roosevelt Elk Observed During Spotlight Counts Along Highway 19 from Oct. 16, 1999 to Feb. 20, 2000

Species	Time of Day	Behaviour		
		Feeding	Bedded Down	Other [a]
Roosevelt Elk (n=18)	Morning	33.3%	11.1%	55.6%
	Evening	55.6%	0.0%	44.4%
Black-tailed Deer (n=275)	Morning	52.6%	34.6%	12.8%
	Evening	59.4%	7.6%	33.0%

a = animals that were standing and not observed to be feeding

4.3 Distance of Ungulates from Highway

During spotlight counts the distance ungulates were observed from the highway shoulder was recorded. Figure 6 shows the distances recorded for all the animals from Oct, 16, 1999 to Feb. 20, 2000. As indicated in Figure 6 a significant number of ungulates were seen within 65 metres of the highway shoulder.

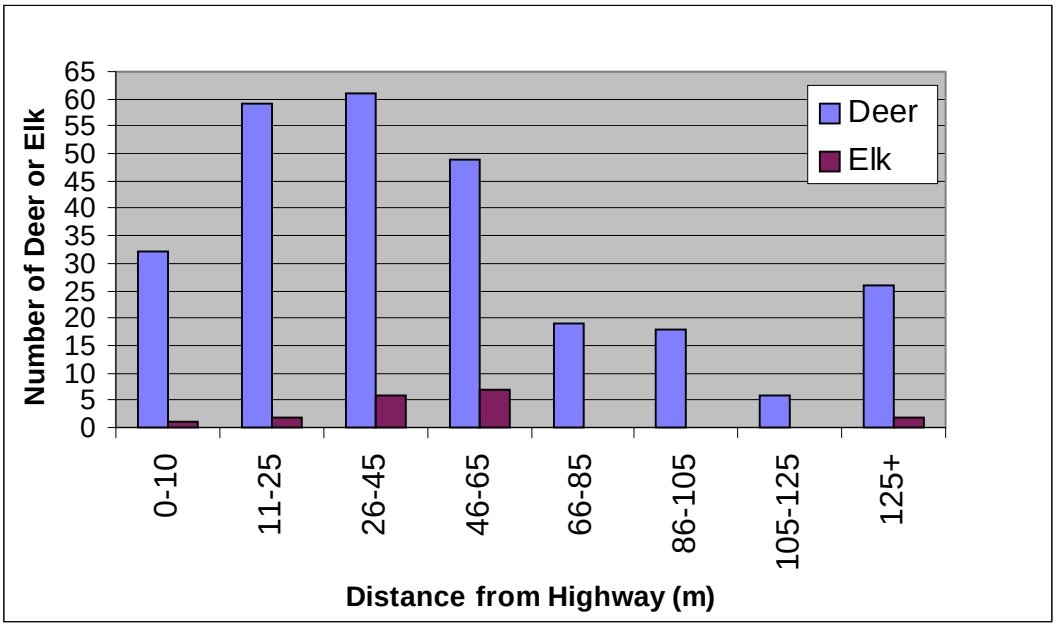

Figure 7: Distance, Black-tailed Deer & Roosevelt Elk were observed from Highway 19, Oct. 16, 1999 to Feb. 20, 2000

4.4 Summary of Scare Tactics & Spotlight Counts

There has been a noticeable change in the effectiveness of scare devices on deer and elk frequenting the highway since the study began. It appears that the ungulates are becoming less afraid of the bangers and screechers being used. Deer have been observed coming back into the same area within 10 minutes from the time they were scared.

Table 3 is a summary of the scare tactics and spotlight counts from October 16, 1999 – February 20, 2000.

Table 3: Summary of Field Data for Spotlight Counts & Scare Tactics along the Inland Island Highway from Oct. 16, 1999 to Feb. 20, 2000

Date	AM/PM	Start Time	Stop Time	Total Km	Weather	Total Scare Devices [a]	Total Deer	Total Elk
16-Oct-99	AM	5:30	7:40	98	N/A	5	10	0
16-Oct-99	PM	18:45	22:37	115	N/A	29	59	0
17-Oct-99	AM	5:35	7:28	83	N/A	4	14	0
30-Oct-99	AM	5:51	8:11	86	Overcast, Heavy Rain	8	13	2
30-Oct-99	PM	18:20	21:05	115	Overcast, Heavy Rain	15	25	2
31-Oct-99	AM	6:10	7:25	65	Clear, Cool	0	0	0
13-Nov-99	AM	5:45	7:35	85	Overcast, Cold	0	0	0
13-Nov-99	PM	17:45	20:45	132	Overcast, Raining	7	22	2
14-Nov-99	AM	5:45	7:30	84.7	Overcast, Raining	4	8	2
27-Nov-99	AM	6:05	7:35	58	Heavy Rain	0	2	0
27-Nov-99	PM	18:00	19:32	66	Light Rain, Gusting Wind	2	1	3
28-Nov-99	AM	5:55	7:33	66	Heavy Rain, Gusting Wind	5	2	3
11-Dec-99	AM	6:00	7:47	63.5	O.C. Cool	1	1	0
11-Dec-99	PM	18:28	19:58	47.8	O.C. Cool	17	10	2
12-Dec-99	AM	6:20	7:50	57.4	Heavy Rain	0	6	0
8-Jan-00	AM	6:28	7:50	59.1	Overcast	0	0	0
8-Jan-00	PM	17:35	19:56	74.8	Overcast	0	31	0
9-Jan-00	AM	6:30	N/A	43.2	Clear, Windy, Icy Conditions	0	1	0
22-Jan-00	AM	6:05	7:43	57.3	O.C./Cold / Snow on Ground	5	1	2
22-Jan-00	PM	17:20	19:30	74.8	O.C./Cool / Snow on Ground	0	8	0
23-Jan-00	AM	6:10	7:30	57.3	O.C./Cool / Snow on Ground	0	3	0
5-Feb-00	AM	6:09	7:28	57.2	Variable/Mainly Clear/Cold	0	0	0
5-Feb-00	PM	18:00	20:20	77.5	Overcast	0	10	0
6-Feb-00	AM	6:00	7:28	64.2	Light Rain, cool/patchy fog	3	11	0
19-Feb-00	AM	5:25	7:04	56.8	Clear, Cold	2	3	0
19-Feb-00	PM	18:40	20:45	66	Clear, Cold	9	31	0
20-Feb-00	AM	5:30	7:03	56.9	Partly O.C., Cool	0	3	0
TOTAL:				1967.5		116	275	18

a = scare devices include, bear bangers, cracker shells or blanks.

4.5 Summary of Track Counts

The majority of elk tracks and sign were observed ~ 4-km north and south of McLeod Road along the highway right-of-way (ROW). Off highway searches were conducted on both the west and east sides of the highway. More elk sign was observed on the east side, along the power-lines that parallel highway 19 near McLeod Road than on the west side.

Highway 19 south of McLeod Road has SWAREFLEX reflectors on both sides of the highway. Scent stations can also be found north and south of McLeod Road. Visual sign of elk and deer indicate that ungulates are crossing the highway near McLeod Road and are using the highway ROW.

Table 4 is a summary of the track count surveys from November 27, 1999 – February 20, 2000.

Table 4: Summary of Field Data for Track Counts along the Inland Island Highway from Nov. 27, 1999 to Feb. 20, 2000

Date	AM/PM	Start Time	Stop Time	Total Km	Weather	Start	Total Elk Tracks
27-Nov-99	AM	7:45	9:00	57.6	Heavy Rain	Cumberland exit. South	0
11-Dec-99	AM	7:48	8:15	19.2	O.C. / Cool	Buckley Bay to McLeod Road, (logging rd, on W. side of HHY, McLeod rd. North to Cumberland exit	0
11-Dec-99	AM	8:25	9:00	9.2	O.C. / Cool	McLeod Rd. to Cumberland exit	8
11-Dec-99	PM	17:00	17:49	15.7	O.C. / Cool	Cumberland exit South to Buckley Bay exit	11
12-Dec-99	AM	8:00	9:00	18.4	Raining	Buckley Bay South towards Cook Creek Rd. & North to McLeod Rd.	74
8-Jan-00	AM	8:00	9:36	32.5	O.C.	Cumberland exit. South	72
22-Jan-00	AM	7:50	9:39	35.3	O.C. / Cold / Snow on Grd.	Buckley Bay to McLeod Road, (logging rd, on W. side of HHY, Buckley Bay to Cumberland exit along HWY.	12
23-Jan-00	AM	7:35	7:50	8.8	O.C. / Cold / Snow on Grd.	Cumberland exit South to McLeod Rd.	0
5-Feb-00	AM	7:30	9:05	27.5	Variable/Mainly Clear/Cold	McLeod Rd. To Buckley Bay Exit & (logging rd. on W.side of HWY) also walked powerlines to Hart Creek from McLeod Rd.	0
5-Feb-00	PM	16:40	17:51	31	Partly O.C. / Cool	Cumberland exit South to McLeod Rd. & Buckley Bay North to Cumberland exit	84
19-Feb-00	AM	7:04	8:53	26.6	Clear, Cold	Cumberland Rd. To Buckley Bay Exit & (logging rd. on W.side of HWY) also walked powerlines to Hart Creek from McLeod Rd.	4
19-Feb-00	PM	17:35	18:20	15.6	Clear, Cold	Buckley Bay North to Cumberland exit	39
TOTAL:				297.4			304

There is no simple or concrete solution to prevent wildlife-vehicle collisions. Knowing the number, location and distribution of animals serves as important information and could be used to help identify areas for further study or where certain mitigation options may be necessary. Field data and observations of the number of tracks seen along the shoulder and across the highway indicate that there is a need for a permanent wildlife deterrent device such as an ungulate exclusion fence. Wildlife fencing on Highway 19 would cost ~ $58,000 per km, with two wildlife gates every kilometre the total cost of the fence would be ~ $3.8 million. Maintenance costs would be $190,000 per year. Projecting over 30 years, it would cost $9.5 million to construct and maintain a wildlife exclusion fence.

There have been 37 vehicle-wildlife collisions including one elk-vehicle collision along the highway since it was opened to traffic on September 25th 1999. Fencing may have negative impacts on animal populations. Herd separation, and the potential reduction of gene pools are two possible outcomes. Installing fencing along the highway though, would almost totally reduce the possibility of an ungulate-vehicle collision. This would eliminate any costs through ICBC and save lives. ICBC insurance claims for vehicle-wildlife collisions are ~ $240,000 per year, over 30 years it would cost $7.2 million.

5.0 Conclusions & Recommendations

Between October 16, 1999 and February 20, 2000 twenty-seven field surveys were conducted. During these surveys 275 deer and 18 elk were observed using the highway corridor between Cook Creek road and the Cumberland interchange. Sightings of deer and elk have been relatively consistent, although during heavy rains, snow, and storms few or no animals were observed. During field surveys deer were usually seen on the east side of the highway in the morning. In the evening deer were more evenly distributed on the west and east sides (Table 2). The majority of elk were observed primarily on the east side of the highway in the morning and in the evening. Deer were observed along the entire 30-km section of highway, while elk were concentrated within a 10-15 km section north and south of McLeod road.

From analyzing field data, we have found that there are a significant number of ungulates using the highway 19 corridor. The majority of ungulates we observed were <65 metres from the highway shoulder. Higher use in these areas increase the potential for a wildlife-vehicle collision.

Although numerous scent stations and SWAREFLEX reflectors are present in the study area, we have observed ungulates and tracks in the vicinity of these deterrent devices. MOTH is involved in an ongoing study to determine the effectiveness of the scent stations in deterring ungulates from using the highway corridor.

Due to the considerable number of deer and moderate number of elk that use the Highway 19 corridor, we have several recommendations:

- Continue monitoring and evaluating the use of repellants and reflectors being used along the IIHWY to determine whether or not these methods are effective in deterring wildlife from using highway right-of-ways.

- Research on the migration patterns, behavior, size of deer and elk populations, and habitat ranges may help to estimate the number of wildlife-vehicle collisions that may occur on the highway and the potential effects of separating the herd.

- Install a permanent wildlife deterrent device such as an ungulate exclusion fence. Field data and observations of the number of animals using the highway corridor, and tracks seen along the shoulder and crossing the highway indicate there is a need for such a device.

- Conduct further studies on the impacts of wildlife fencing on animal populations, especially once wildlife fencing is in place.

5.1 Data Collection Methods

The following recommendations are for future data collection methods for conducting roadside spotlight counts.

We recommend:

- Using two observation vehicles equipped with spotlights, driving one behind the other approximately 25-50m apart. Having a second vehicle will ensure that the animals missed by the first observation vehicle are recorded.

- Driving at a constant speed of 40-50 km/hr. Depending on road conditions speeds may be slower. Driving faster than 50 km/hr. will not give the observer enough time to scan large areas such as cutblocks with a spotlight.

- Establishing a technique for using spotlights during counts and maintain this technique throughout each survey such as, sweeping the spotlight from the front of the vehicle to the side rather than pointing it straight out the side of the vehicle. This will help eliminate possible biases associated with inconsistent observation methods.

- Maintaining consistent observation routes and times. A more reliable estimate of a population's abundance and distribution is more likely if survey methods are consistent.

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Appendix 1:

Sample Field Data Sheet

Date	File Name	Time	Ref.No	Photo (R/S)	Buck	Doe	Ukn.	Bull	Cow	Ukn.	W/E	Dist. (m)	Brg.	Banger	Screecher	Dist (km)	Behavior Before	Behavior After	Comments