

I-70 ECO-LOGICAL MONITORING 2009 PROGRESS REPORT

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INTRODUCTION

The I-70 Eco-Logical Project is being conducted by Center for Native Ecosystems, Colorado Department of Transportation, Colorado Watershed Assembly, ECO-resolutions LLC, and Western Transportation Institute. The I-70 Eco-Logical Project is designed to field test the ecosystem approach developed by FHWA (<http://www.environment.fhwa.dot.gov/ecological/ecological.pdf>). Specifically, the goal of the project is to develop solutions for restoring and mitigating transportation impacts on wildlife habitat connectivity and reducing animal-vehicle collisions along the I-70 Mountain Corridor from Genesee (MP 256) to west of Dotsero (MP 130).

The scope of work is composed of five tasks:

- 1) Compile inventory data, spatial layers, and research studies on aquatic and terrestrial wildlife and their connectivity needs along the I-70 Mountain Corridor (March 2009 – May 2010).
- 2) Monitor wildlife use of existing culverts and activity along the roadway (May 2009 – November 2010);
- 3) Participate in multi-agency stakeholder meetings (throughout project duration);
- 4) Integrate conservation priorities into the transportation planning process for the I-70 Mountain Corridor (January 2010 – May 2011);
- 5) Develop recommendations to reduce transportation impacts on wildlife (September 2010 – May 2011).

METHODOLOGY

This report focuses on the monitoring activities of this project which, at this time, are limited to motion-triggered cameras. Data collected during Year 1 will be used to validate and refine previously-identified Linkage Interference Zones (LIZs)¹. Monitoring activities in year 2 will be focused within these LIZs. In order to collect data missed by the cameras, track beds may be incorporated at existing structures in year 2. No monitoring is currently underway to track measures of aquatic connectivity.

Camera Monitoring

Two versions of the Cuddeback Expert digital scouting camera (Non Typical, Inc., Park Falls, WI, USA) were used to monitor wildlife presence at existing culverts and other potential roadway crossing locations along the interstate. Cameras were set to a one minute delay, which is the lowest delay possible on these camera models. Monitoring locations include existing bridges and culverts (18 stations) as well as potential crossing locations – such as fill slopes blocking natural drainages – where there are no suitable crossing structures (16 stations). Camera monitoring commenced May 20, 2009 at 29 monitoring stations, representing 15 milepost locations between Dotsero and Golden, Colorado. Over the course of the field season, this was increased to 34 stations at 19 milepost locations. Two cameras were set up at each location with a structure, one at either entrance to the structure. At one bridge location (MP 144.5), a third camera was set up part-way through the

¹ Linkage Interference Zones were first mapped by the interagency ALIVE group (A Landscape Level Inventory of Valued Ecosystem Components) composed of representatives from CDOT, FHWA, Colorado Division of Wildlife, Bureau of Land Management, US Forest Service, and US Fish and Wildlife Service.

summer. At locations without any type of passage structure, either one or two cameras were set up on either side of the roadway, depending on the situation and the feasibility of setting up cameras on both sides of the road. Overall, there were five milepost locations with just one camera on one side of the road. Cameras were checked approximately every six weeks. Though this study year does include one monitoring location on west Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now CNE) from 2006 to 2008.

Data Reporting and Standardization

Species totals for each camera station were calculated by summing the number of individuals of a specific species in each photograph (rather than the number of photos taken). For example, if a station had 6 pictures of mule deer – 1 image with 3 deer, 1 image with 5 deer and 4 images with 1 deer – then the total would be reported as 12 deer (rather than 6) for that station. In cases where humans and domestic animals are documented in the same picture, only the humans were recorded for that image. Cars were not included in the human totals. Exact numbers of cars were not recorded at sites where mostly cars were documented.

Several of the graphs used in this report show the number of animals detected standardized by the number of sample nights. Sampling nights are the number of nights a given camera was functioning during the sampling period. Sampling nights were calculated as 12pm on day 1 to 12pm on day 2. For instance, the sampling night for May 31 was considered as 12pm on May 31 until 12pm on June 1. Any photos taken on June 1 before 12pm were considered as captured in May. This calculation method was used so sampling nights were not missed at the end and beginning of the month. Some sites have fewer sampling nights because of equipment difficulties or battery failures (see *Equipment Malfunctions* section below).

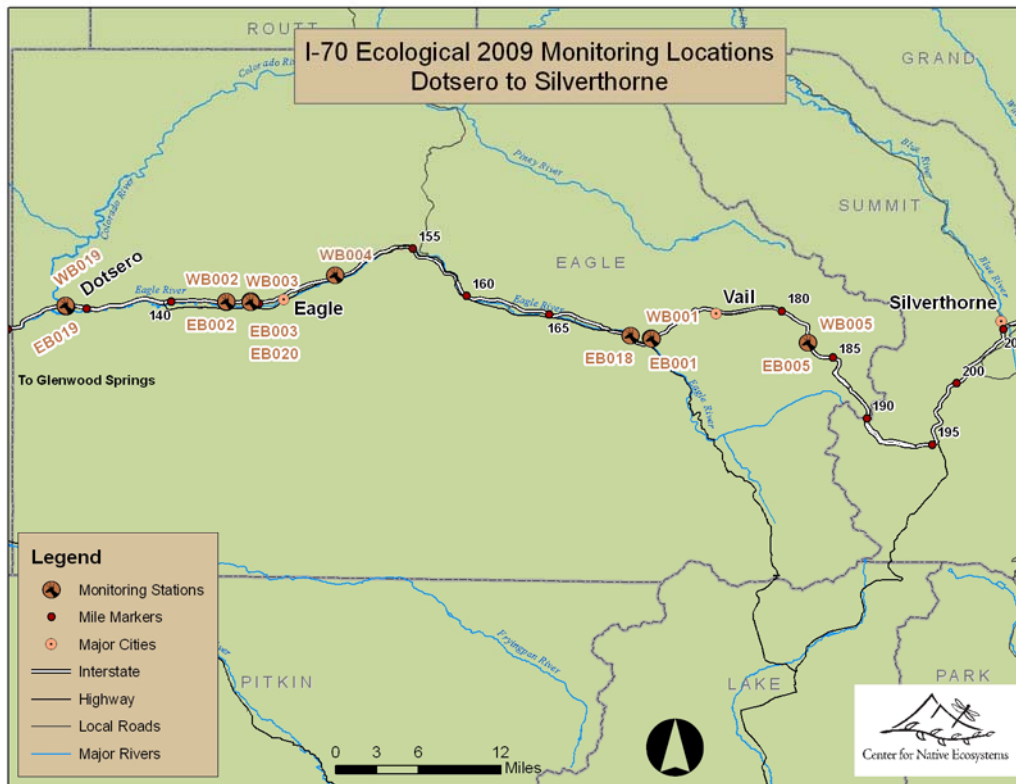
Data Caveats

The totals for some species, especially mule deer and cattle, may be inflated due to double counting of animals lingering in front of the camera. In addition, because sampling nights were averaged over the entire study period for some analyses, this does not take into account that one camera may have malfunctioned during a period of peak activity while another camera may have malfunctioned during a lull in activity. Therefore, some of the comparisons between sites are limited. Both of these issues will be addressed in the analysis of year 2 data.

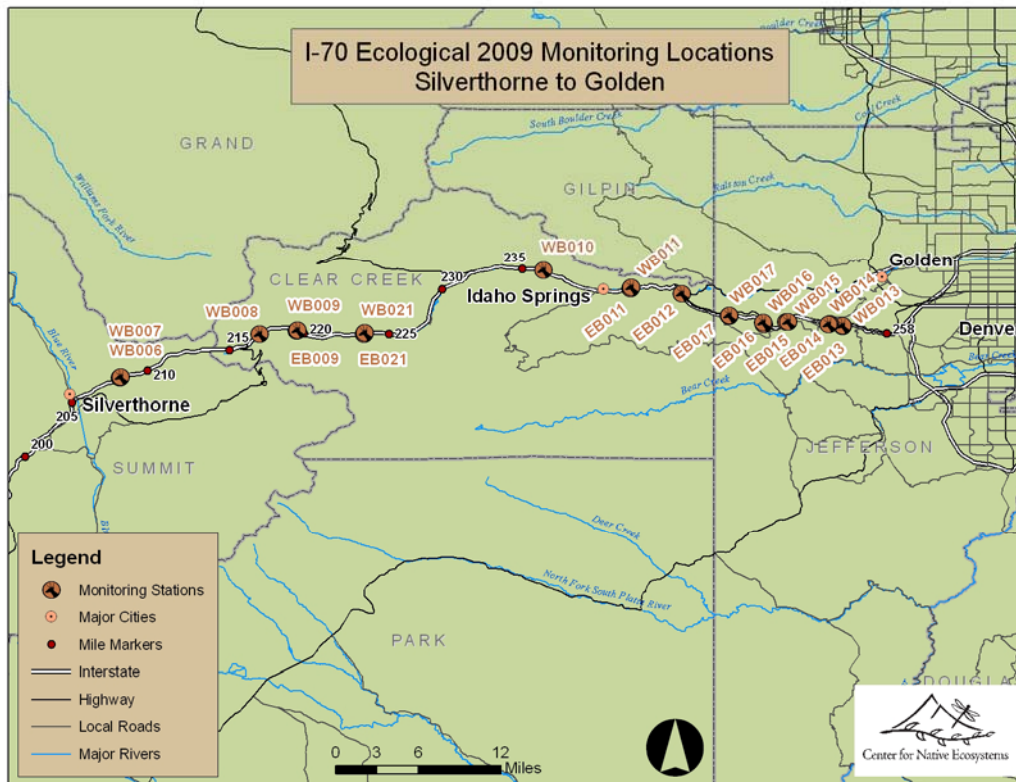
Equipment Malfunctions

Throughout the monitoring season, cameras malfunctioned at several sites for a variety of reasons. In most cases, this was due to battery failure and was remedied the next time a camera was checked. Some camera malfunctions were due to a more serious condition and in these cases, the cameras were replaced as soon as possible. A couple of stations were plagued by multiple malfunctioning cameras.

Monitoring Station Descriptions



Map 1 – I-70 Ecological 2009 Monitoring Locations – Dotsero to Silverthorne



Map 2 – I-70 Ecological 2009 Monitoring Locations – Silverthorne to Golden

MP 134 (Underpass)

Location: near Dotsero

Type: concrete box culvert

Monitoring station(s): WB019 (north), EB019 (south)

Description: culvert spanning both east- and westbound lanes of I-70 and frontage road running parallel to interstate to the north; culvert is a two partition box at north entrance (under frontage road) which joins midway through to become just one partition (under the interstate); structure changes angle at the joint.

Dimensions:

Westbound entrance (north): 6.3 m (W) x 3 m (H) x 131 m (L)

Eastbound entrance (south): 3 m (W) x 3.2 m (H) x 131 m (L)

Wildlife Fencing: none in 2009

Sampling period: 8/4/2009 to 11/11/2009 (both stations)

Species Documented:

WB019: 3 humans and 1 unknown

EB019: 1 coyote, 2 domestic dogs and 1 domestic cat

Summary: The two monitoring stations at this culvert near Dotsero were set up late in the season. Equipment difficulties hindered data collection at each station at this site. The railroad parallels this structure (perpendicular to the highway) to the west. In addition to the animals documented with the cameras, raccoon, coyote, skunk and possibly bobcat and rabbit/hare tracks as well as rabbit/hare and possibly mountain lion scat were recorded in or near the culvert, indicating usage by a variety of species.

MP 143 (Underpass)

Location: east of Gypsum

Type: divided bridge

Monitoring station(s): WB002 (north), EB002 (south)

Description: divided bridge with matching spans for both the east- and westbound lanes of I-70

Dimensions:

Westbound entrance (north): 134.4 m (W) x 25 m (H) x 14 m (L)

Eastbound entrance (south): 121.3 m (W) x 22.4 m (H) x 14 m (L)

Median width: approx. 29.2 m

Wildlife Fencing: fencing in place north and south of highway

Sampling period: 5/20/2009 to 11/11/2009 (both stations)

Species Documented:

WB002: 11 birds, 9 domestic goats, 3 humans and 1 mule deer (1 human counted above accompanied by goats not reflected in count above)

EB002: 4 cattle, 1 coyote, 2 domestic dogs, 1 elk, 2 domestic goats, 4 humans and 4 mule deer (2 humans counted above accompanied by goats not reflected in count above)

Summary: The two monitoring stations at this divided bridge east of Gypsum were set up at the beginning of the season. Limited data was collected at WB002 early in the season due to difficulties positioning the camera. There is a game trail running north-south under both spans of the structure. In addition to the animals documented with the cameras, elk and mule deer scat were recorded in or near the structure. There is a horse pasture to the south of this location so there is a lot of associated

domestic animal activity, particularly horse and cattle. There is other human use (on foot, horse or bicycle) at this site as well.

MP 144.5 (Underpass)

Location: west of Eagle

Type: divided bridge

Monitoring station(s): WB003 (north), EB003 (south)*, EB020 (south)*

Description: divided bridge with matching spans for both the east- and westbound lanes of I-70; large median between the east- and westbound bridges

Dimensions:

Westbound span (north): 24.5 m (W) x 13 m (L)

Eastbound span (south): 25 m (W) x 13.5 (L)

Median width: approx. 116 m

Wildlife Fencing: fencing in place north and south of highway

Sampling period:

WB003, EB003: 5/20/2009 to 11/11/2009; *EB020:* 8/4/2009 to 11/11/2009

Species Documented:

WB003: 2 badgers, 41 cattle, 13 coyotes, 4 domestic dogs, 1 mountain lion, 44 mule deer, 7 rabbits/hares, 1 red fox, 1 striped skunk and 1 unknown

EB003: 3 badgers, 2 birds, 144 cattle, 25 coyotes, 9 domestic cats, 1 domestic dog, 65 mule deer, 4 rabbits/hares, and 3 unknown

EB020: 16 mule deer

Summary: Two of the three monitoring stations at this divided bridge west of Eagle were set up at the beginning of the season. EB020 was set up later in the monitoring season to capture anything EB003 may have missed. Equipment difficulties hindered data collection at EB020. Based on times and dates, it is likely that seven images taken at EB003 are capturing the same animals (though not always the same number of individuals) documented in seven images taken at EB020. In addition to the species documented with the cameras, elk and rodent tracks were recorded near the structure. There is a game trail running north-south under both spans of the structure. There is evidence of other human (on foot) and domestic animal (horse and cattle) use at this site. Cattle and mule deer at this site lingered under the bridge (especially at the eastbound (south) stations for mule deer); thus numbers for these species may be inflated at this site. It is also likely that some animals are using the habitat in the very wide median at this structure and are not traveling through both spans. This is evidenced through the detection of some species at the westbound (north) station and not the east, and vice versa.

** In several of the graphs found in this report, EB003 is represented as 144.5 EB 1 and EB020 is represented as 144.5 EB 2.*

MP 149.8 (Underpass)

Location: east of Eagle

Type: concrete box culvert

Monitoring station(s): WB004 (north)

Description: culvert with road running through it

Dimensions: 4.25 m (W) x 4.2 m (H) x 44.6 m (L)

Wildlife Fencing: fencing in place north and south of highway

Sampling period: 5/20/2009 to 11/11/2009

Species documented: 84 birds, 4 elk, 30 horses, 83 humans, 5 mule deer, 1 raccoon and 6 unknown; (49 humans counted above riding or accompanied by horses not reflected in count above; 2 humans accompanied by domestic dogs not reflected in count above; 20 humans on bikes and 6 humans riding in cars or on ATVs and are included in the count above.)

Summary: The one monitoring station at this concrete box culvert east of Eagle was set up at the beginning of the season. A chain-link gate at the north entrance of this structure allows access to BLM land to the north. Several humans were documented accessing this land for recreation (biking and ATV use) and possibly grazing (humans on horses possibly checking on cattle or sheep and several horses documented without humans). By the end of the study season, the chain-link gate was closed, cutting off use of the culvert. Some humans and horses may have been documented more than once.

MP 170 (Underpass)

Location: near Eagle-Vail

Type: concrete box culvert

Monitoring station(s): EB018 (south)

Description: culvert with a dirt road running through it

Dimensions: 4.2 m (W) x 4.2 m (H) x 53 m (L)

Wildlife Fencing: none in 2009

Sampling period: 7/13/2009 to 8/4/2009

Species documented: 3 birds, 3 domestic dogs, 49 humans, 1 mule deer, 8 red foxes, and 2 unknown (2 humans counted above accompanied by dogs not reflected in count above; 23 humans on bikes and 9 humans riding in cars and are included in count above)

Summary: The one monitoring station at this concrete box culvert near Eagle-Vail was set up midway through the season. The camera was stolen sometime between 8/4 and 9/29/2009. South of the culvert, there is access to a small dirt parking lot and the Whiskey Creek trailhead. Access to the culvert is from US Highway 6 which parallels the interstate to the north. Several humans were documented accessing the parking lot by car, including after dark. During the day, the Whiskey Creek trail was popular with mountain bikers and hikers. In addition to the animals documented with the cameras, coyote and possibly bobcat and black bear tracks and elk scat were recorded in or near the culvert.

MP 172.2 (Underpass)

Location: between Minturn and Vail at Dowd's Junction

Type: concrete box culvert

Monitoring station(s): WB001 (north), EB001 (south)

Description: sediment-collecting baffles through the culvert provide a dirt bottom; Gore Creek runs parallel to roadway to the south; game trail runs perpendicular to the highway to the north; animals exiting structure to the south go under bridge for bike path

Dimensions: 3 m (W) x 2.8 m (H) x 30.1 m (L)

Wildlife Fencing: fencing in place north and south of highway

Sampling period: 5/20/2009 to 11/11/2009 (both stations)

Species documented:

WB001: 7 black bears, 1 chipmunk, 7 domestic dogs, 13 elk, 10 humans, 241 mule deer, 1 raccoon and 7 unknown (1 human counted above accompanied by a dog not included in count above)

EB001: 8 black bears, 2 domestic dogs, 15 elk, 30 humans, 111 mule deer, 1 raccoon, and 10 unknown (2 humans accompanied by dogs not included in count above)

Summary: The two monitoring stations at this concrete box culvert between Minturn and Vail at Dowd's Junction were set up at the beginning of the season. Graffiti on the culvert walls and photos indicate human use. In addition to the animals documented with cameras, mule deer, black bear, raccoon and small mammal tracks were recorded in or near the culvert. Some photos even indicated through passage by large mammals like elk and black bear. One individual elk was likely documented multiple times towards the end of the season at the westbound (north) station at this site.

MP 183 (Underpass)

Location: on West Vail Pass about seven miles from the summit

Type: small divided bridge

Monitoring station(s): WB005 (north), EB005 (south)

Description: bridge where interstate crosses over drainage entering into Black Gore Creek drainage which parallels roadway to the north; underpass is small divided bridge with matching spans for both east- and westbound lanes of I-70

Dimensions:

East- and westbound spans: 23 m (W) x 4.2 m (H) x 12.4 m (L)

Median width: approx. 8.4 m

Wildlife Fencing: none in 2009

Sampling period: 5/21/2009 to 11/11/2009 (both stations)

Species documented:

WB005: 5 coyotes, 1 domestic dog, 2 humans, 7 marmots, 677 mule deer, 2 porcupines, 3 red foxes, and 4 unknown

EB005: 2 coyotes, 1 domestic dog, 5 humans, 5 marmots, 419 mule deer, 1 squirrel and 1 unknown (1 human accompanied by a domestic dog not included in count above)

Summary: The two monitoring stations at this small divided bridge on West Vail Pass were set up at the beginning of the season. Mule deer at this site lingered under the bridge spans to forage. Thus numbers for this species may be inflated at this site. In addition to the animals documented with cameras, mule deer and marmot tracks were recorded near the monitoring stations.

MP 208.4 (No structure)

Location: east of Silverthorne at the Laskey Gulch drainage

Type: fill slope

Monitoring station(s): WB006 (north), WB007 (north)

Description: cameras set up at base of tall fill slope on game trail; WB006 was easternmost of two cameras at location; WB007 was westernmost

Dimensions: approx. 25 m (H) x 90 m (imprint of fill slope)

Wildlife Fencing: none in 2009

Sampling period: 5/21/2009 to 11/11/2009 (both stations)

Species documented:

WB006: 1 bird, 5 black bears, 2 coyotes, 1 elk, 79 humans, 1 moose, 9 mule deer, 1 donkey/pack mule and 1 unknown

WB007: 1 domestic dog, 18 elk, 148 humans, 29 mule deer, 1 red fox, and 1 unknown (7 humans documented with donkey/pack mules not included in the count above; 3 humans accompanied by dogs not included in count above)

Summary: The two monitoring stations at this fill slope east of Silverthorne at the Laskey Gulch drainage were set up at the beginning of the season. There was a resident marmot at the base of the fill slope and a game trail ran east-west and then north-south in relation to the highway. In addition to the animals documented with cameras, elk scat was recorded near the monitoring stations.

MP 217.2 (No structure)

Location: east of Loveland Ski Resort and the junction with US Highway 6 at Dry Gulch

Type: at-grade

Monitoring station(s): WB008 (north)

Description: camera set up on small flat road-like area in woods that runs parallel to I-70

Dimensions: N/A

Wildlife Fencing: none in 2009

Sampling period: 5/21/2009 to 11/12/2009

Species documented: 4 coyotes, 2 elk, 7 humans, 55 mule deer and 2 red foxes

Summary: The one monitoring station at this at-grade location east of Loveland Ski Resort and the junction with US Highway 6 at Dry Gulch was set up at the beginning of the season. As evidenced by data collected by the camera at this site, several species, including humans, are present in this area.

MP 219.5 (No structure)

Location: west of Bakerville at Watrous Gulch

Type: at-grade

Monitoring station(s): WB009 (north), EB009 (south)

Description:

WB009: camera set up at base of Watrous Gulch drainage

EB009: camera set up on flat area below chain-up area

Dimensions: N/A

Wildlife Fencing: none in 2009

Sampling period: *WB009*: 6/22/2009 to 11/12/2009; *EB009*: 5/21/2009 to 11/11/2009

Species documented:

WB009: 1 coyote, 4 elk, 16 humans, 24 mule deer and 1 rabbit/hare were documented; most humans documented were on the roadway in the background and not in close proximity to the camera.

EB009: 5 coyotes, 50 elk, 117 mule deer, 1 rabbit/hare, 1 red fox and 1 unknown

Summary: The two monitoring stations at this at-grade location west of Bakerville at Watrous Gulch were set up at the beginning of the season. There is human activity associated with the chain-up areas adjacent to both monitoring stations. Mule deer at the westbound (north) station may have lingered in front of the camera. Thus numbers for this species may be inflated at that station.

MP 223.5 (Overpass)

Location: west of Silver Plume

Type: bridge

Monitoring station(s): WB021 (north), EB021 (south)

Description: overpass is a bridge with a two-lane paved road with a guard rail that crosses over both lanes of I-70 and Clear Creek.

Dimensions: 7.9 m (W) x 115 m (L)

Wildlife Fencing: none in 2009

Sampling period: 9/9/2009 to 11/11/2009

Species documented:

This camera captured mostly pictures of cars or other forms of motorized vehicles. An exact total was not calculated. Below are totals for humans documented walking and other species:

WB021: 11 humans (2 domestic dogs accompanying humans not included in the count above)

EB021: 6 humans and 2 squirrels

Summary: The two monitoring stations at this overpass bridge west of Silver Plume were set up late in the season. This overpass is a bridge with a two-lane paved road that receives intermittent traffic as humans access the jeep roads to the north that head east and west from the overpass. Access to the bridge is from a frontage road immediately to the south that receives intermittent traffic at moderately high speeds. In addition to the animals documented with cameras, elk and bighorn sheep tracks were recorded near the bridge. There is human activity associated with this site. Some humans may have been documented more than once at both monitoring stations.

MP 236.2 (Underpass)

Location: between Downieville and Fall River Road

Type: concrete box culvert

Monitoring station(s): WB010 (north)

Description: culvert with Spring Gulch Road, a dirt road, running through it

Dimensions:

Westbound entrance (north): 5 m (W) x 4.7 m (H) x 42.3 m (L)

Eastbound entrance (south): 5 m (W) x 4.4 m (H) x 42.3 m (L)

Wildlife Fencing: none in 2009

Sampling period: 5/21/2009 to 11/12/2009

Species documented: This camera captured hundreds of pictures of cars or other forms of motorized vehicles. An exact total was not calculated. However, 105 humans were documented on foot, 6 on bikes, and 10 on horses. 6 humans were documented with domestic dogs.

Summary: The one monitoring station at this concrete box culvert between Downieville and Fall River Road at Spring Gulch Road was set up at the beginning of the season. Though the camera only documented motorized vehicles, bighorn sheep were seen at this location. However, the presence of humans at this site may limit use of this structure by wildlife.

MP 241.8 (Underpass)

Location: east of Idaho Springs

Type: bridge

Monitoring station(s): WB011 (north), EB011 (south)

Description: bridge where both the east- and westbound lanes of I-70 cross Clear Creek; both monitoring stations were located on the east side of the creek on a 15.5 meter wide flat dirt area that allows for animal passage under the bridge.

Dimensions: 57.5 m (W) x 5 m (H) (from top of embankment) x 36 m (L)

Wildlife Fencing: none in 2009

Sampling period: 5/21/2009 to 11/11/2009

Species documented:

WB011: 1 gray fox, 4 humans, 52 mule deer, 1 raccoon and 9 red foxes

EB011: 1 black bear, 8 humans, 140 mule deer, 6 raccoons, 15 red foxes and 6 unknown

Summary: The two monitoring stations under the bridge east of Idaho Springs were set up at the beginning of the season. Both monitoring stations were located on the east side of the creek on a 15.5 meter wide flat dirt area that allows for animal passage under the bridge. On the south side of the bridge, wildlife movement is restricted by Clear Creek. A small road with access to county property/storage is located on west side of creek. In addition to the animals documented with cameras, coyote, fox and several mule deer tracks and bighorn sheep scat were recorded near the bridge.

MP 244.9 (No structure)

Location: east of the junction of US 6 to Golden through Clear Creek Canyon

Type: fill slope

Monitoring station(s): EB012 (south)

Description: No additional description

Dimensions: approx. 9 m (H) x 167 m (imprint of fill slope)

Wildlife Fencing: none in 2009

Sampling period: 5/21/2009 to 11/11/2009

Species documented: 16 humans, 120 mule deer and 1 unknown

Summary: The one monitoring station east of the junction of US 6 to Golden through Clear Creek Canyon was set up at a fill slope at the beginning of the season. In addition to the animals documented with the camera at this site, mule deer tracks and a snake were documented at the site. There are scattered homes to the south of the highway.

MP 248.2 (No structure)

Location: near the Beaver Brook/Floyd Hill exit

Type: fill slope

Monitoring station(s): WB017 (north), EB017 (south)

Description:

WB017: camera set up at bottom of fill slope

EB017: camera set up two-thirds down fill slope; small pipe with ephemeral flows at base of fill

Dimensions:

WB017: fill slope with larger imprint than EB017 (measurements only taken at EB017)

EB017: approx. 10 m (H) x 75 m (imprint of fill slope)

Wildlife Fencing: none in 2009

Sampling period: *WB017*: 6/10/2009 to 11/12/2009; *EB017*: 6/10/2009 to 11/11/2009

Species documented:

WB017: 5 elk, 1 human, 149 mule deer and 2 unknown

EB017: 1 mule deer and 1 unknown

Summary: The two monitoring stations near the Beaver Brook/Floyd Hill exit were set up at fill slopes at the beginning of the season. Equipment difficulties hindered data collection at EB017. There is a house and parking area at the base of the fill slope that is north of the highway. Mule deer at the westbound (north) station may have lingered in front of the camera. Thus numbers for this species may be inflated at that station.

MP 250.2 (No structure)

Location: west of the junction with US40 and the El Rancho/Evergreen Parkway exit

Type: fill slope

Monitoring station(s): WB016 (north), EB016 (south)

Description:

WB016: camera set up halfway down fill slope

EB016: camera set up on small flat area at the base of a fill slope

Dimensions:

WB016: measurements only taken at EB016

EB016: approx. 13 m (H) x 176 m (imprint of fill slope)

Wildlife Fencing: none in 2009

Sampling period: *WB016:* 6/10/2009 to 11/12/2009; *EB016:* 6/10/2009 to 11/11/2009

Species documented:

WB016: no animals detected

EB016: 2 black bears, 3 coyotes, 7 elk, 27 mule deer, 15 rabbits/hares, 3 squirrels, 1 striped skunk and 1 unknown

Summary: The two monitoring stations west of the junction with US40 and the El Rancho/Evergreen Parkway exit were set up at fill slopes at the beginning of the season. Equipment difficulties hindered data collection at WB016. There are several residences at the base of the fill slope that is south of the highway. There is a chain station at the top of the fill slope that is north of the highway. Elk and mule deer tracks and elk scat were detected near EB016 (south).

MP 251.8 (No structure)

Location: *WB015:* just east of the Evergreen Parkway exit; *EB015:* just west of the Chief Hosa exit

Type: fill slope

Monitoring station(s): WB015 (north), EB015 (south)

Description:

WB015: camera set up at base of fill slope

EB015: camera set up on top of broad fill with retaining wall across top

Dimensions:

WB015: smaller imprint than EB015 (measurements only taken at EB015)

EB015: approx. 11.5 m (H) x 244 m (imprint of fill slope)

Wildlife Fencing: none in 2009

Sampling period: *WB015:* 6/10/2009 to 11/12/2009; *EB015:* 6/10/2009 to 11/11/2009

Species documented:

WB015: 1 bird, 1 black bear, 2 bobcats, 4 coyotes, 1 elk, 2 gray foxes, 134 mule deer, 1 raccoon, 1 red fox and 1 unknown

EB015: 31 elk, 11 mule deer and 1 unknown

Summary: The monitoring stations just east of the Evergreen Parkway exit (for the southern station) and just west of the Chief Hosa exit (for the northern station) were set up at fill slopes at the beginning of the season. There are a few residences beyond the base of the fill slope that is north of the highway. In addition to the animals documented with cameras, elk and mule deer tracks were detected near the station to the south of the highway. Mule deer at the westbound (north) station

may have lingered in front of the camera. Thus numbers for this species may be inflated at that station. Mule deer were seen on the north side of the highway.

MP 254.5 (No structure)

Location: just east of the junction with US 40 at the Genesee Park/Buffalo Overlook exit

Type: fill slope

Monitoring station(s): WB014 (north), EB014 (south)

Description:

WB014: camera set up near pipe culvert and stream adjacent to large meadow at base of broad, open fill slope

EB014: camera set up near pipe culvert and stream adjacent to large meadow at base of long, steep fill slope

Dimensions:

WB014: measurements only taken at EB014

EB014: approx. 12 m (H) x 157 m (imprint of fill slope)

Wildlife Fencing: none in 2009

Sampling period: *WB014:* 6/10/2009 to 11/12/2009; *EB014:* 6/10/2009 to 11/11/2009

Species documented:

WB014: 3 birds, 6 coyotes, 7 elk, 48 mule deer and 1 unknown

EB014: 24 coyotes, 33 elk, 1 human, 8 mule deer, and 1 unknown

Summary: The monitoring stations just east of the junction with US 40 at the Genesee Park/Buffalo Overlook exit were set up at fill slopes at the beginning of the season. In addition to the animals documented with cameras, elk tracks and scat were recorded near the station to the south of the highway. There are scattered residences to the north and south of the monitoring stations at this location.

MP 255.3 (No structure)

Location: just west of the Lookout Mountain/Cabrini Shrine exit

Type: fill slope

Monitoring station(s): WB013 (north), EB013 (south)

Description:

WB013: camera set up near pipe culvert and stream at base of fill slope

EB013: camera set up midway down steep fill slope

Dimensions:

WB013: approx. 16 m (H) x 140 m (imprint of fill slope)

EB013: approx. 15 m (H) x 100 m (imprint of fill slope)

Wildlife Fencing: none in 2009

Sampling period: *WB013:* 6/10/2009 to 11/12/2009; *EB013:* 6/10/2009 to 11/11/2009

Species documented:

WB013: 1 bird, 3 elk, 3 humans and 21 mule deer

EB013: No animals detected

Summary: The monitoring stations just west of the Lookout Mountain/Cabrini Shrine exit were set up at fill slopes at the beginning of the season. Equipment difficulties hindered data collection at each station at this site. In addition to the animals documented with cameras, elk and mule deer tracks were recorded near the station to the north of the highway. Mule deer at the westbound

(north) station may have lingered in front of the camera. Thus numbers for this species may be inflated at that station. There are residences to the north of the highway.

PRELIMINARY RESULTS

ALL SPECIES

Between May 20, 2009 and November 12, 2009, we documented the following species throughout the study area: 2529 mule deer, 195 elk, 96 coyote, 41 red fox, 29 black bear, 28 rabbit/hare, 12 marmot, 11 raccoon, 5 badger, 3 gray fox, 2 porcupine, 2 bobcat, 2 striped skunks, 1 mountain lion, and 1 moose. The number of images taken (only counting photographs, not counting individuals in each photograph) for each species are: 1939 mule deer, 174 elk, 92 coyote, 41 red fox, 29 black bear, 28 rabbit/hare, 12 marmot, 10 raccoon, 5 badger, 3 gray fox, 2 porcupine, 2 bobcat, 2 striped skunk, 1 mountain lion and 1 moose. Domesticated animals documented include dogs, cats, horses, donkeys/pack mules, cattle and goats. The following graphs show the number of animals detected standardized by the number of sample nights for each site in the study area where the identified animals were detected. Though this study year does include one monitoring location on west Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now CNE) from 2006 to 2008. See the *Data Caveats* section for more information on these data.

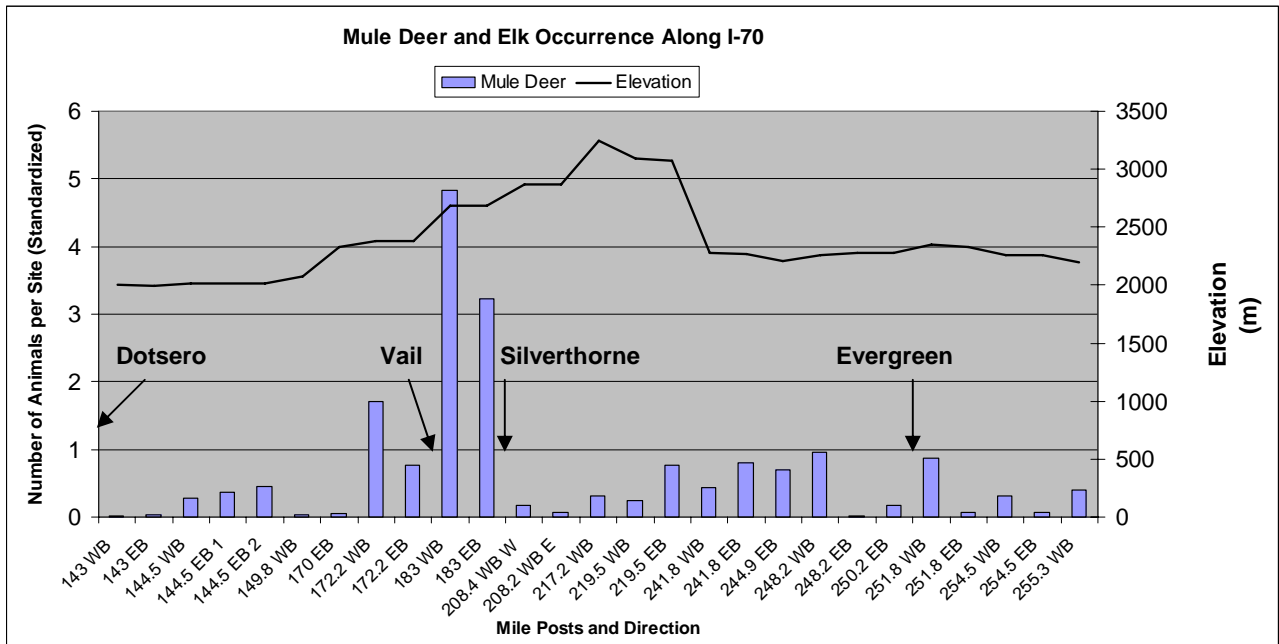


Figure 1 – Number of mule deer and elk detected

*Of the sites listed above, equipment difficulties hindered data collection at 143 WB, 144.5 EB 2, 248.2 EB, and 255.3 WB.

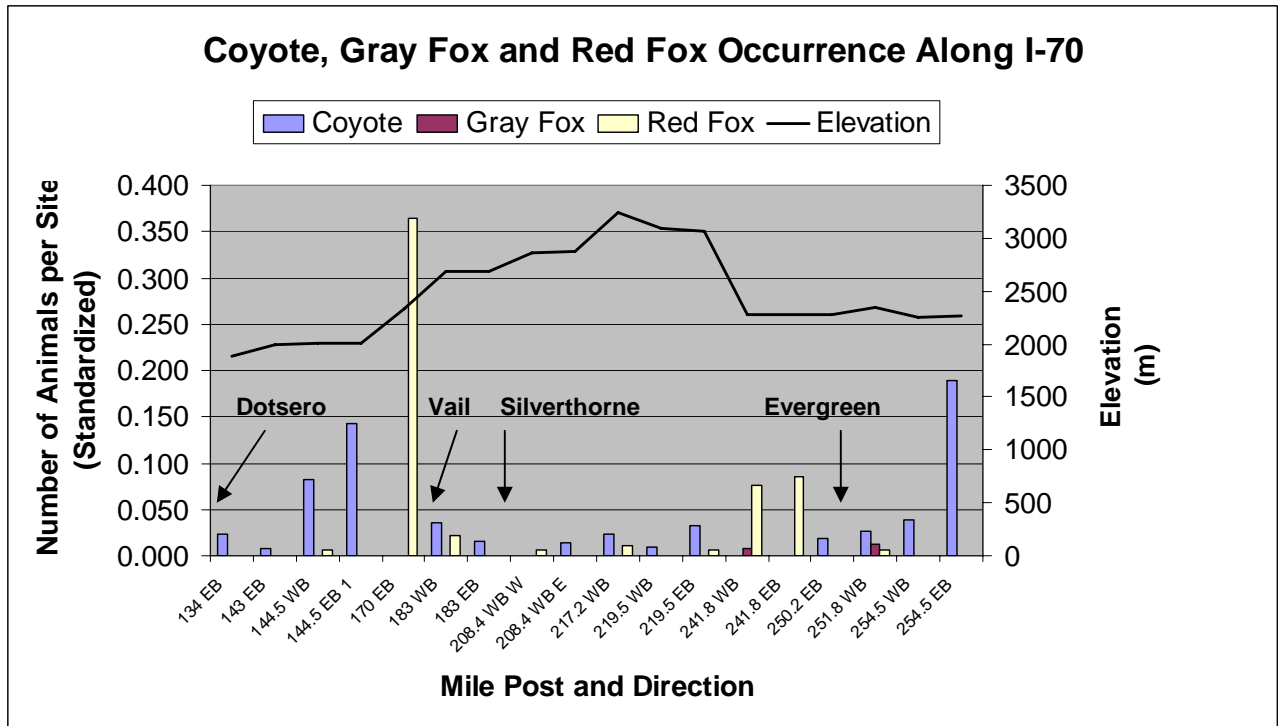


Figure 2 – Number of coyote, gray fox and red fox detected
 *Of the sites listed above, equipment difficulties hindered data collection at 134 EB.

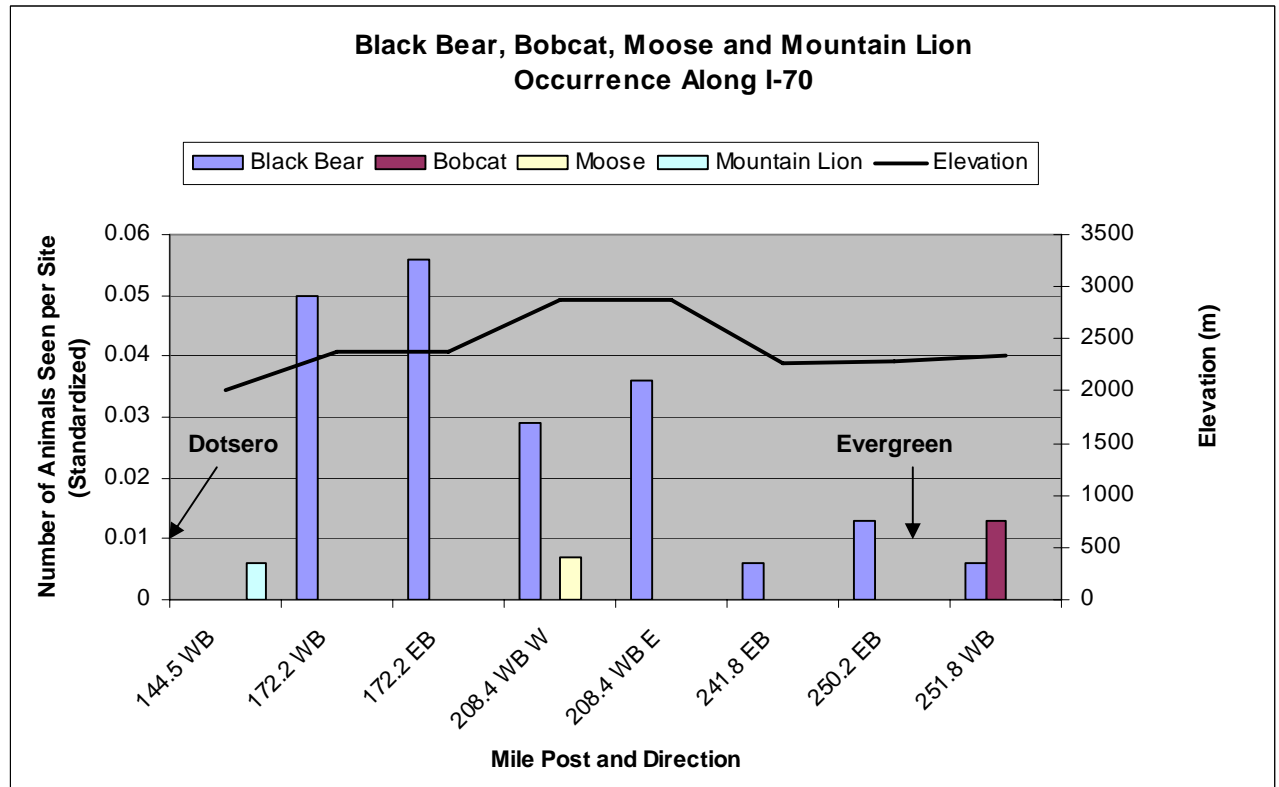


Figure 3 – Number of black bear, bobcat, moose and mountain lion detected

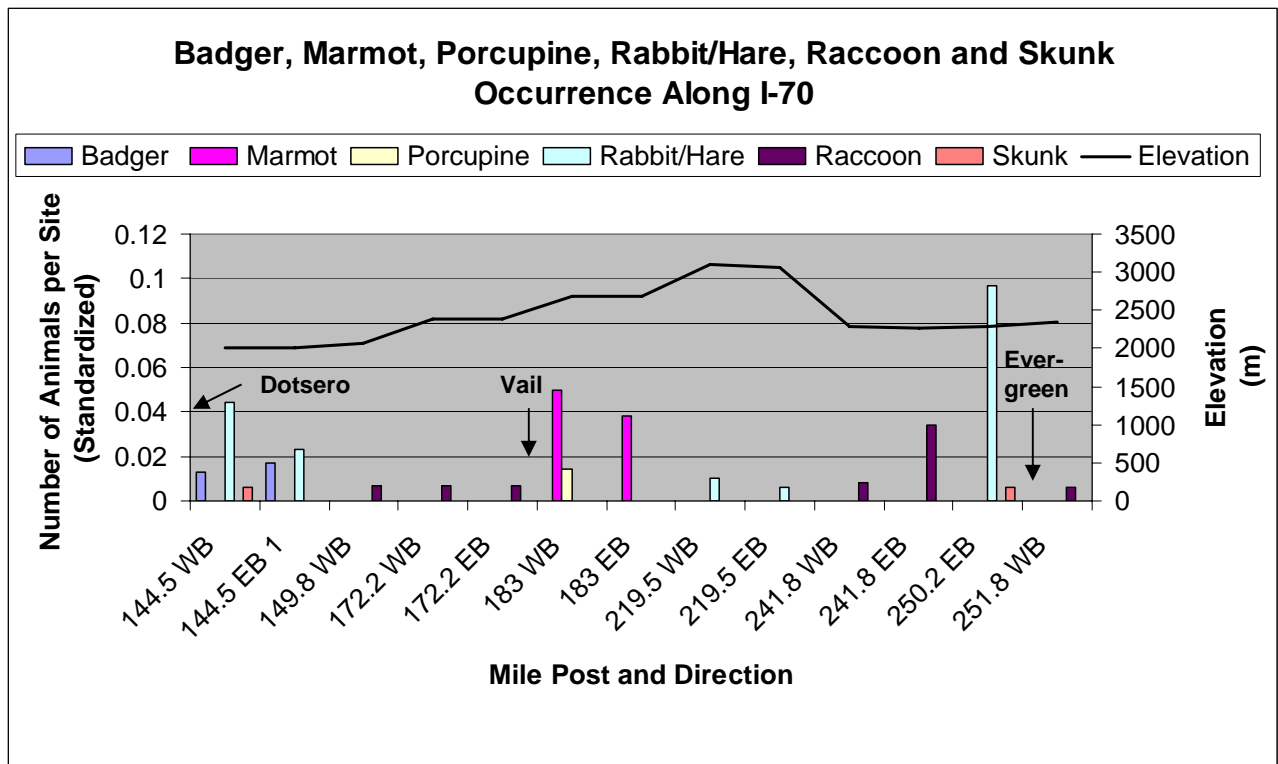


Figure 4 – Number of badger, marmot, porcupine, rabbit/hare, raccoon and skunk detected

MULE DEER AND ELK

We documented 2529 mule deer and 195 elk throughout the study area. The largest percentage of mule deer, over 25%, was documented at the westbound (north) station at mile post 183 on west Vail Pass. The structure at this site is a divided bridge, and the corresponding eastbound (south) station at mile post 183 had the second largest percentage of mule deer, a little less than 20%. It should be noted that mule deer at these two stations lingered under the bridge spans to forage. Thus numbers for this species are likely inflated at this site. The largest percentage of elk, slightly less than 25%, was documented at mile post 119.5 at the eastbound (south) station. The following graphs show the proportion of mule deer and elk use throughout the study area. These percentages were determined based on the number of animals detected standardized by the number of sample nights. Though this study year does include one monitoring location on west Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now CNE) from 2006 to 2008. See the *Data Caveats* section for additional information on these data.

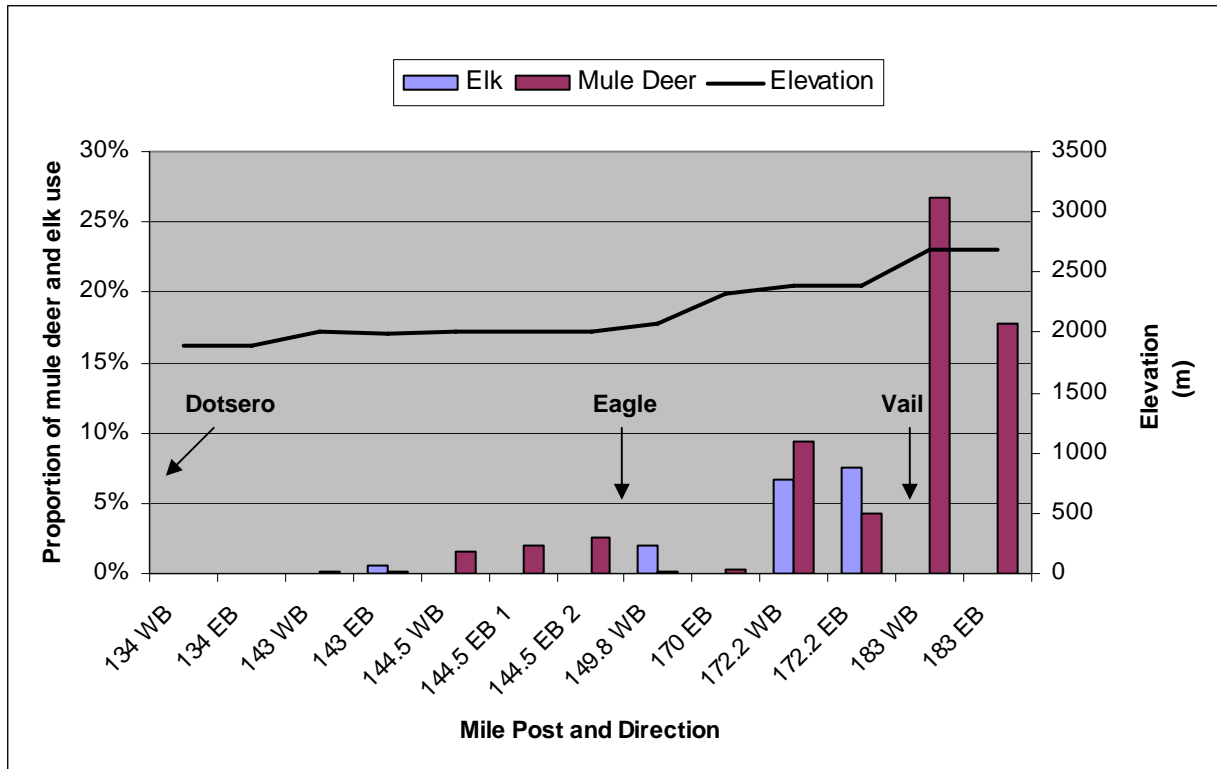


Figure 5 – Proportional level of mule deer and elk use at MP 134 – 183 (West of Dotsero to West Vail Pass)
 *Of the sites listed above, equipment difficulties hindered data collection at 134 WB, 134 EB, 143 WB, and 144.5 EB 2.

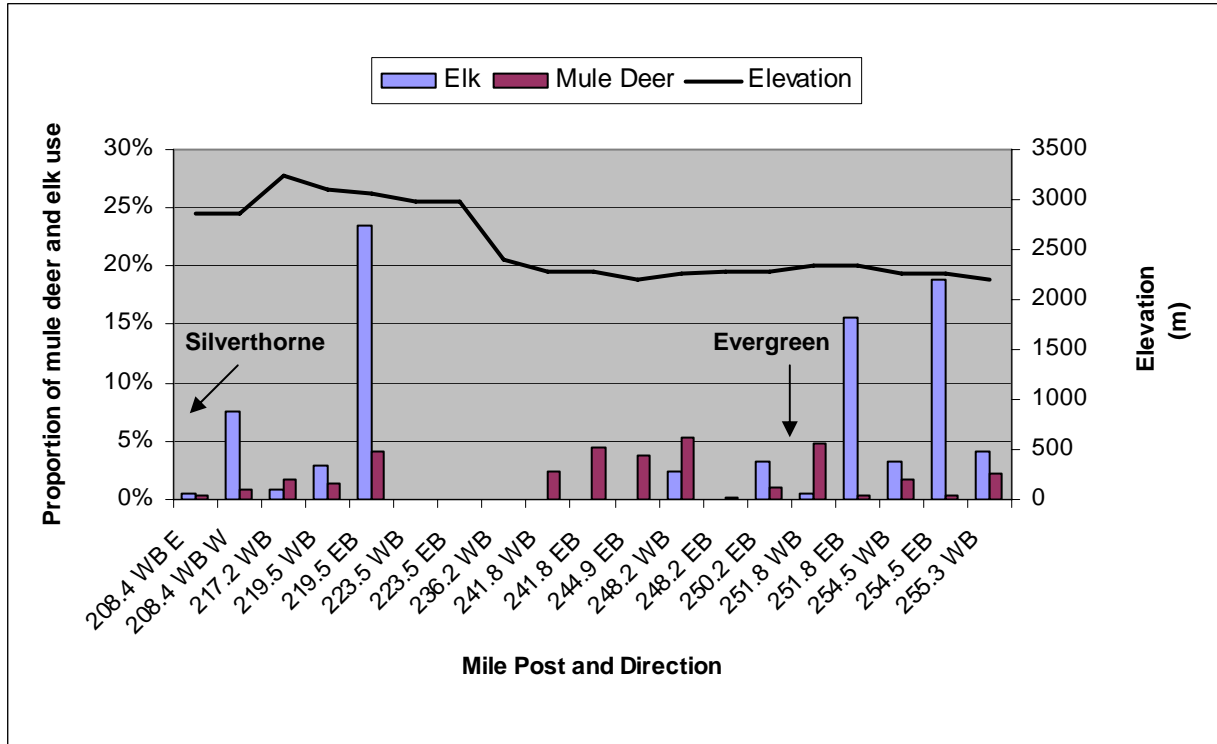


Figure 6 – Proportional level of mule deer and elk use at MP 208.4 – 255.3 (Laskey Gulch to Genessee)
 *Of the sites listed above, equipment difficulties hindered data collection at 248.2 EB and 255.3 WB. 250.2 WB and 255.3 EB are not represented due to equipment difficulties which resulted in no data recovery.

Mule Deer - Structured and Non-Structured Sites by Month

Thirteen mile post locations had corresponding monitoring stations set up on both the west- (north) and eastbound (south) side of the interstate. Seven of these sites have a structure, either a bridge or a culvert. The following graphs compare the number of mule deer detected by month at both the westbound (north) and eastbound (south) monitoring stations for each structured site where sufficient mule deer were detected. Again, the number of animals detected was standardized by the number of sampling nights. See the *Data Caveats* section for additional information on these data.

There is no evident overall trend for the sites with structures. The stations at MP 144.5 had few detections until the fall and was relatively consistent at both the east- (south) and westbound (north) stations. MP 183 and MP 241.8 had detections throughout the study session, but varied between the east- (south) and westbound (north) stations. MP 172.2 had a peak early and late in the study session and number of detections varied between the east- (south) and westbound (north) stations, although proportions remained fairly constant.

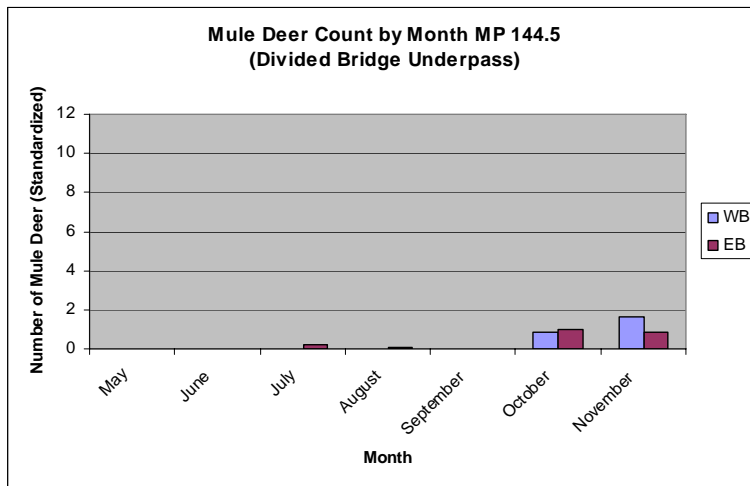


Figure 7 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 144.5 west of Eagle (EB includes data from both EB003 and EB020); Elevation – EB and WB approx. 2010m
*Equipment difficulties hindered data collection at EB020.

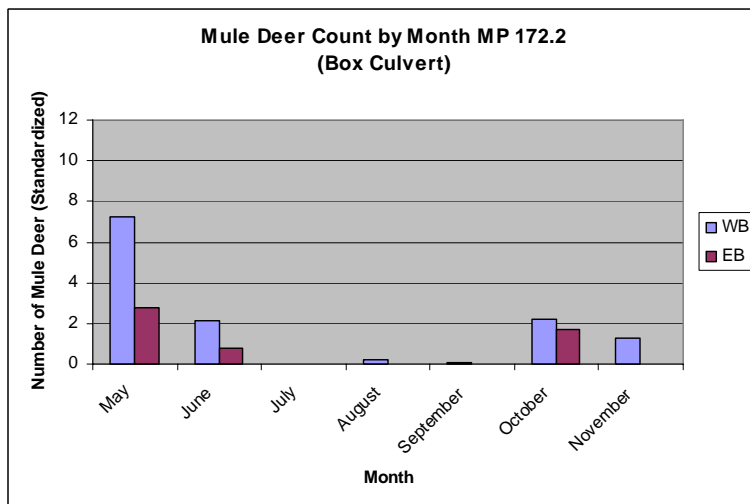


Figure 8 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 172.2 between Minturn and Vail at Dowd's Junction; Elevation – EB and WB approx. 2380m

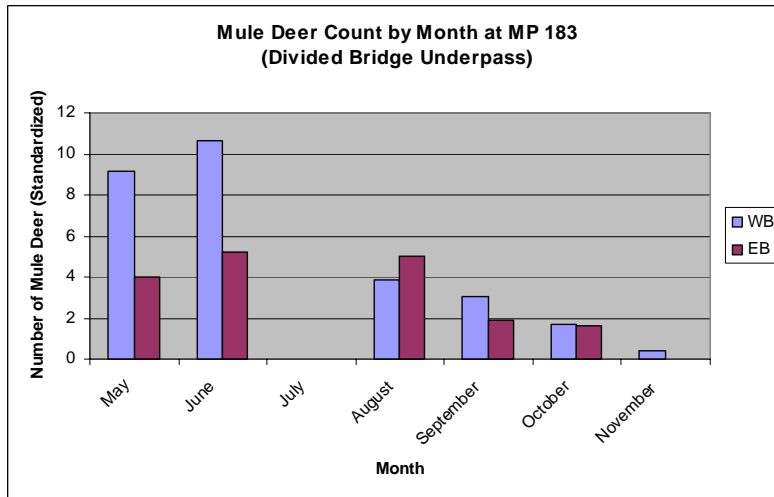


Figure 9 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 183 west of Vail about seven mile from the summit of Vail Pass; Elevation – EB and WB approx. 2680m

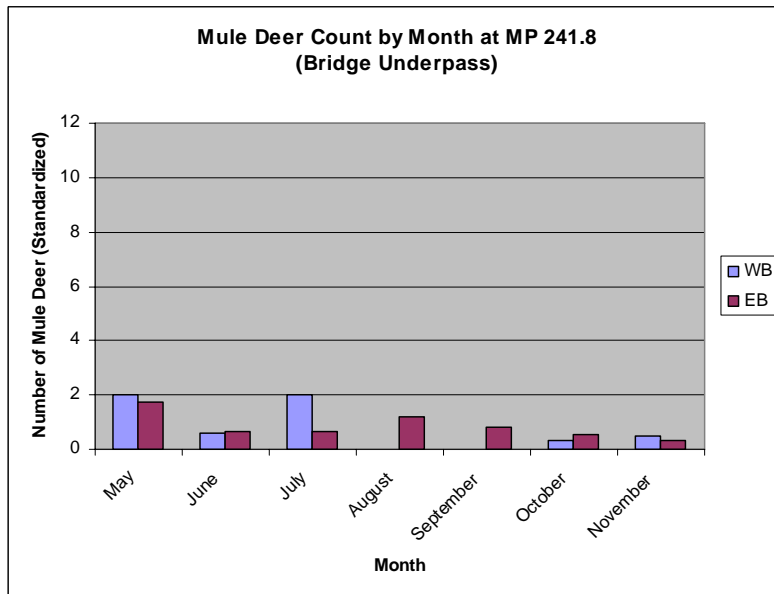


Figure 10 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 241.8 east of Idaho Springs; Elevation – EB approx. 2270m, WB approx. 2280m

Six sites did not have a structure. The following graphs compare the number of mule deer detected by month for each of the non-structured sites where mule deer were detected on both the west- (north) and eastbound (south) sides of the highway. Again, the number of animals detected was standardized by the number of sampling nights. See the *Data Caveats* section for additional information on these data.

Several months and several sites had a more mule deer detected on either the west- (north) or eastbound (south) side of I-70. Most sites saw a decrease of animals detected from spring and summer into fall. Mule deer numbers were consistently low at mile post 254.5.

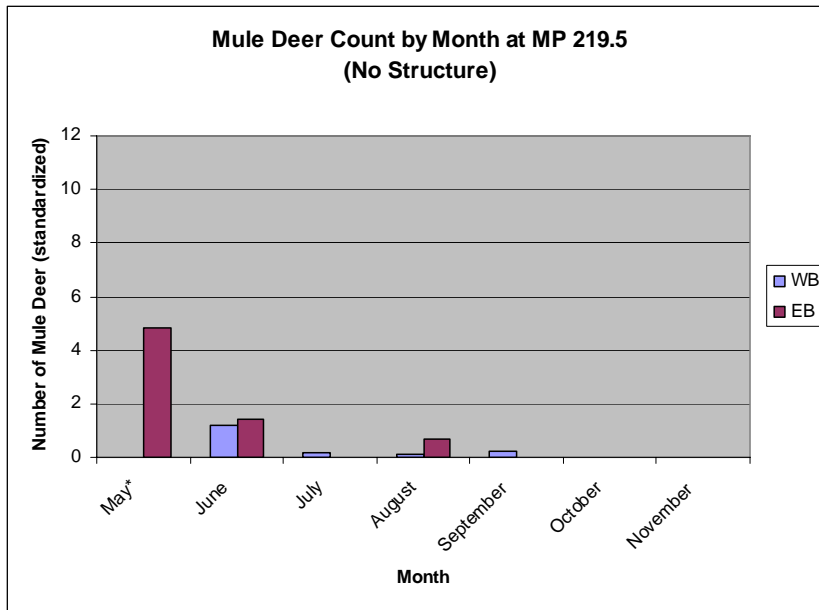


Figure 11 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 219.5 west of Bakerville at Watrous Gulch; Elevation – EB approx. 3070m, WB approx. 3090m
 *The westbound monitoring station was not set up until June at this location.

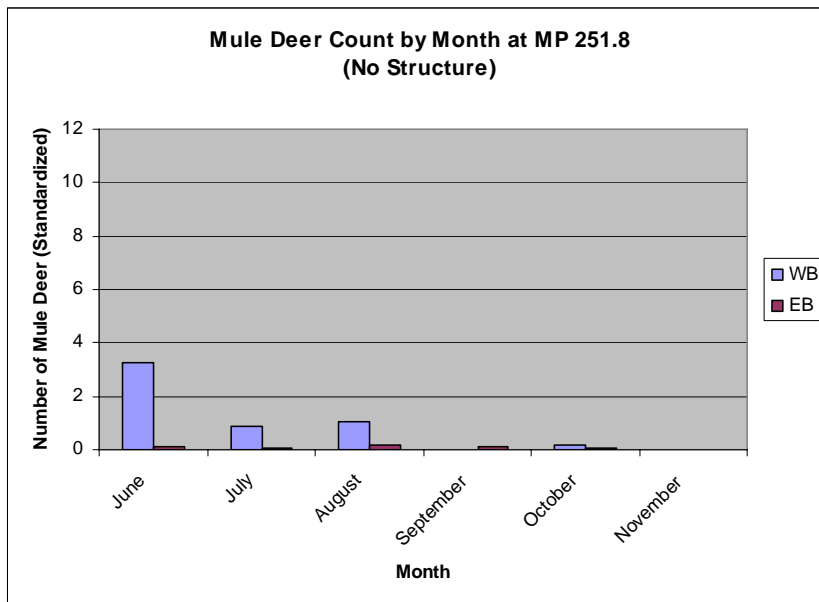


Figure 12 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 251.8 near the Chief Hosa (EB)/ Evergreen Parkway (WB) exits; Elevation – EB approx. 2330m, WB approx. 2350m

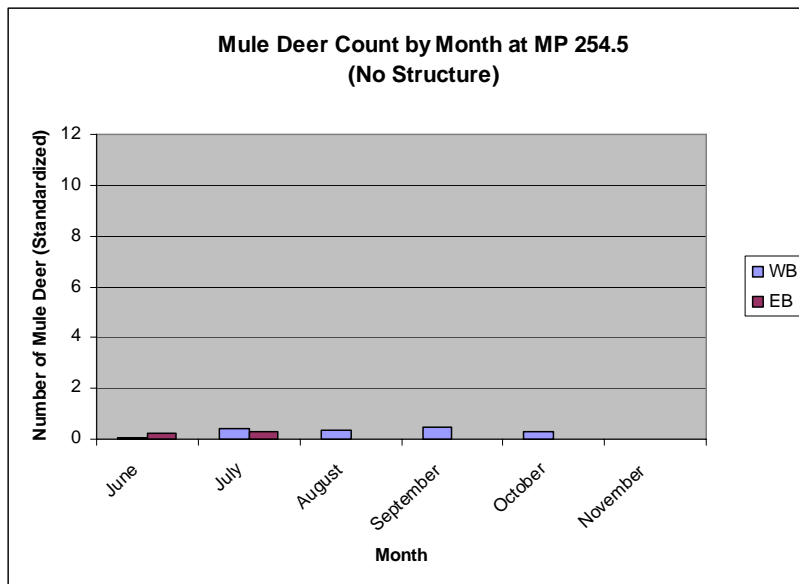


Figure 13 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 254.5 near the Genesee Park/ Buffalo Overlook exit; Elevation – EB and WB approx. 2260m

The following graphs show the total number of mule deer by month documented at east- (south) and westbound (north) sites with structures. The number of animals detected have been standardized by the number of sample nights. See the *Data Caveats* section for additional information on these data.

In general, when the data is divided out by month, sites with structures have more consistent mule deer activity on both the east- (south) and westbound (north) sides. This implies through passage, but still photographs don't confirm passage behavior. The sites without structures, on the other hand, tend to have more activity on one side than the other.

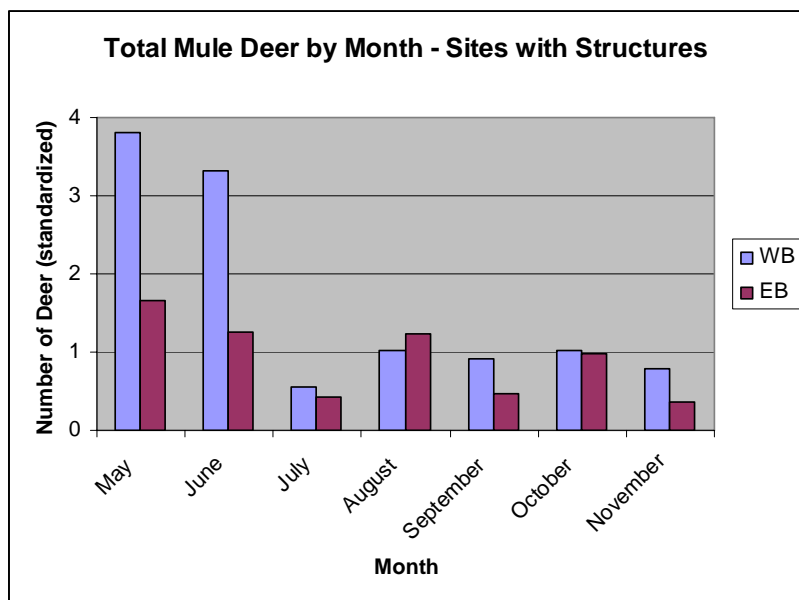


Figure 14 – Number of mule deer detected by month at eastbound and westbound monitoring sites with structures

When the data is compiled for the entire study period, the trends seen above are less obvious. The following graph shows the total number of mule deer documented at east- (south) and westbound (north) sites grouped by sites with structures and sites without structures. The number of animals detected have been standardized by the number of sample nights. For both types of sites, more mule deer were documented on the westbound side (north) of the interstate than on the eastbound (south) side. See the *Data Caveats* section for additional information on these data.

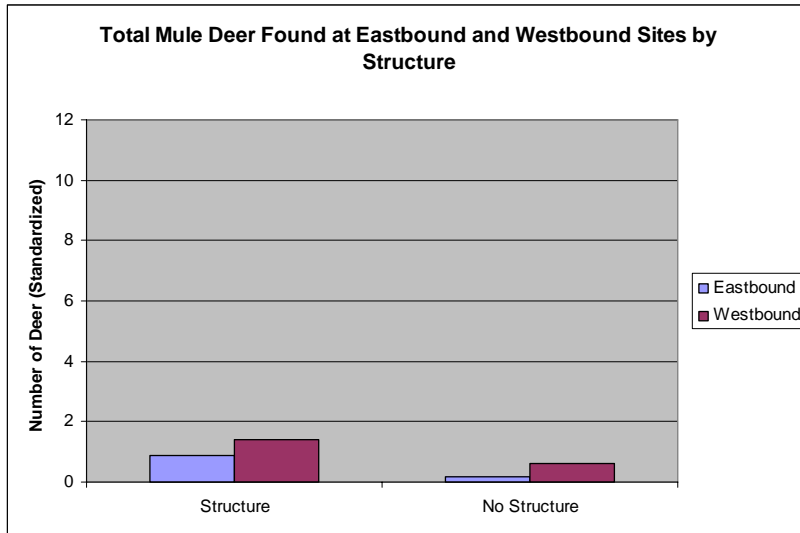


Figure 15 – Number of mule deer detected at eastbound and westbound monitoring sites with and without structures

Mule Deer by Season

The following graph shows mule deer activity by season. These numbers have been standardized by sampling night. Though this study year does include one monitoring location on west Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now CNE) from 2006 to 2008. See the *Data Caveats* section for more information on these data.

In general, mule deer in our study area tended to be more active in the spring/summer than the fall. Spring includes the months of March, April and May. Summer includes the months of June, July and August. Fall includes the months of September, October and November.

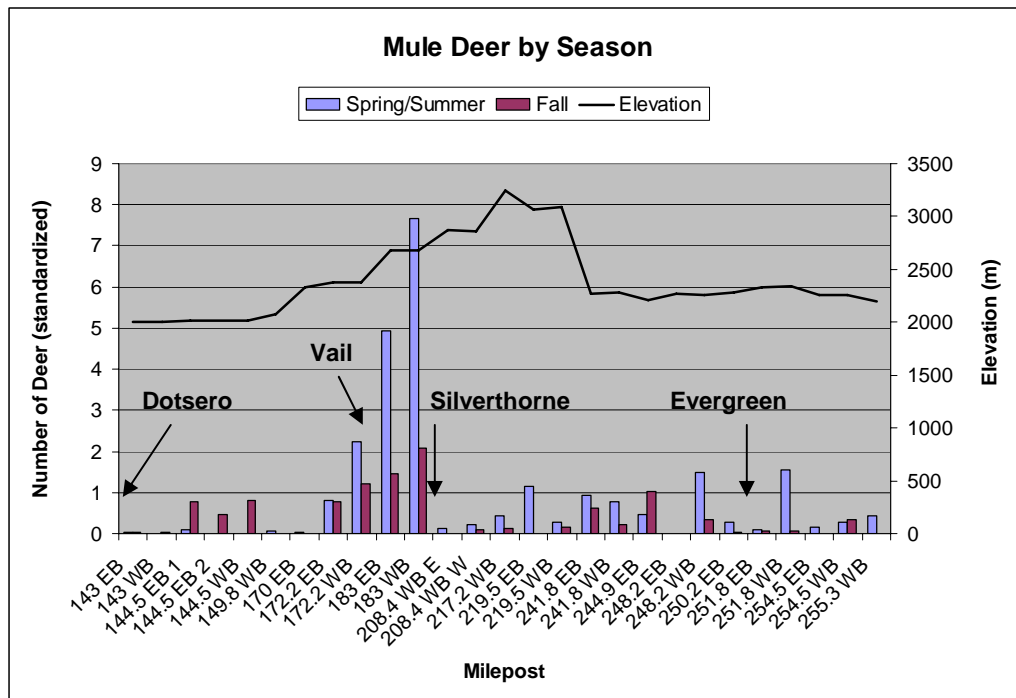


Figure 16 – Number of mule deer detected in the spring/summer and fall

*Of the sites listed above, equipment difficulties hindered data collection at 143 WB, 144.5 EB 2, 248.2 EB and 255.3 WB.

Mule Deer by Hour

The following graphs show mule deer activity by hour. These numbers have not been standardized by sampling night. In general, mule deer in our study area tended to be more active in the morning and evening hours. In the spring and summer, the sun rises sometime between 5:30-6:30am. During the same time period, the sun sets sometime between 7:30-8:30pm. In the fall, the sun rises between 6:30-7:30 am and sets between 5:30-7:30pm (not accounting for the end of Daylight Saving Time which fell two weeks before the end of our field season). See the *Data Caveats* section for additional information on these data.

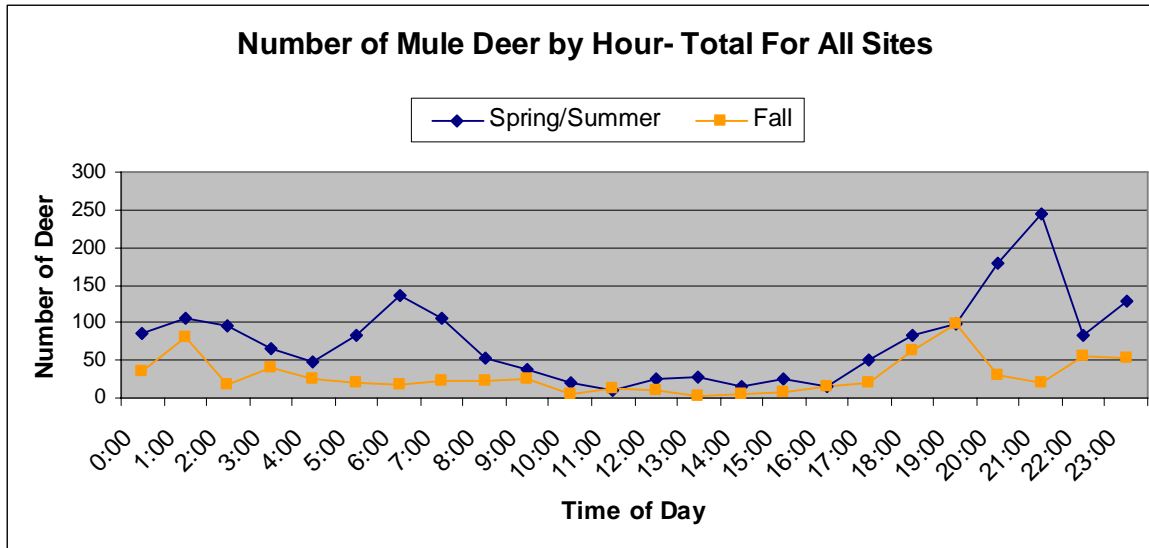


Figure 17 – Number of mule deer detected by hour across all sites

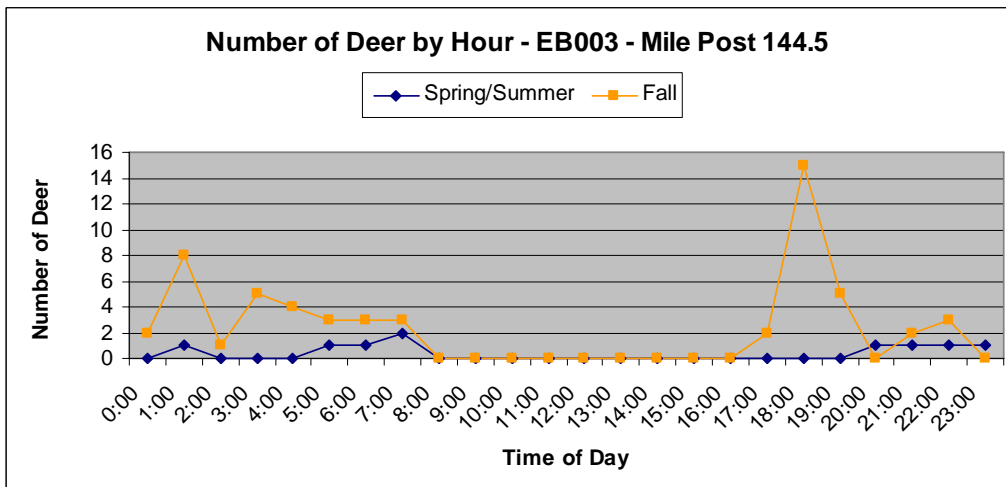


Figure 18 – Number of mule deer detected by hour at EB003, MP 144.5

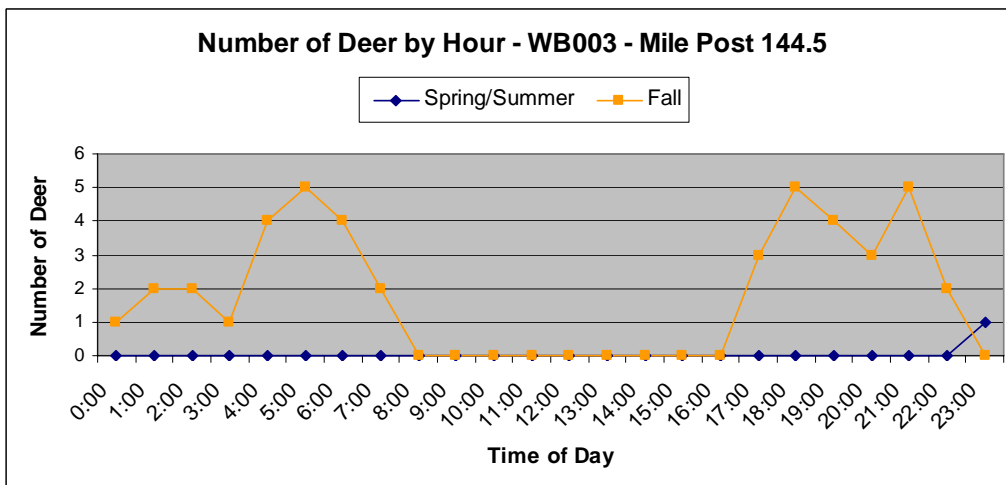


Figure 19 – Number of mule deer detected by hour at WB003, MP 144.5

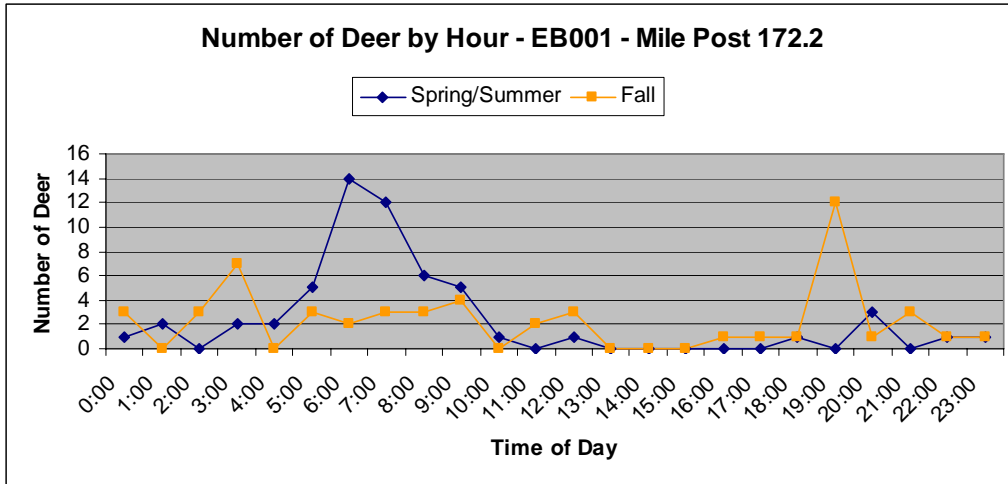


Figure 20 – Number of mule deer detected by hour at EB001, MP 172.2

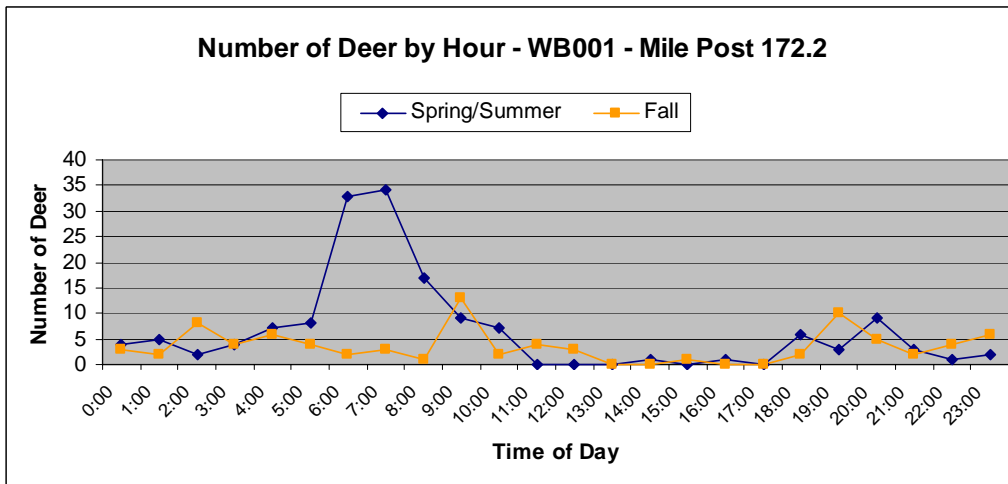


Figure 21 – Number of mule deer detected by hour at WB001, MP 172.2

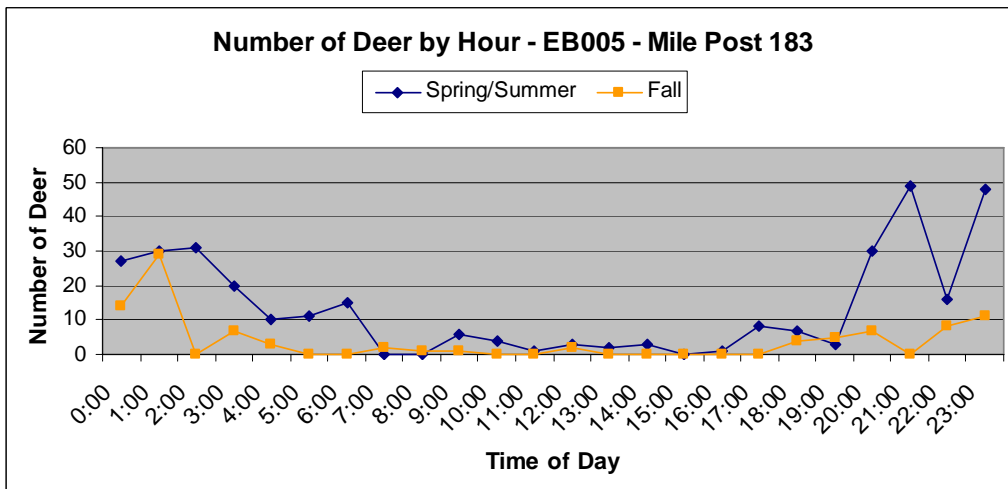


Figure 22 – Number of mule deer detected by hour at EB005, MP 183

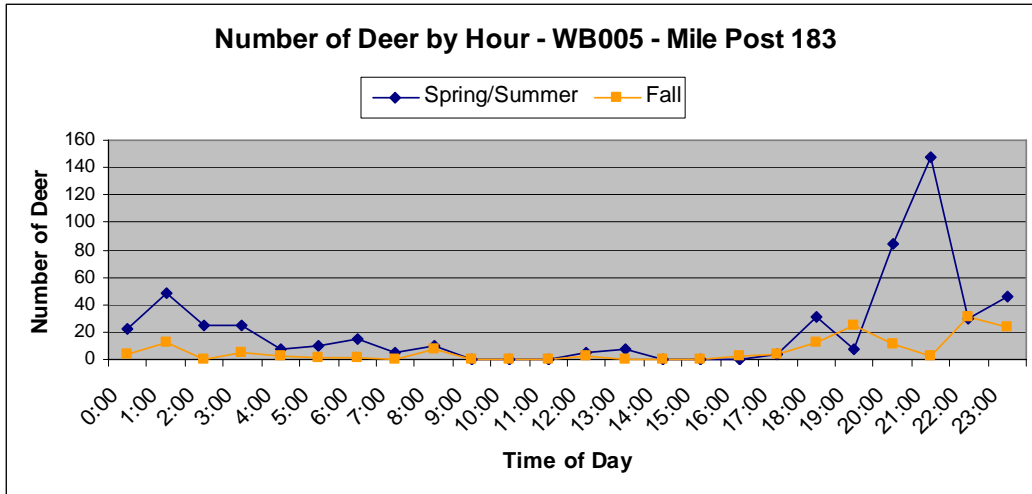


Figure 23 – Number of mule deer detected by hour at WB005, MP 183

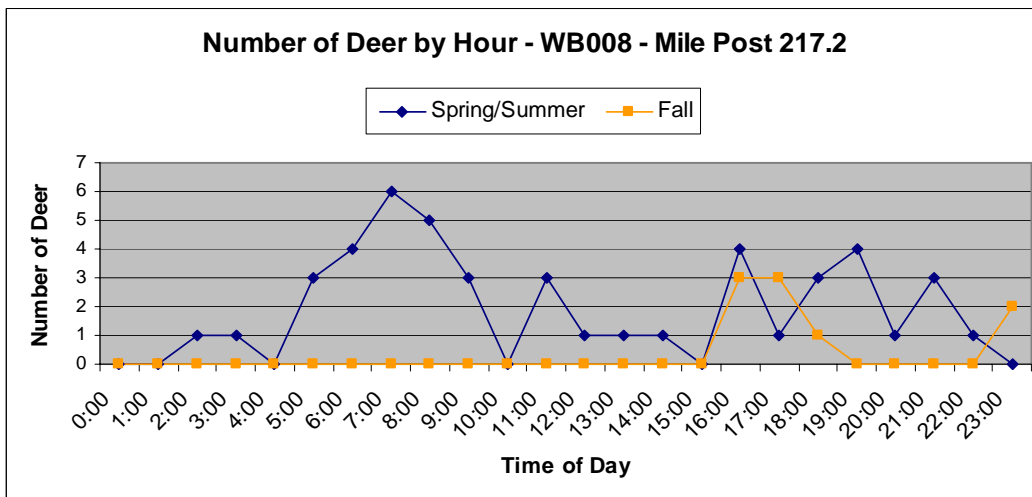


Figure 24 – Number of mule deer detected by hour at WB008, MP 217.2

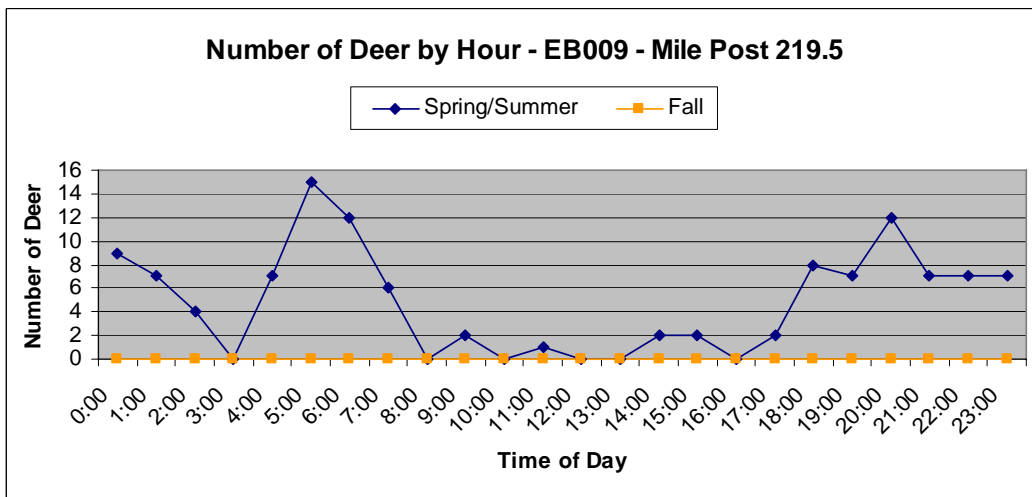


Figure 25 – Number of mule deer detected by hour at EB009, MP 219.5

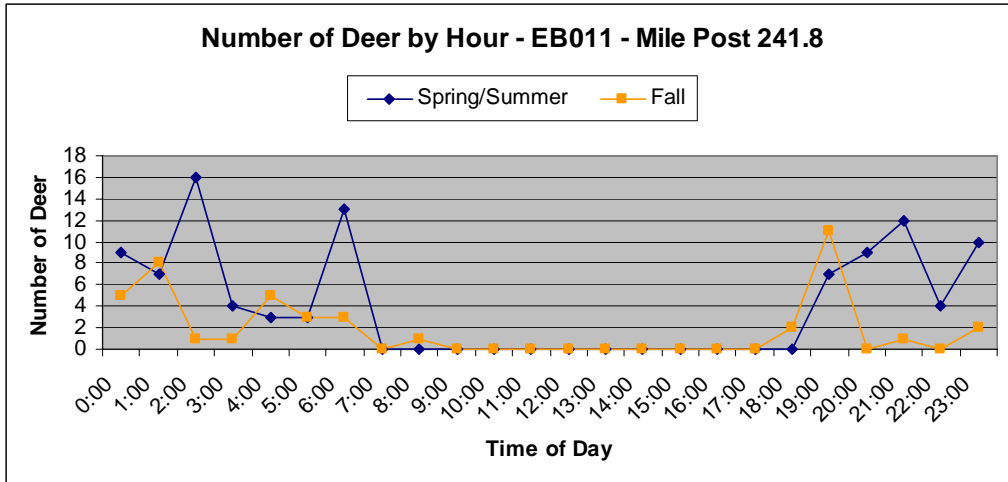


Figure 26 – Number of mule deer detected by hour at EB011, MP 241.8

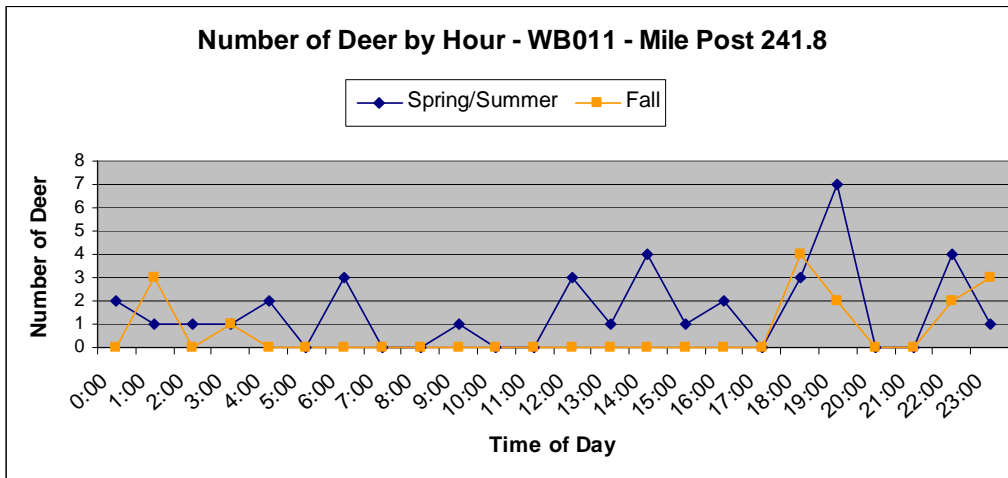


Figure 27 – Number of mule deer detected by hour at WB011, MP 241.8

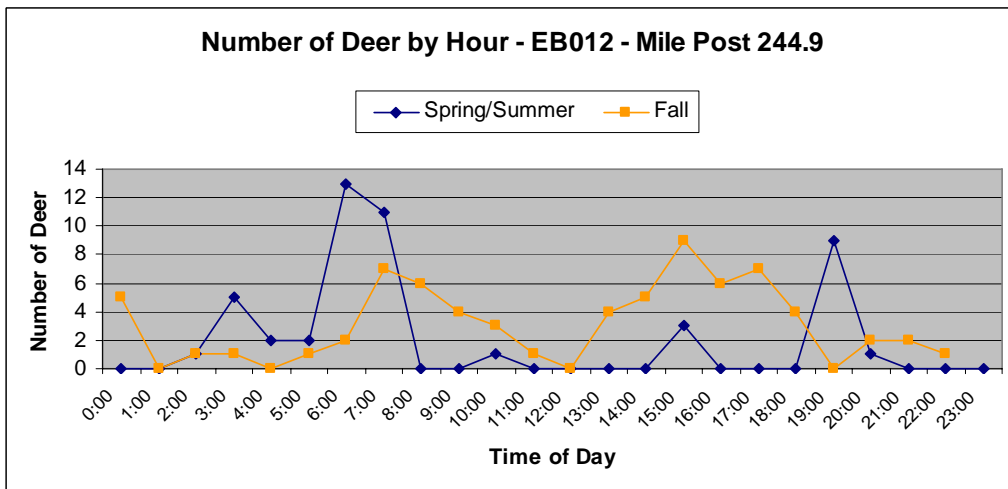


Figure 28 – Number of mule deer detected by hour at EB012, MP 244.9

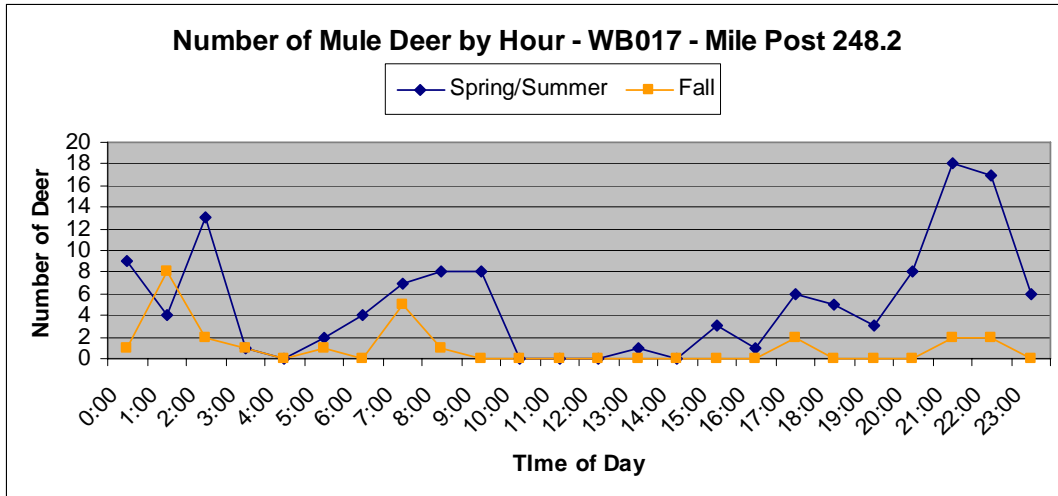


Figure 29 – Number of mule deer detected by hour at WB017, MP 248.2

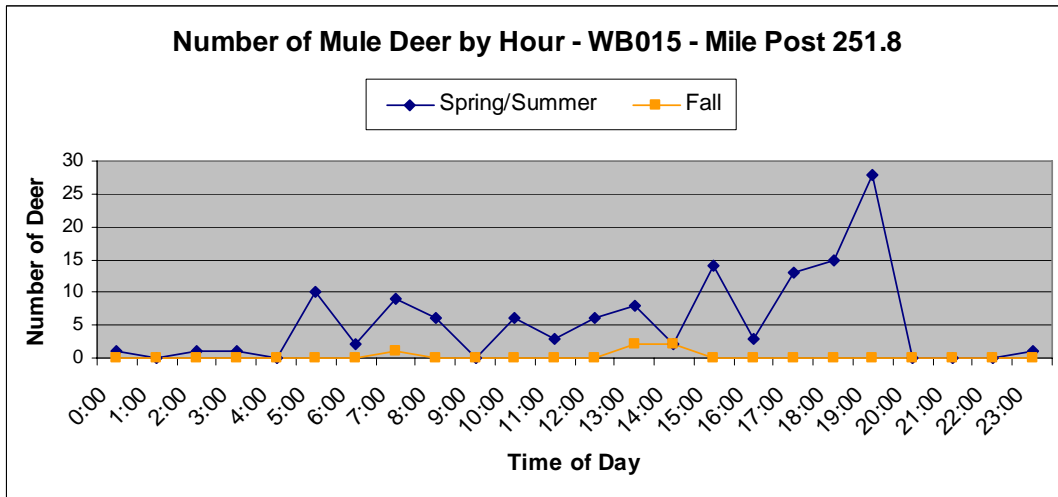


Figure 30 – Number of mule deer detected by hour at WB015, MP 251.8

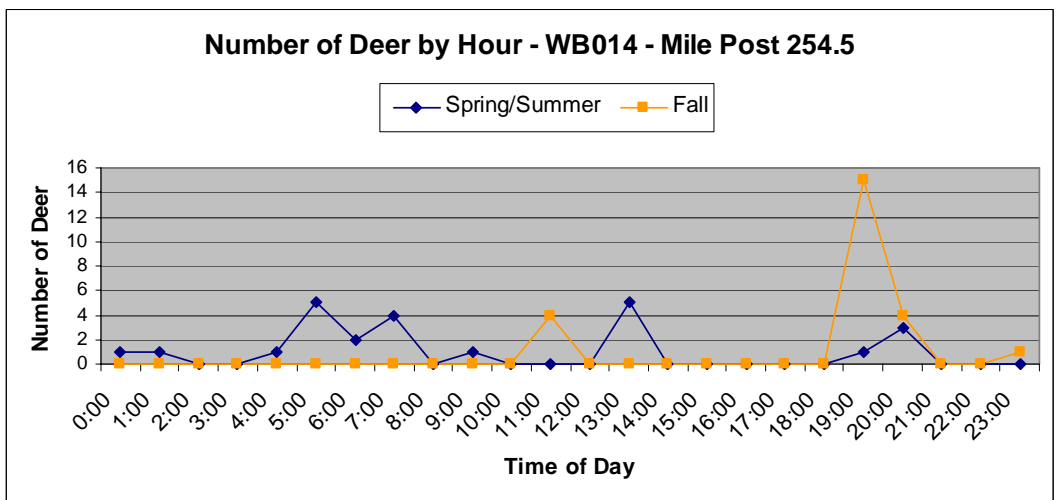


Figure 31 – Number of mule deer detected by hour at WB014, MP 254.5

Elk - Structured and Non-Structured Sites

The following graphs compare the number of elk detected at each site (structured and non-structured) where elk were detected on both the west- (north) and eastbound (south) sides of the highway. The number of animals have been standardized by the number of sample nights. See the *Data Caveats* section for additional information on these data.

One site represented, MP 172.2, had a box culvert structure; the remaining sites had no structure. Though only one site with a structure is represented in the graphs below, there is less of a difference between the east- (south) and westbound (north) stations at that site than the sites without structures. Elk were prevalent east of Idaho Springs, but none of these sites had structures.

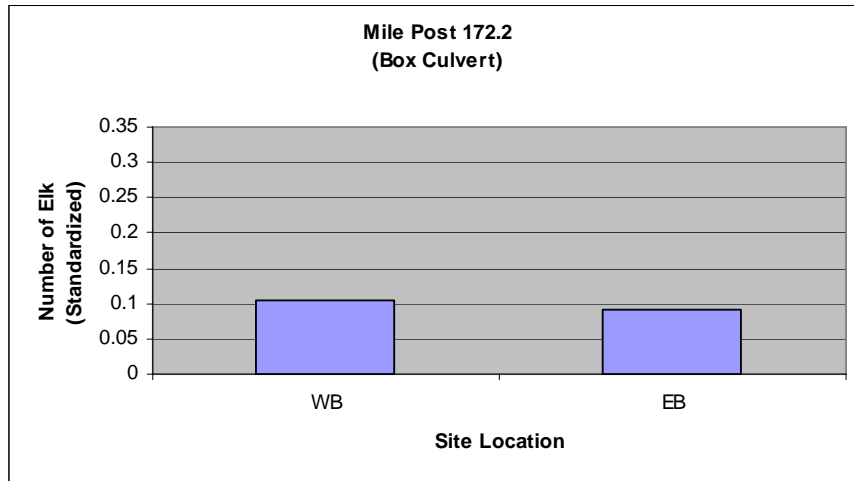


Figure 32 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 172.2

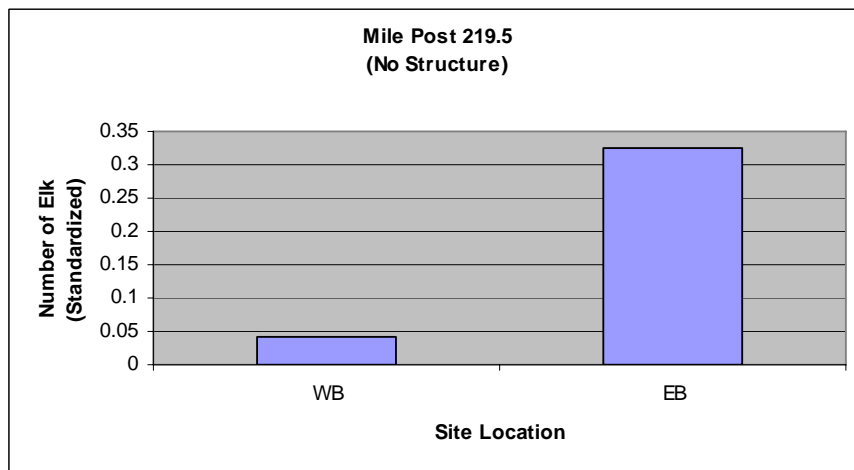


Figure 33 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 219.5

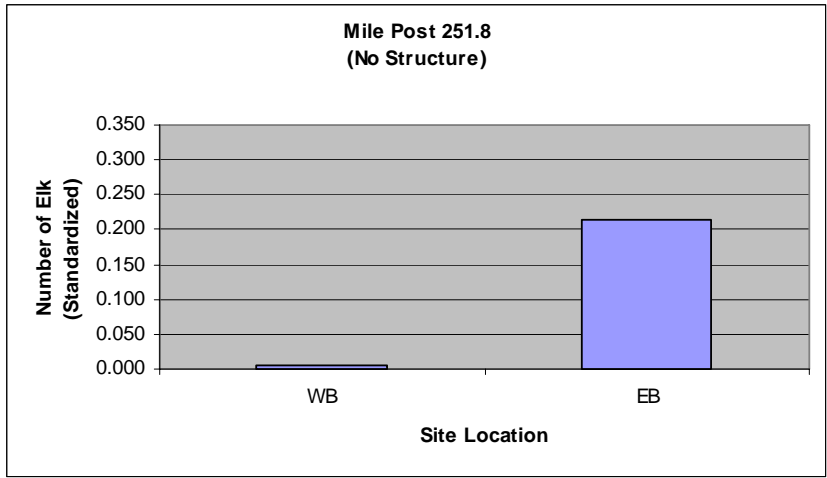


Figure 34 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 251.8

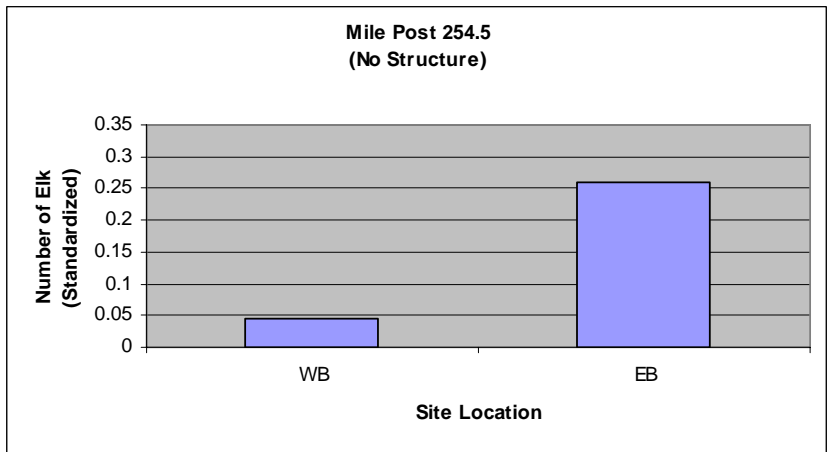


Figure 35 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 254.5

Elk by Season

The following graph shows elk activity by season. These numbers have been standardized by sampling night. Though this study year does include one monitoring location on west Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now CNE) from 2006 to 2008. See the *Data Caveats* section for additional information on these data.

In general, elk in our study area, like mule deer, tended to be more active in the spring/summer than the fall. Spring includes the months of March, April and May. Summer includes the months of June, July and August. Fall includes the months of September, October and November.

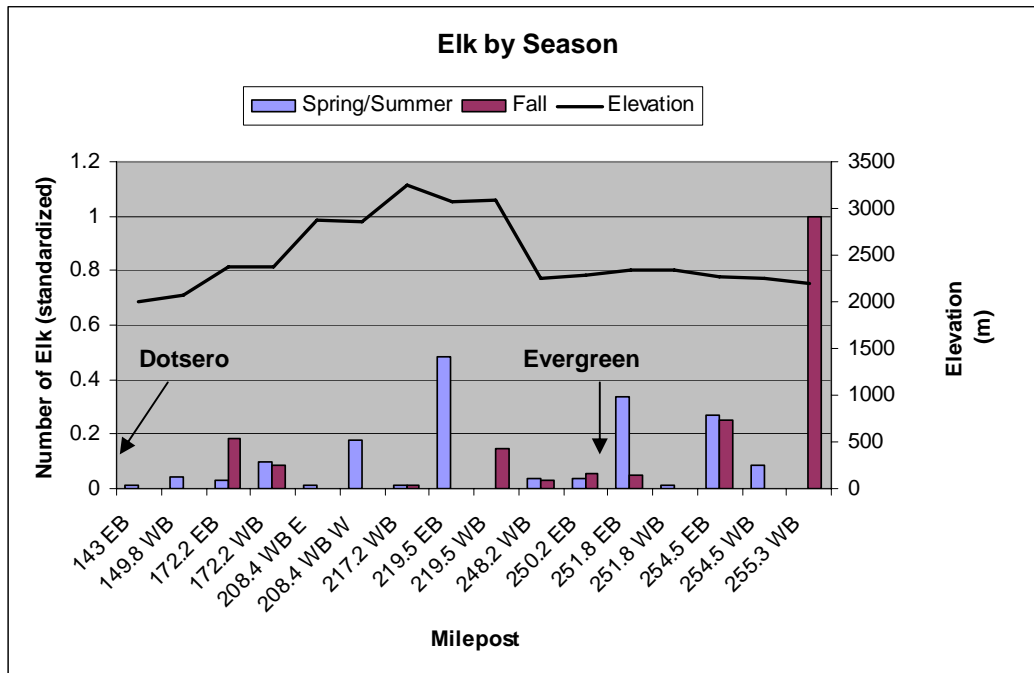


Figure 36 – Number of elk detected in the spring/summer and fall

*Of the sites listed above, equipment difficulties hindered data collection at 255.3 WB.

Elk by Hour

The following graphs show elk activity by hour. These numbers have not been standardized by sampling night. In general, elk in our study area, like mule deer, tended to be more active in the morning and evening hours. In the spring and summer, the sun rises sometime between 5:30-6:30am. During the same time period, the sun sets sometime between 7:30-8:30pm. In the fall, the sun rises between 6:30-7:30 am and sets between 5:30-7:30pm (not accounting for the end of Daylight Saving Time which fell two weeks before the end of our field season). See the *Data Caveats* section for additional information on these data.

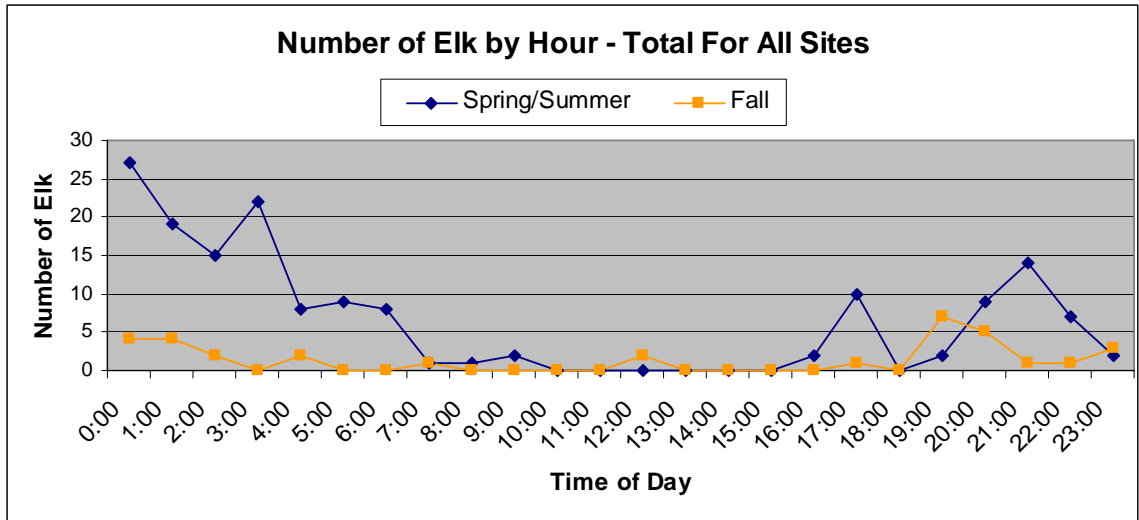


Figure 37 – Number of elk detected by hour at all sites

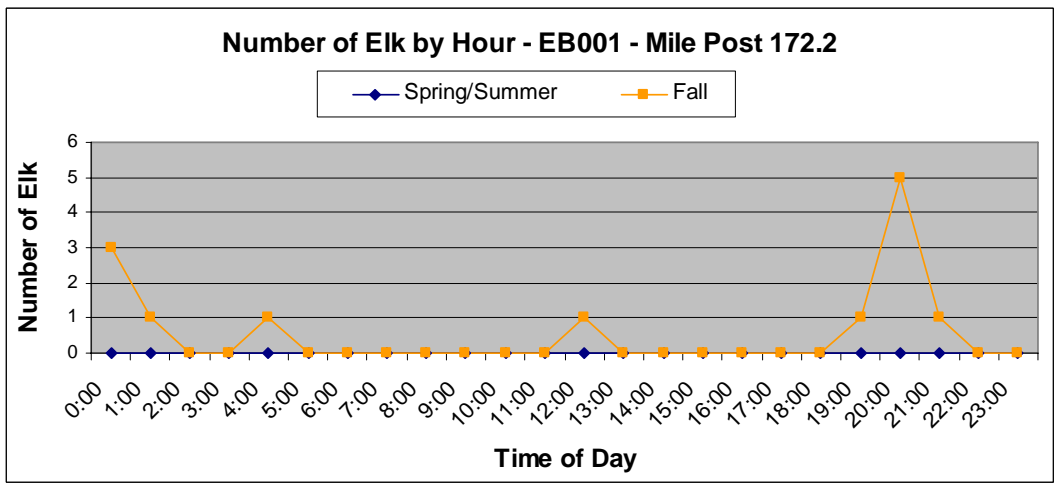


Figure 38 – Number of elk detected by hour at EB001, MP 172.2

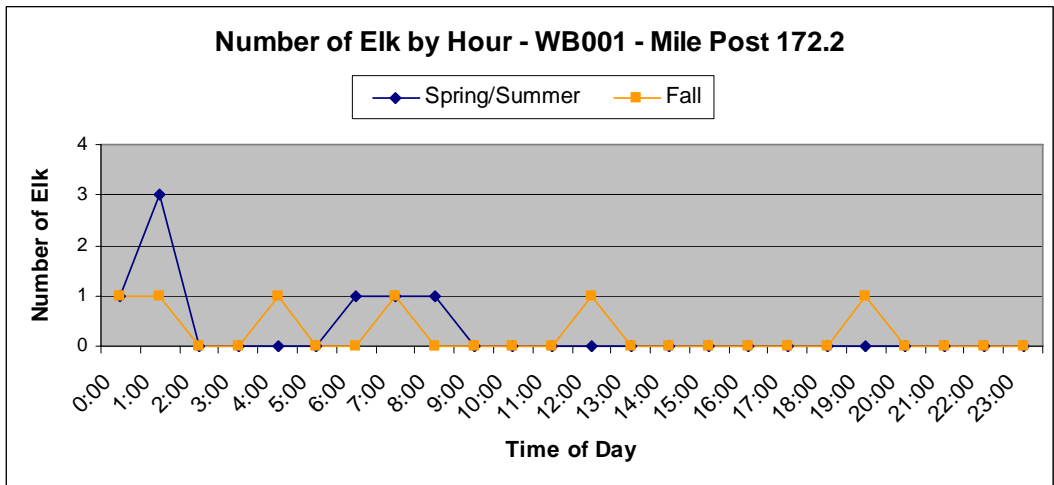


Figure 39 – Number of elk detected by hour at WB001, MP 172.2

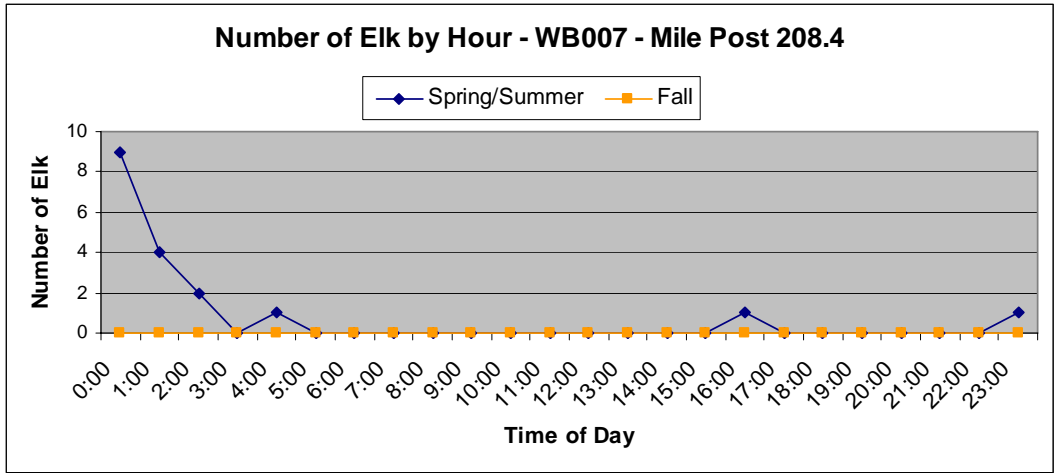


Figure 40 – Number of elk detected by hour at WB007, MP 208.4

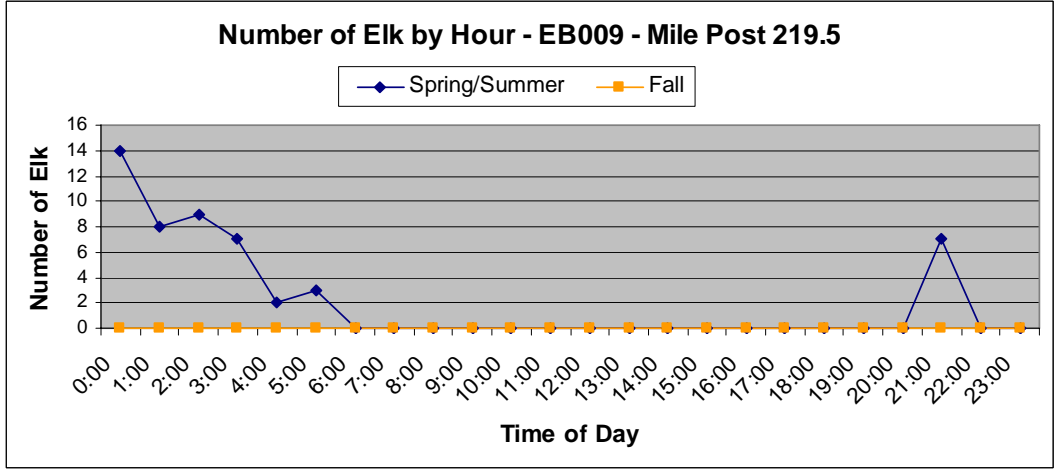


Figure 41 – Number of elk detected by hour at EB009, MP 219.5

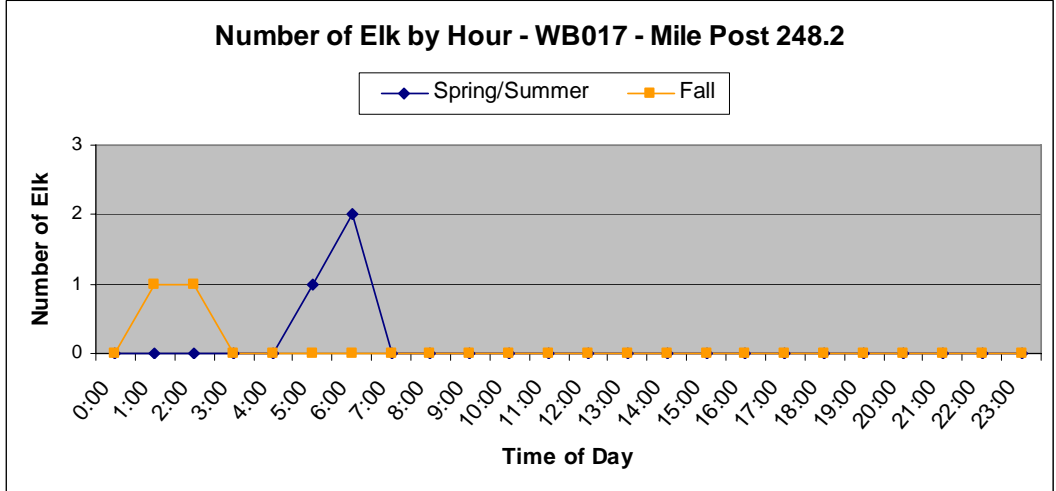


Figure 42 – Number of elk detected by hour at WB017, MP 248.2

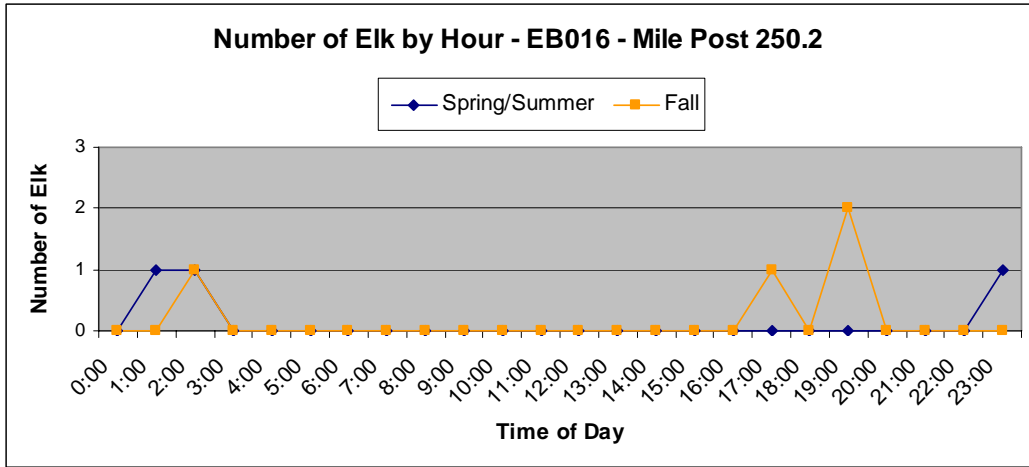


Figure 43 – Number of elk detected by hour at EB016, MP 250.2

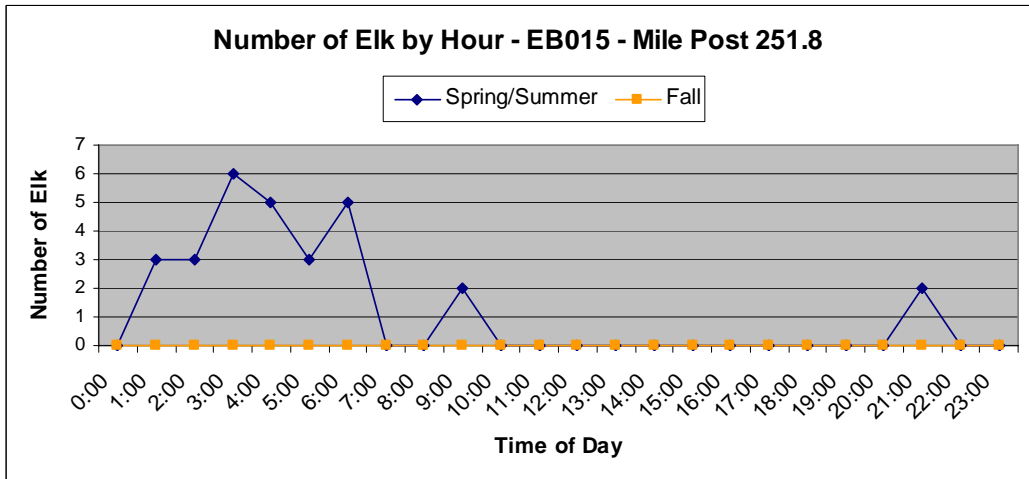


Figure 44 – Number of elk detected by hour at EB015, MP 251.8

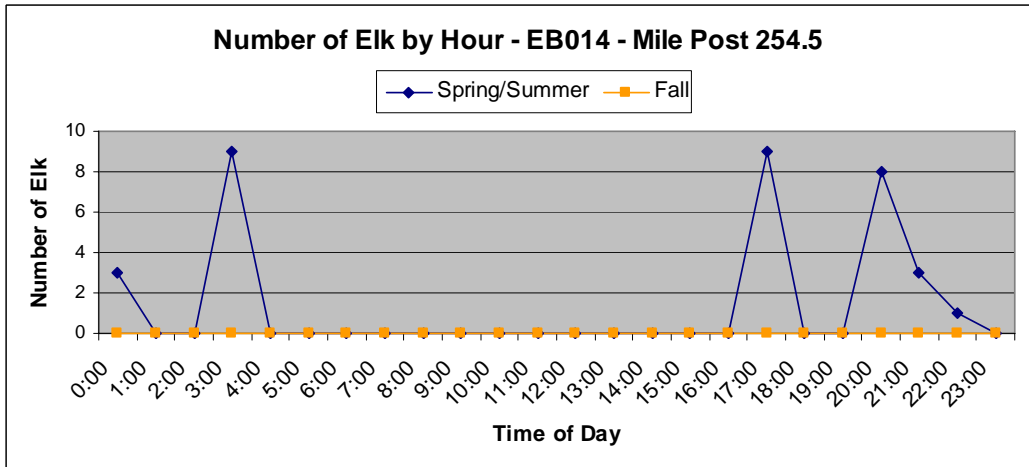


Figure 45 – Number of elk detected by hour at EB014, MP 254.5

DOMESTIC ANIMALS

At several monitoring stations, we documented domesticated animals such as cattle, dogs, cats, goats and horses. The following graphs demonstrate the level of human and domestic animal activity (lumped together under the label “domestic” because humans are often accompanying domestic animals) at a site in comparison to the level of other wildlife activity. These numbers have been standardized by sampling night. See the *Data Caveats* section for additional information on these data.

In general, the more human and domestic animal activity at a site, the less active other wildlife was at that same site during the same time period.

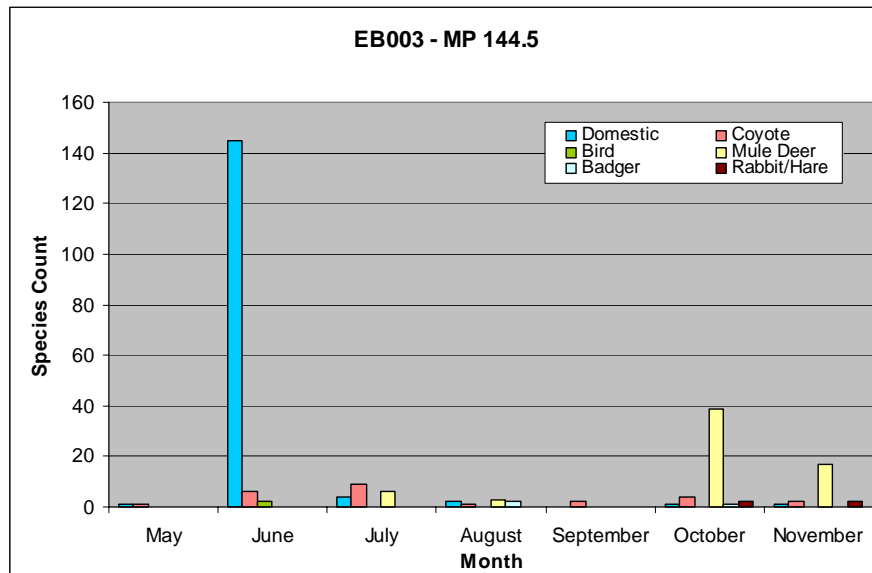


Figure 46 – Number of wildlife and domestic animals (incl. humans) detected at EB003, MP 144.5 west of Eagle

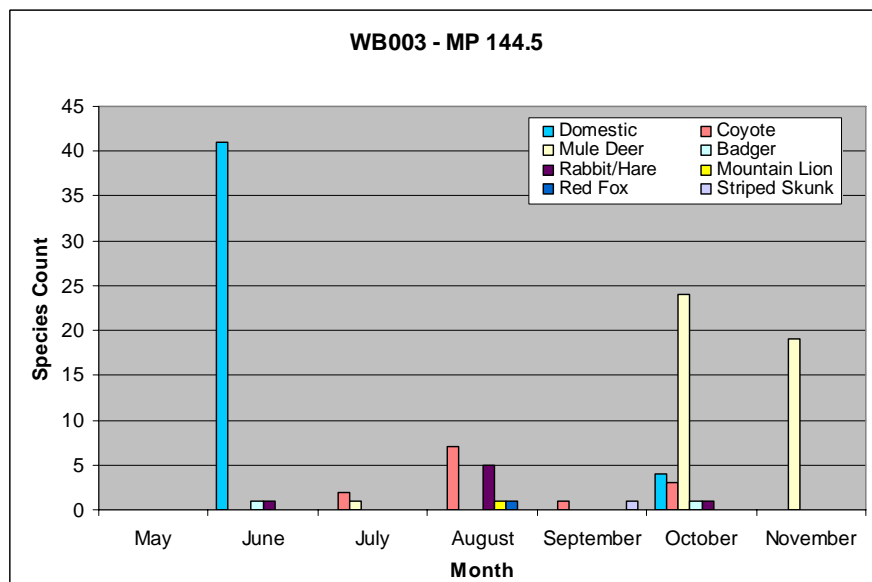


Figure 47 – Number of wildlife and domestic animals (incl. humans) detected at WB003, MP 144.5 west of Eagle

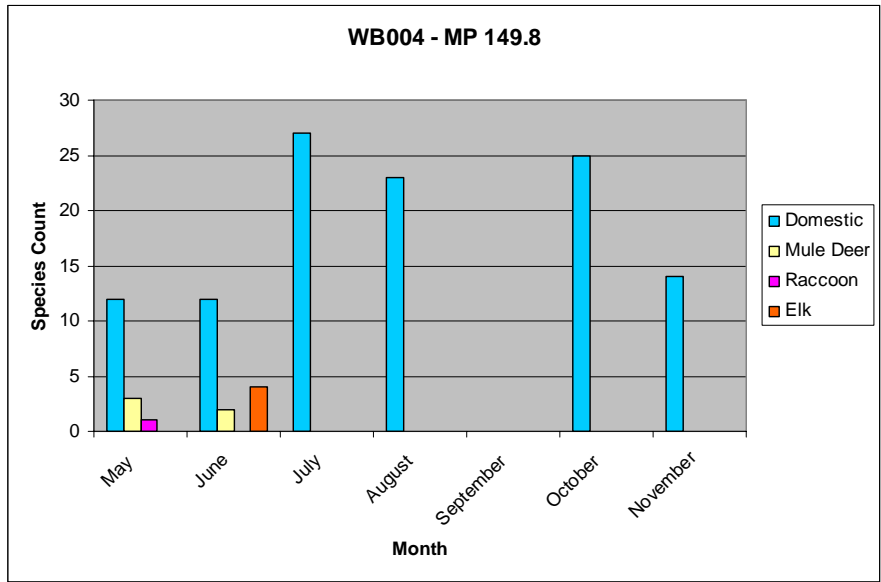


Figure 48 – Number of wildlife and domestic animals (incl. humans) detected at WB004, MP 149.8 east of Eagle

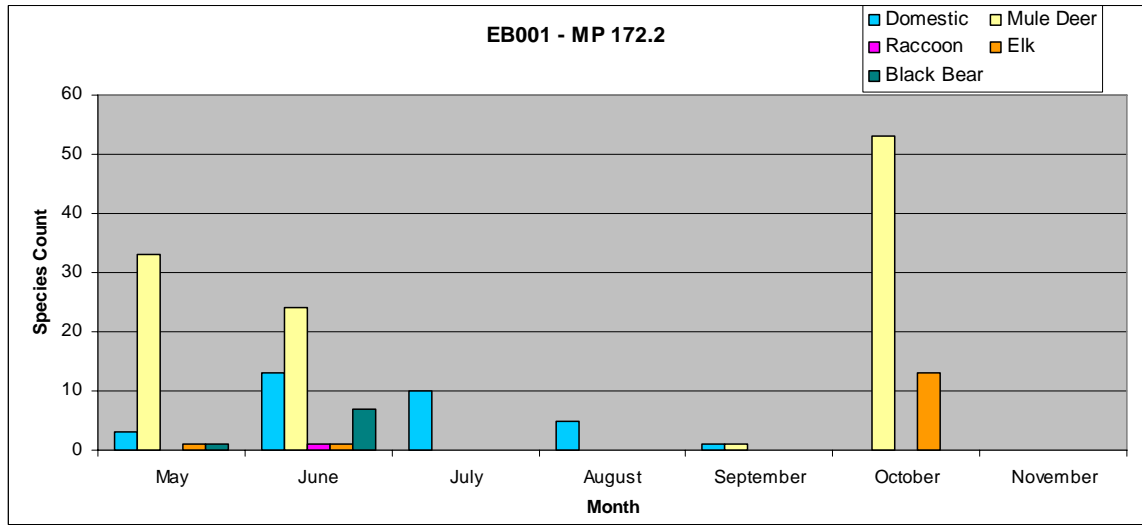


Figure 49 – Number of wildlife and domestic animals (incl. humans) detected at EB001, MP 172.2 between Minturn and Vail at Dowd's Junction

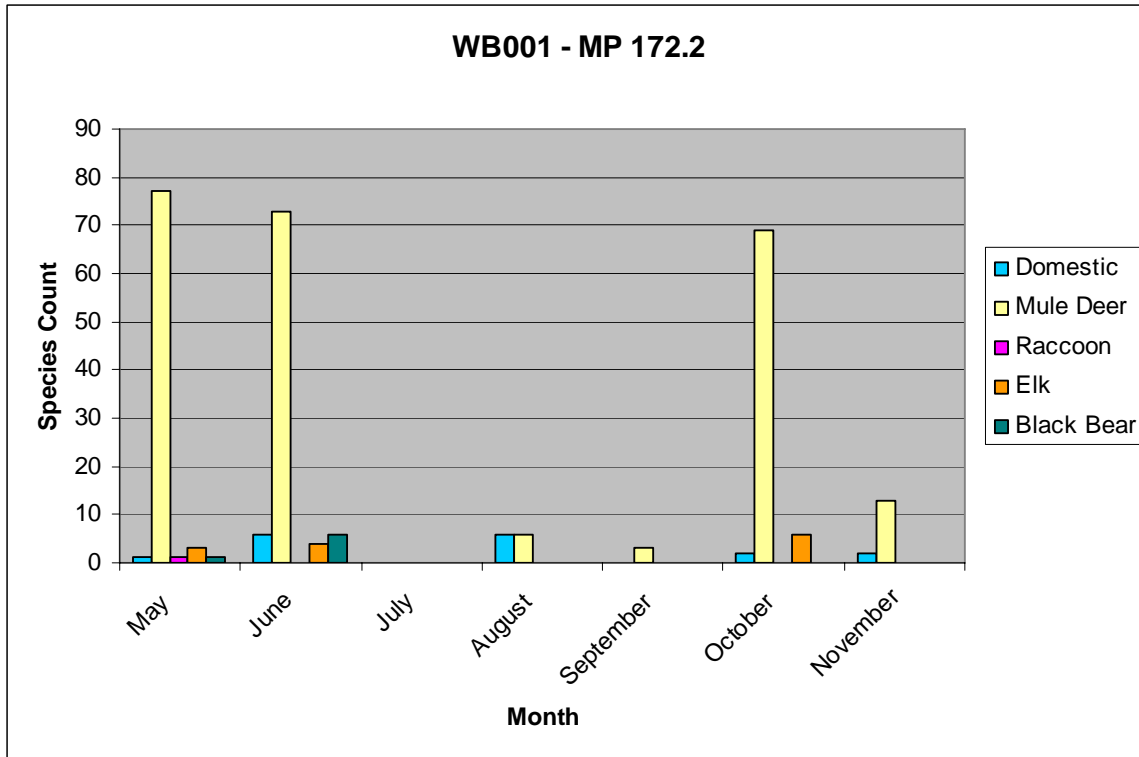


Figure 50 – Number of wildlife and domestic animals (incl. humans) detected at WB001, MP 172.2 between Minturn and Vail at Dowd’s Junction

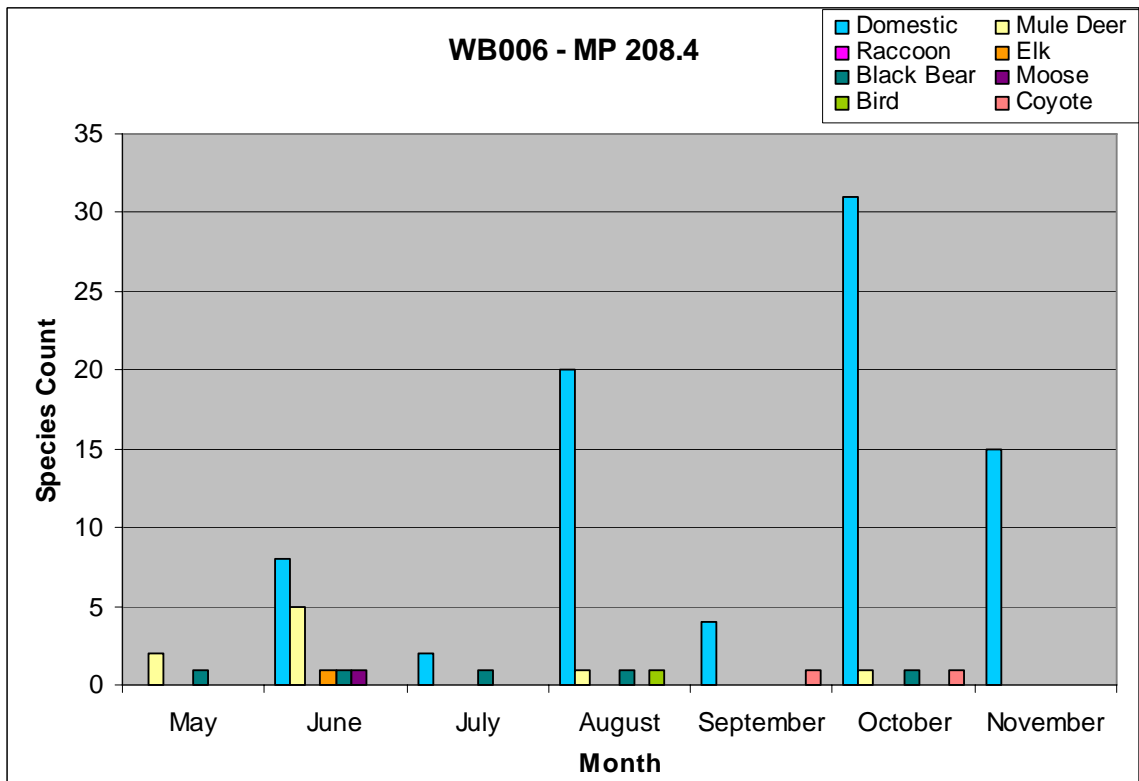


Figure 51 – Number of wildlife and domestic animals (incl. humans) detected at WB006, MP 208.4 east of Silverthorne at the Laskey Gulch drainage

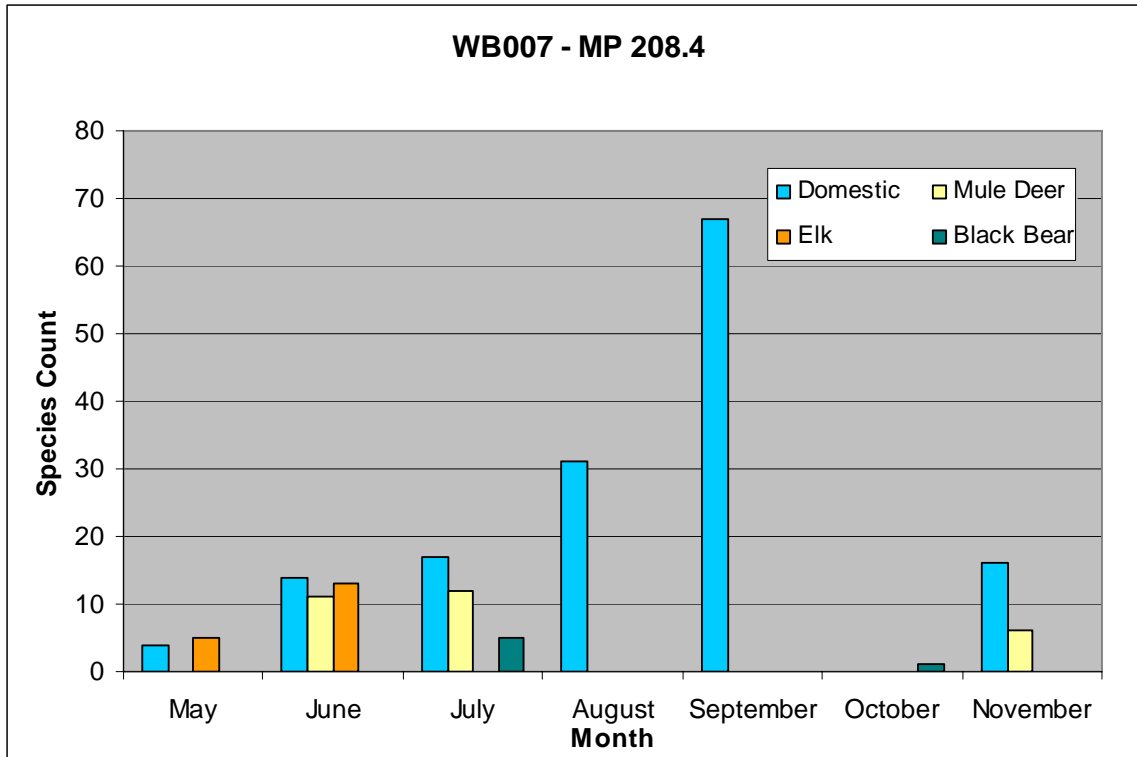


Figure 52 – Number of wildlife and domestic animals (incl. humans) detected at WB007, MP 208.4 east of Silverthorne at the Laskey Gulch drainage

DISCUSSION

The data collected in this study gives insight into which species are present at each monitoring location and are, in turn, using the surrounding habitat. By only using motion-triggered cameras for Year 1 monitoring, several species are likely underrepresented.² Additionally, as the smallest time delay available on the model of cameras used is one minute, it is difficult to infer behavior from the images. Therefore, in most cases, it could not be determined whether an animal moved completely through a structure. The issues mentioned in the *Data Caveats* section will be address in the analysis of year 2 data by changing the protocols used for inputting data into the database and changing the time frame over which the sampling nights were averaged.

² Bonaker, Paige. 2008. Field Method Efficacy to Detect Medium and Large Mammal Presence Near Roadways at Vail Pass, Colorado. Master’s Professional Paper, University of Montana, Missoula. 68 p.