

# I-70 ECO-LOGICAL MONITORING and I-70 WILDLIFE WATCH REPORT

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## PART I: I-70 ECO-LOGICAL MONITORING REPORT 2009 – 2010

### Introduction

The I-70 Eco-Logical Project is being conducted by Rocky Mountain Wild (formerly 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 Golden (MP 258) 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

#### *Camera Monitoring*

Camera monitoring was conducted in 2009 and 2010 to collect baseline information on wildlife activity and use of existing crossing structures along I-70. Over the course of the 2009 field season, cameras were set up at 33 stations, representing 19 milepost locations between Dotsero and Golden. Similarly, in the 2010 field season, camera monitoring occurred at 38 monitoring stations, representing 24 milepost locations between Eagle and Golden (Map 1 and 2). Monitoring locations included existing bridges and culverts (17 stations in 2009, 20 stations in 2010) as well as potential crossing locations – such as fill slopes blocking natural drainages – where there are no suitable crossing structures (16 stations in 2009, 18 stations in 2010).

Previously-identified linkage interference zones first mapped in 2004 (LIZ-2004) by the ALIVE (A Landscape Level Inventory of Valued Ecosystem Components) group were used to guide monitoring site selection in 2009. Stations that fell outside of these zones were, in most cases, located at additional structures with potential for wildlife use. In contrast, monitoring activities in 2010 were focused within areas of identified connectivity concern as determined by a preliminary analysis used to validate and refine the LIZs-2004. The primary steps for this analysis included identifying at least one priority zone within each bioregion based on identified primary criteria, ranking and tallying the presence/absence of primary parameters, applying decision rules for delineating connectivity zones within each bioregion and applying secondary criteria as appropriate.<sup>1</sup> The analysis used to determine the locations of the 2010 monitoring sites was preliminary and thus slightly different from the final analysis establishing the

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<sup>1</sup> For a more in-depth discussion of the methods used for this analysis, please see 'Appendix D - LIZ-2011 Analysis Methods' in the report 'A Regional Ecosystem Framework for Terrestrial and Aquatic Wildlife Along the I-70 Mountain Corridor in Colorado: An Eco-Logical Field Test'.

revised LIZs (LIZs-2011). However, only a few of the 2010 monitoring sites fall outside of the final LIZs-2011. This preliminary analysis allowed monitoring activities in 2010 to focus within areas of greatest connectivity concerns along the corridor based on the current best available data.

In most cases, two cameras were set up at each location with a structure, one at either entrance to the structure. 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, in 2009 there were six milepost locations with just one camera on one side of the road (3 structures, 3 non-structures) and in 2010 the number increased to eleven milepost locations with just one camera (2 structures, 9 non-structures). Two locations in 2010 only had a structure for one direction of traffic. These locations had cameras to the north of the westbound lanes of traffic and south of the eastbound lanes, but each structure only had one camera station.

In 2009 and 2010, a third camera was set late in the season at MP 144.5 and MP 248.2, respectively, to better document all present individuals. After the close of the 2010 field season, three cameras were setup on both the north and south sides of the highway at MP 248.2 to document use of a pipe culvert at the base of the fill slope that was not monitored during the regular 2009 or 2010 season. Data from these eight cameras are only included in this report anecdotally (and thus, are not included in the counts above).

Two versions of the Cuddeback Expert digital scouting camera and one version of the Cuddeback Capture camera (Non Typical, Inc., Park Falls, WI, USA) were used to monitor wildlife presence at existing structures and other potential roadway crossing locations along the interstate. The Cuddeback Expert cameras were set to a one minute delay, the lowest delay possible on these camera models. The Cuddeback Capture cameras were set to the lowest delay setting of 30 seconds. Cameras were checked approximately every four to six weeks.

Recognizing that camera monitoring does not fully capture all wildlife activity at a site (Bonaker 2008), an attempt was made during the 2010 field season to expand monitoring to include track beds using the existing substrate at the site. However, due to insufficient substrate that did not register track imprints well, the track beds were discontinued for the purposes of this study, as they were contributing little additional data at a high cost of staff time and travel. Anecdotal data from the track beds was collected when researchers were in the field to maintain the cameras every four to six weeks. No monitoring was conducted to track measures of aquatic connectivity as a part of this study.

Though both study years do include monitoring locations on east and west Vail Pass (1 in 2009, 7 in 2010), this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now RMW) from 2006 to 2008.

### *Data Reporting*

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 there were multiple species in one photo (ex. humans with domesticated dogs), the species were documented and counted separately. Cars were not included in the human totals. Exact numbers of cars were not recorded at sites where mostly cars were documented in 2009. 2010 reporting methods were adjusted to document the exact number of motorized (cars, ATVs, motorcycles) and non-motorized (bicycles) vehicles at each site.

### *Double Counting*

At several sites in both the 2009 and 2010 monitoring season, animals had the tendency to linger in front of the camera causing the potential for double counting of individuals. Indeed, this resulted in an inflation of the number of animals reported in the 2009 Monitoring Report. However, this issue was remedied in this report, for both the 2009 and 2010 data, by using the following five minute double counting rule: if, in a succession of photos ordered by date and time, there was less than five minutes between photos of the same species, individuals from that series of photos were assumed to be the same animal(s) and only counted once. Thus, the subsequent photos in the series were not included in the analysis. In instances where the number of individuals differed between photographs within a series, the largest number was used. This report includes updated species totals for 2009 data analysis reflecting this methodology.

### *Standardization*

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). Sampling nights were calculated by month in order to take into account that one camera may have malfunctioned during a month of peak activity while another malfunctioned during a month with a lull in activity. In only a few instances, the sampling nights were averaged over the entire study period, thus not taking the above into account and limiting our ability to make comparisons between sites. In addition, on each graph we note when a camera was active for less than 50% of the month, making the data from that camera for that month less valid for comparison between sites.

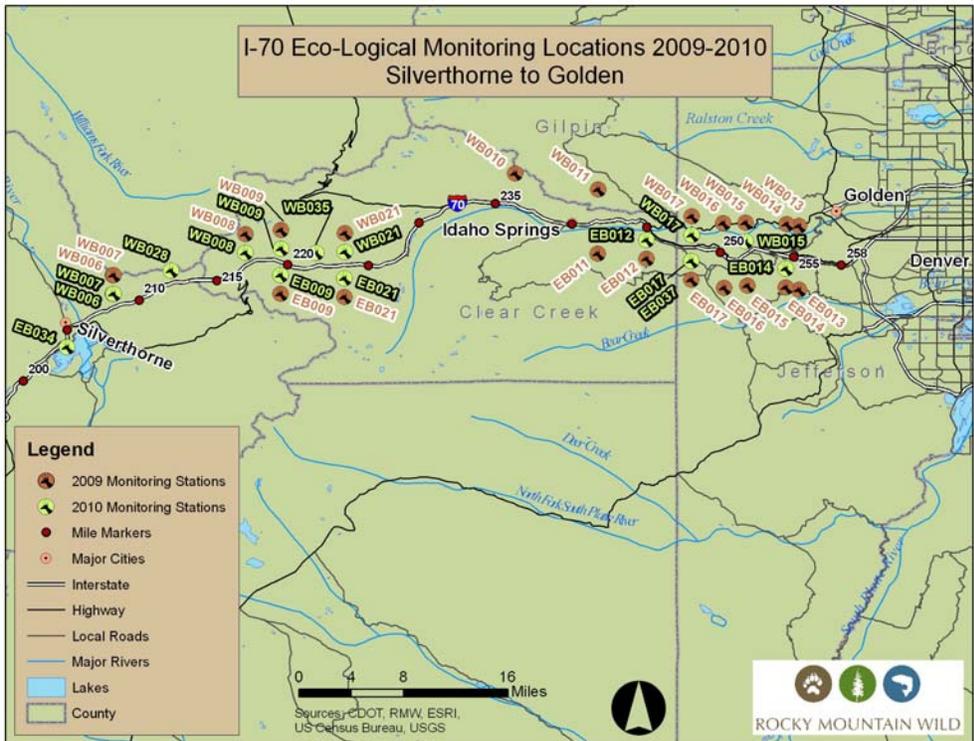
### *Equipment Malfunctions*

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 cameras 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 Locations



Map 1 – I-70 Ecological 2009 and 2010 Monitoring Locations – Dotsero to Silverthorne



Map 2 – I-70 Ecological 2009 and 2010 Monitoring Locations – Silverthorne to Golden

## **Monitoring Station Descriptions**

This section contains a summary description of each location where camera monitoring was conducted in 2009 and/or 2010, organized by mile post. Information for each monitoring location includes, if applicable: general location of monitoring station, type of structure at location, monitoring station ID, ID for associated inventoried structure, brief description of structure/location, dimensions of structure, presence/absence of wildlife fencing, sampling period of camera monitoring, species documented, and a brief summary. *The animal counts below reflect the raw numbers of animals captured at each monitoring station; thus, animals that have been determined to be duplicate animals at a given monitoring location and which are not included in the analyses for this report, are included here.*

### **MP 134.0 (Underpass)**

**Location:** near Dotsero

**Type:** concrete box culvert

**Monitoring station(s):** **2009:** WB019 (north), EB019 (south); **2010:** not monitored

**Associated Inventory ID:** JP052

**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):* 6.2 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

**Sampling period:** **2009:** 8/4/2009 to 11/11/2009

**Species documented:**

**2009:** *WB019:* 3 humans and 1 unknown; *EB019:* 1 coyote, 1 domestic cat, 2 domestic dogs, and 1 human

**Summary:**

**2009:** 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 143.0 (Underpass)**

**Location:** east of Gypsum

**Type:** divided bridge

**Monitoring station(s):** **2009:** WB002 (north), EB002 (south); **2010:** not monitored

**Associated Inventory ID:** JP012

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

**Dimensions:** *Westbound entrance (north):* 25 m (W) x 39 m (H) x 13.5 m (L); *Eastbound entrance (south):* 25.5 m (W) x 13.5 m (L); *Median width:* approx. 37 m

**Wildlife fencing:** fencing in place north and south of highway

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

**Species documented:**

**2009:** *WB002:* 11 birds, 13 domestic goats, 3 humans and 1 mule deer; *EB002:* 4 cattle, 1 coyote, 2 domestic dogs, 4 domestic goats, 1 elk, 4 humans and 4 mule deer

**Summary:**

**2009:** 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. Associated domestic animal activity at this location includes goats and cattle. A wire fence and gate across the north entrance of the north entrance was closed intermittently.

### **MP 144.5 (Underpass)**

**Location:** west of Eagle

**Type:** divided bridge

**Monitoring station(s):** **2009:** WB003 (north), EB003 (south), EB020 (south)\*; **2010:** not monitored

**Associated Inventory ID:** JP013

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

**Species documented:**

**2009:** *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:**

**2009:** The two main monitoring stations (WB- and EB003) 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 see if EB003 was missing anything. Equipment difficulties hindered data collection at EB020. Based on times and dates, it is likely that seven of the eight images taken at EB020 are capturing the same animals already documented at EB003. In addition to the species documented with the cameras, elk, rodent and possible coyote and bobcat 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 the numbers originally reported (above) for these species may be inflated. Duplicates have been removed for analysis in this report. 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.

\* *The data from EB020 is only included in this report anecdotally and is not presented in any of the graphs.*

### **MP 149.8 (Underpass)**

**Location:** east of Eagle

**Type:** concrete box culvert

**Monitoring station(s):** **2009:** WB004 (north); **2010:** WB004 (north), EB004 (south)

**Associated Inventory ID:** JP125

**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:** **2009:** 5/20/2009 to 11/11/2009; **2010:** *WB004:* 06/22/2010 to 11/12/2010; *EB004:* 06/22/2010 to 8/2/2010

**Species documented:**

**2009:** WB004: 4 ATVs, 20 bikes, 2 cars, 84 birds, 2 domestic dogs, 4 elk, 80 horses, 56 humans, 5 mule deer, 1 raccoon, and 6 unknown

**2010:** WB004: 6 bikes, 12 cattle, 11 coyotes, 8 domestic dogs, 6 horses, 10 humans, 3 mountain lions, 18 mule deer, 3 raccoon, and 2 unknowns; EB004: 2 ATVs, 2 bikes, 1 coyote, 4 domestic dogs, 5 humans, 2 mountain lions, 23 mule deer, 2 raccoon, 1 rodent, and 1 unknown

**Summary:**

A chain-link gate at the north entrance of this structure allows access to BLM land to the north. The south side of the culvert backs up to a large field used by a nearby farm.

**2009:** The one monitoring station at this concrete box culvert east of Eagle was set up at the beginning of the season. Several humans were documented accessing the land to the north 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.

**2010:** The two monitoring stations at this concrete box culvert east of Eagle were set up a few weeks into the season. Sometime between 8/2/2010 and 9/16/2010 the camera located on the south side of the interstate (EB004) was stolen and not replaced. The gate at the north entrance of this structure was closed periodically throughout the season cutting off access to the culvert. Mountain lions were consistently caught using this concrete box culvert as well as humans, domestic dogs and horses. Track beds were initially implemented at this location but were later only loosely maintained due to insufficient substrate. Mule deer, mountain lion, small mammal, raccoon, canine, horse, cattle, car, bicycle and unknown species tracks were documented in the track beds or elsewhere near the structure. Horse scat and a small dead rodent were also seen in the structure. Towards the end of the study season on the westbound side, cattle documented using the culvert dislodged the camera limiting the number of pictures captured.

**MP 152.6 (Underpass)**

**Location:** west of Wolcott

**Type:** corrugated pipe culvert

**Monitoring station(s):** **2009:** not monitored; **2010:** WB032 (north), EB032 (south)

**Associated Inventory ID:** JP126

**Description:** separate ephemeral pipe culverts under east- and westbound lanes, separated by a wide median

**Dimensions:** *East- and westbound road width:* 13.5 m; *Westbound pipe diameter:* 2.2 m; *Eastbound pipe diameter:* 2.25 m

**Wildlife fencing:** fencing in place north and south of highway

**Sampling period:** **2010:** 6/4/2010 to 11/12/2010

**Species documented:**

**2010:** WB032: 4 birds and 1 human; EB032: 1 bobcat, 1 mountain lion, 18 rabbits/hares, 7 rodents, 2 squirrels, 2 weasels, and 3 unknown

**Summary:**

**2010:** The two monitoring stations at this corrugated pipe culvert west of Wolcott were set up at the beginning of the season. The cameras were set up to the north of the westbound lanes and south of the eastbound lanes; none were set up within the median. The outlets on both sides were between the roadway and the wildlife fencing, limiting wildlife access to the culvert. The fencing to the south had a large gap under it that likely allowed some animal movement. A debris screen covers the top 1/2 of eastbound median north entrance. Few individuals were documented near the pipe culvert on the north side of the interstate. However, on the south side, several species were caught, including an adult mountain lion (walking perpendicular to the culvert, not using it), a baby bobcat and several smaller animals exiting or entering the culvert. In addition to the species documented on camera, small mammal tracks and elk scat were also found in the area.

### **MP 153.0 (Underpass)**

**Location:** west of Wolcott

**Type:** bridge

**Monitoring station(s):** *2009:* not monitored; *2010:* WB030 (north)

**Associated Inventory ID:** JP119

**Description:** small bridge with dirt road running through it

**Dimensions:** *East-and Westbound Spans:* 15.5 m (W) x 6 m (H) x 23.3 m (L); *Median width:* 11.6 m

**Wildlife fencing:** fencing in place north and south of highway

**Sampling period:** *2010:* 6/3/2010 to 11/12/2010

**Species documented:**

*2010:* 3 ATVs, 1 bike, 870 cars, 1 coyote, 3 domestic cats, 1 domestic dog, 19 humans, 2 motorcycles, and 2 mule deer

**Summary:**

*2010:* The one monitoring station at this bridge west of Wolcott was set up at the beginning of the season. The camera was set up on a fence to the north, facing south towards the bridge. A gate at the north entrance of the structure grants access to private land. The gate was open at most site visits throughout the sample period. Access to the bridge and the private land is from US Highway 6 which runs parallel to the highway to the south. Though the camera captured mostly motorized vehicles or humans, mule deer tracks were documented near the bridge.

### **MP 154.0 (Underpass)**

**Location:** west of Wolcott

**Type:** divided bridge

**Monitoring station(s):** *2009:* not monitored; *2010:* WB031 (north), EB031 (south)

**Associated Inventory ID:** JP116

**Description:** divided bridge with spans for both the east- and westbound lanes of I-70; both lanes of traffic span US Highway 6, Eagle River and railroad

**Dimensions:** *Westbound span (north):* 13.4 m (W) x 5.3 m (H) x 341 m (L); *Eastbound span (south):* 13.4 m (W) x 5.7 m (H) x 341 m (L); *Median width:* 11.4 m

**Wildlife fencing:** fencing in place north and south of highway

**Sampling period:** *2010:* 6/4/2010 to 11/12/2010

**Species documented:**

*2010:* *WB031:* 17 humans; *EB031:* 1 bird, 1 bobcat, 1 domestic dog, 8 humans, 12 mule deer, 1 squirrel, and 2 unknowns

**Summary:**

*2010:* The two monitoring stations west of Wolcott were set up in the beginning of the season. The cameras were set up northwest of the railroad and Eagle River, one under the eastbound span of the highway and one under the west. US Highway 6 is located to the south on the other side of the Eagle River. Track beds were initially implemented at this location but were later only loosely maintained due to insufficient substrate. Elk, mountain lion, possible canine, unspecified canine/feline, mule deer, human and unknown species tracks were documented in the track beds or elsewhere near the structure. A deer leg was also found at this structure. Though access to the site seems limited, these cameras caught mostly humans.

### **MP 170.0 (Underpass)**

**Location:** near Eagle-Vail

**Type:** concrete box culvert

**Monitoring station(s):** *2009:* EB018 (south); *2010:* not monitored

**Associated Inventory ID:** JP048

**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

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

**Species documented:**

**2009:** 18 bikes, 3 birds, 4 domestic dogs, 18 humans, 1 mule deer, 8 red foxes, 2 unknown, and several cars (an exact total was not calculated)

**Summary:**

**2009:** 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 possible bobcat and black bear tracks and elk scat were recorded in or near the culvert.

### **MP 171.1 (Underpass)**

**Location:** near Minturn

**Type:** bridge

**Monitoring station(s): 2009:** not monitored; **2010:** WB033 (north), EB033 (south)

**Associated Inventory ID:** JP047

**Description:** bridge spanning US Highway 6/US Highway 24, Eagle River and railroad (not running)

**Dimensions:** 122 m (W) x 7.6 m (H) x 35 m (L)

**Wildlife fencing:** fencing in place north and south of highway to east of bridge, no fencing to the west

**Sampling period: 2010:** *WB033:* 6/4/2010 to 8/2/2010; *EB033:* 6/4/2010 to 11/12/2010

**Species documented:**

**2010:** *WB033:* 77 bikes, 5 birds, 2 coyotes, 56 domestic dogs, 38 domestic sheep, 5 elk, 2 horses, 53 humans, 2 marmots, 1 motorcycle, 89 mule deer, 7 raccoon, 3 red fox, and 5 unknown; *EB033:* 8 bikes, 15 cars, 34 domestic dogs, 47 domestic sheep, 23 humans, and 33 mule deer

**Summary:**

**2010:** Two monitoring stations were set up at the beginning of the season at this bridge near Minturn. The cameras were set up northeast of the Eagle River next to the railroad, one under the eastbound lanes of the highway and one under the west. Some time between 8/2/2010 – 9/16/2010, the camera on the north side of the structure (WB033) was stolen. After that, the remaining camera was moved to the center of the structure so that it would better capture activity under the whole structure. US Highway 24, located to the southwest on the other side of the Eagle River, provides access to Minturn and, therefore, receives regular traffic. Two game trails are present at this site: one trail leads under the bridge and runs perpendicular to the highway on the south side; the other runs parallel to the highway on the north side. Track beds were initially implemented at this location but were later only loosely maintained due to insufficient substrate. Elk, raccoon, mule deer, canine, horse, bicycle, car, human, and unknown species tracks were documented in the track beds or elsewhere near the structure. Two live minks, a live marmot, a deer leg and elk and possible fox scat were also seen at this structure. This location receives ample human use as bikers, fishermen, sheep herders and hikers were all documented using an unofficial trail running perpendicular to the bridge.

### **MP 171.8 (Underpass)**

**Location:** between Minturn and Vail at Dowd's Junction

**Type:** concrete box culvert

**Monitoring station(s): 2009 and 2010:** WB001 (north), EB001 (south)

**Associated Inventory ID:** JP045

**Description:** culvert spanning east- and westbound lanes

**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: 2009:** 5/20/2009 to 11/11/2009; **2010:** 6/3/2010 to 11/12/2010

**Species documented:**

**2009:** WB001: 7 black bears, 9 domestic dogs, 13 elk, 10 humans, 242 mule deer, 1 raccoon, 1 squirrel and 6 unknown; EB001: 8 black bears, 4 domestic dogs, 15 elk, 31 humans, 116 mule deer, 1 raccoon, and 5 unknown

**2010:** WB001: 4 black bears, 2 domestic dogs, 1 elk, 4 humans, 3 mountain lions, 250 mule deer, 4 raccoon, and 3 unknown; EB001: 3 black bears, 1 domestic cat, 1 domestic dog, 1 human, 33 mule deer, 32 raccoons, 4 red fox, and 22 squirrels

**Summary:**

Sediment-collecting baffles found in the culvert provide a dirt bottom. Gore Creek runs parallel to roadway to the south. A game trail runs perpendicular to the highway to the north. Animals exiting the structure to the south go under a bridge for the bike path. Graffiti on the culvert walls and photos indicate human use.

**2009:** 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. In addition to the animals documented with cameras, mule deer, black bear, raccoon, dog, human 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; thus the numbers originally reported (above) for this species may be inflated. Duplicates have been removed for analysis in this report.

**2010:** The two monitoring stations were set up in the beginning of the season. Cameras at both the north and south stations malfunctioned, limiting data collection early in the season. Several different species were documented using the culvert, most of which were mule deer. A golden-mantled ground squirrel resided in a crack in the structure and was documented on the cameras repeatedly on the south side of the structure. Track beds were initially implemented at this location but were later only loosely maintained due to insufficient substrate. The substrate on the south side of the structure was washed out several times making it even more difficult to distinguish tracks. Black bear, unspecified canine/feline, mule deer, canine, raccoon, small mammal, human and unknown species tracks were documented in the track beds or elsewhere near the structure. Fox and black bear scat were also recorded at this structure.

### **MP 183.0 (Underpass)**

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

**Type:** divided bridge

**Monitoring station(s): 2009 and 2010:** WB005 (north), EB005 (south)

**Associated Inventory ID:** JP061

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

**Dimensions:** *East- and westbound spans:* 23 m (W) x 4.2 m (H) x 12.4 m (L); *Median width:* 8.4 m

**Wildlife fencing:** none

**Sampling period: 2009:** 5/21/2009 to 11/11/2009; **2010:** 6/2/2010 to 11/12/2010

**Species documented:**

**2009:** WB005: 5 coyotes, 1 domestic dog, 2 humans, 7 marmots, 675 mule deer, 2 porcupines, 3 red foxes, and 4 unknown; EB005: 2 coyotes, 2 domestic dogs, 5 humans, 5 marmots, 419 mule deer, 1 squirrel and 1 unknown

**2010:** WB005: 6 humans, 8 marmots, 524 mule deer, 3 red foxes, and 2 unknown; EB005: 5 humans, 4 marmots, 233 mule deer, and 3 unknown

**Summary:**

In both 2009 and 2010, the camera stations at this small divided bridge on West Vail Pass were set up one under each span. Also in both years, mule deer at this site lingered under the bridge to forage; thus the numbers originally reported (above) for this species may be inflated. Duplicates have been removed for analysis in this report.

**2009:** The two monitoring stations at this site were set up at the beginning of the season. In addition to the animals documented with cameras, mule deer and marmot tracks were recorded near the monitoring stations.

**2010:** The two monitoring stations at this small bridge were set up at the beginning of the season. Track beds were initially implemented at this location but were later only loosely maintained due to insufficient substrate. Badger, red fox, unknown species, mule deer, human and marmot tracks were documented in the track beds or elsewhere near the structure.

**MP 185.5 (Underpass)**

**Location:** West Vail Pass about 4.5 miles from the summit

**Type:** divided bridge

**Monitoring station(s):** **2009:** not monitored; **2010:** WB025 (north), EB025 (south)

**Associated Inventory ID:** JP058

**Description:** divided bridge with matching spans for both the east- and westbound lanes of I-70; small median between the east- and westbound bridges; structure spans bike path and sediment pond (both at east end) and creek (west end)

**Dimensions:** *East- and Westbound spans:* 214 m (W) x 12 m (H) x 31.2 m (L); *Median width:* 5.4 m

**Wildlife fencing:** none

**Sampling period:** **2010:** 6/2/2010 to 11/12/2010

**Species documented:**

**2010:** WB025: 1 coyote, 3 humans, 3 mule deer, and 1 red fox; EB025: 2 black bears, 4 humans, 47 mule deer and 3 unknown

**Summary:**

**2010:** The two monitoring stations were set up at this large span bridge on West Vail Pass at the beginning of the season. Terrestrial pathways for wildlife exist on both east and west sides of creek. One camera was set up under each span, but due to the size of the structure it was impossible to document activity under the entire structure with only two cameras. There is a game trail running north-south under both spans of the structure and up the side slopes. Track beds were initially implemented at this location but were later only loosely maintained due to insufficient substrate. Fox, coyote, canine, unknown species, mule deer, elk and human tracks were documented in the track beds or elsewhere near the structure. A live small mammal, a live marmot and elk scat were also seen at this structure. The camera captured mostly mule deer crossing beneath the large divided bridge. Camera monitoring data has been previously conducted at this location as part of the Citizen Science Wildlife Monitoring project led by RWM.

**MP 187.4 (No structure)**

**Location:** West Vail Pass about 2.6 miles from the summit

**Type:** at-grade

**Monitoring station(s):** **2009:** not monitored; **2010:** WB036 (north), EB036 (south)

**Associated Inventory ID:** Not applicable

**Description:** large at-grade on both north and south side of highway

**Dimensions:** Not applicable

**Wildlife fencing:** none

**Sampling period: 2010:** *WB036:* 6/23/2010 to 11/12/2010; *EB036:* 6/23/2010 to 11/13/2010

**Species documented:**

**2010:** *WB036:* 2 birds, 3 coyotes, 3 elk, 2 humans, 15 mule deer, and 1 red fox; *EB036:* 6 birds, 1 coyote, 3 elk, 7 humans, 8 mule deer, 1 red fox, and 2 unknown

**Summary: 2010:** The two monitoring stations at this site on West Vail Pass were set up a few weeks into the monitoring season. The camera at WB036 was set up on the north side of a large sediment pond. The camera at EB036 was set up in a grassy area between the highway and a sparse forest. The bike path runs parallel to the highway to the south. WB036 experienced technical difficulties part way through the season, limiting data collection. Few species were documented on the south side of the interstate, however anecdotal track data documented canine, possible coyote, mule deer, elk and unknown species using the area despite being missed by the camera. In addition to the species documented by the camera on the north side of the interstate, mule deer, elk and coyote tracks were also seen near this station. This site represents the location chosen for the ARC: International Wildlife Crossing Infrastructure Competition, and camera monitoring data has been previously conducted at this location as part of the Citizen Science Wildlife Monitoring project led by RWM.

### **MP 192.0 (No structure, Underpass)**

**Location:** East Vail Pass about two miles from the summit

**Type:** *Westbound:* at-grade; *Eastbound:* divided bridge; pipe present but not monitored

**Monitoring station(s): 2009:** not monitored; **2010:** WB024 (north), EB024 (south)

**Associated Inventory ID:** JP031

**Description:** large median between east- and westbound lanes of traffic; *Westbound:* at-grade with gentle, shrubby, wet drainage running perpendicular to road; *Eastbound:* divided bridge for eastbound lanes of traffic only; spans drainage for small perennial unnamed creek

**Dimensions:** *Westbound at-grade:* 177 m (L); *Eastbound divided bridge:* 74.5 m (W), 9.5 m (H), 12.5 m (L); *Median width:* approx. 204.5 m

**Wildlife fencing:** none

**Sampling period: 2010:** 6/2/2010 to 11/12/2010

**Species documented:**

**2010:** *WB024:* 65 elk, 5 mule deer, 3 red foxes, and 19 unknown; *EB024:* 8 elk, 72 mule deer, and 1 red fox

**Summary:**

**2010:** The two monitoring stations on East Vail Pass were set up at both the divided bridge and the at-grade at the beginning of the monitoring season. The camera at the structure was set up under the bridge; the camera at the at-grade was set up in a depression adjacent to the roadway. In addition to the species documented with the cameras, fox, human, and unknown species tracks were documented at the bridge location. Camera monitoring data has been previously conducted at the eastbound underpass as part of the Citizen Science Wildlife Monitoring project led by RWM.

### **MP 192.5 (No structure, Underpass)**

**Location:** East Vail Pass about 2.5 miles from the summit

**Type:** *Westbound:* at-grade; *Eastbound:* divided bridge

**Monitoring station(s): 2009:** not monitored; **2010:** WB023 (north), EB023 (south)

**Associated Inventory ID:** *At-grade:* JP057; *Divided bridge:* JP033

**Description:** large median between east- and westbound lanes of traffic; *Westbound:* at-grade, directly across from eastbound structure, quickly slopes upward to open forest; *Eastbound:* divided bridge for eastbound lanes of traffic only; spans Stafford Creek

**Dimensions:** *Westbound at-grade:* Not applicable; *Eastbound divided bridge:* 93 m (W), 12.8 m (H), 15.3 m (L); *Median width:* approx. 216.5 m

**Wildlife fencing:** none

**Sampling period: 2010:** 6/2/2010 to 11/12/2010

**Species documented:**

**2010:** *WB023:* 54 elk, 3 humans, 40 mule deer, 3 red foxes, and 7 unknown; *EB023:* 1 marmot, 3 mule deer, 2 porcupines, 14 red foxes, and 2 unknown

**Summary:**

**2010:** The two monitoring stations on East Vail Pass were set up at both the divided bridge and the at-grade at the beginning of the monitoring season. The camera at the structure was set up under the bridge; the camera at the at-grade was set up partially up slope at the edge of the open forest. To the north of the highway at the at-grade location, the topography slopes upward toward open forest. There is a grassy fill slope to the south of the highway. Game trails are present at the bridge location. A track bed was initially implemented at the bridge location but was later only loosely maintained due to insufficient substrate. Mule deer, elk, bird, human, bicycle, fox, small mammal, possible marmot and unknown species tracks were documented in the track beds or elsewhere near the structure. Elk scat was also found at this location. At the at-grade location, fox, coyote and unknown species tracks were recorded. Camera monitoring data has been previously conducted at the eastbound underpass as part of the Citizen Science Wildlife Monitoring project led by RWM.

### **MP 193.0 (No structure)**

**Location:** East Vail Pass about three miles from the summit

**Type:** fill slope; pipe present but not monitored adjacent to westbound lanes

**Monitoring station(s): 2009:** not monitored; **2010:** WB022 (north)

**Associated Inventory ID:** JP056

**Description:** fill slope with shrubby, wet drainage with densely forested side slopes; small perennial drainage from the north bisected with westbound lanes of traffic before flowing into West Tenmile Creek in the median

**Dimensions:** approx. 9 m (H) x 62 m (imprint of fill slope)

**Wildlife fencing:** none

**Sampling period: 2010:** 6/2/2010 to 11/12/2010

**Species documented:**

**2010:** *WB022:* 23 elk, 2 humans, 106 mule deer, 1 red fox, and 3 unknown

**Summary:**

**2010:** The one monitoring station was set up at this at-grade on East Vail Pass at the beginning of the monitoring season. The pipe associated with the perennial drainage was not monitored. The camera was moved twice during the study season in order to try to capture any activity in the wooded area adjacent to the clearing. Though there is no direct line of sight, this fill slope is directly across interstate from a mineral lick south of the eastbound lanes. In addition to the animals documented by the cameras, fox, small mammal, elk, mule deer and unknown species tracks and elk and mule deer scat were also found in the area. Camera monitoring data has been previously conducted at this location as part of the Citizen Science Wildlife Monitoring project led by RWM.

### **MP 193.7 (Underpass)**

**Location:** East Vail Pass near Copper Mountain about 3.7 from the summit

**Type:** divided bridge

**Monitoring station(s): 2009:** not monitored; **2010:** EB027 (south)

**Associated Inventory ID:** JP038

**Description:** divided bridge for eastbound lanes of traffic only; spans bike path and West Tenmile Creek; foot trail on north side of creek

**Dimensions:** *Eastbound span:* 189.2 m (H), 10.4 m (H), 12.4 m (L); *Median:* approx. 175.5 m

**Wildlife fencing:** none

**Sampling period:** *2010:* 6/2/2010 to 11/12/2010

**Species documented:**

*2010: EB027:* 6 bikes, 2 cars (on bike path), 6 domestic dogs, 20 humans, 76 mule deer, and 3 unknown

**Summary:**

*2010:* The one monitoring station at this divided bridge near Copper Mountain was set up at the beginning of the monitoring season. The camera was placed under the bridge at the base of a steep slope facing out over the wide grassy median between the east- and westbound lanes of traffic. There is a game trail running along the west side slope through the structure. Due to the size of the structure and the median it was impossible to document all activity with only one camera. In addition to the wildlife documented on the cameras, mule deer and unknown species tracks and fox scat was documented in the area. Several humans, both on bikes and on foot, were photographed using the bike path or crossing the median. Camera monitoring data has been previously conducted at this location as part of the Citizen Science Wildlife Monitoring project led by RWM.

#### **MP 204.5 (No structure)**

**Location:** between Frisco and Silverthorne

**Type:** at-grade; pipe present but not monitored

**Monitoring station(s):** *2009:* not monitored; *2010:* EB034 (south)

**Associated Inventory ID:** Not applicable; *Pipe:* JP039

**Description:** large flat, open at-grade

**Dimensions:** Not applicable

**Wildlife fencing:** none

**Sampling period:** *2010:* 6/4/2010 to 11/12/2010

**Species documented:**

*2010: EB034:* 3 birds, 31 coyotes, 3 humans, 64 mule deer, 6 red foxes, and 4 unknown

**Summary:**

*2010:* The one monitoring station at this at-grade between Frisco and Silverthorne was set up at the beginning of the season. The camera was set up in open, flat area. A nearby pipe with perennial flow was not monitored. There is a nearby hiking trail used by humans and wildlife (as documented by tracks found in snow). Debris and trash were also found scattered through out the area. In addition to the species documented by the cameras, mule deer, fox, coyote, and unknown species tracks, coyote scat, a dead deer and evidence of beaver activity was documented in the area.

#### **MP 208.4 (No structure)**

**Location:** east of Silverthorne at the Laskey Gulch drainage

**Type:** fill slope; pipe present but not monitored

**Monitoring station(s):** *2009 and 2010:* WB006 (north), WB007 (north)

**Associated Inventory ID:** JP021

**Description:**

*2009 and 2010:* large fill slope where Laskey Gulch is bisected by highway; 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

**Sampling period:** *2009:* 5/21/2009 to 11/11/2009; *2010:* 6/1/2010 to 11/12/2010

**Species documented:**

**2009:** WB006: 1 bird, 5 black bears, 2 coyotes, 2 donkey/pack mules, 1 elk, 79 humans, 1 moose, 9 mule deer, and 1 unknown; WB007: 3 domestic dog, 5 black bear, 6 donkeys/pack mules, 18 elk, 148 humans, 29 mule deer, 1 red fox, and 1 unknown

**2010:** WB006: 1 black bear, 20 coyotes, 9 domestic dogs, 1 elk, 73 humans, 1 moose, 35 mule deer, 2 porcupines, 11 red foxes, and 2 unknown; WB007: 1 black bear, 34 coyotes, 17 domestic dogs, 3 donkeys/pack mules, 8 elk, 229 humans, 2 moose, 46 mule deer, 6 red foxes, and 1 unknown

**Summary:**

Several game trails are present at this location including a game trail running east-west and then north-south in relation to the highway. In both 2009 and 2010, the western most camera at this site was set up between the game trail and a barbed wire fence marking the end of the highway right-of-way. The eastern most camera was set up along the same game trail after crossing Laskey Gulch. In both years, several hikers and hunters were documented using the trail, the latter often accompanied by pack mules/donkeys.

**2009:** 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. In addition to the animals documented with cameras, elk scat was recorded near the monitoring stations.

**2010:** The two monitoring stations at this site were set up at the beginning of the season. In the beginning of the field season, a marmot was frequently seen at the base of the fill slope, but he was not sighted later in the season. Mule deer, small mammal, human, and unknown species tracks, unknown scat, a dead elk, and a fish (in Laskey Gulch) were also documented in the area.

**MP 212.4 (No structure)**

**Location:** east of Silverthorne and west of Eisenhower Tunnel

**Type:** fill slope; pipe present but not monitored

**Monitoring station(s):** **2009:** not monitored; **2010:** WB028 (north)

**Associated Inventory ID:** Not applicable; *Pipe:* JP018

**Description:** fill slope where small unnamed stream is bisected by highway

**Dimensions:** Not applicable

**Wildlife fencing:** none

**Sampling period:** **2010:** 6/3/2010 to 11/12/2010

**Species documented:**

**2010:** WB028: 10 humans, 13 mule deer, 2 red foxes, and 2 unknown

**Summary:**

**2010:** The one monitoring station at this location between Silverthorne and Eisenhower Tunnel was placed at the beginning of the season. The camera was placed along a well used game trail that runs north, parallel to the small stream flowing through the pipe. In addition to the species captured on the camera, snowshoe hare, elk and mule deer tracks and elk scat was also present near this station.

**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):** **2009 and 2010:** WB008 (north)

**Associated Inventory ID:** Not applicable

**Description:** at-grade quickly slopes upward to forest

**2009 and 2010:** camera set up on small flat road-like area in woods that runs parallel to I-70

**Dimensions:** Not applicable

**Wildlife fencing:** none

**Sampling period:** **2009:** 5/21/2009 to 11/12/2009; **2010:** 6/3/2010 to 11/12/2010

**Species documented:**

**2009:** WB008: 4 coyotes, 1 domestic dog, 2 elk, 7 humans, 55 mule deer and 2 red foxes

**2010:** WB008: 1 coyote, 1 domestic dog, 5 elk, 5 humans, 11 mule deer, and 3 unknown

**Summary:**

In both years, the camera was set up on small flat road-like area in woods that runs parallel to I-70.

**2009:** 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.

**2010:** The one monitoring station at this site was set up at the beginning of the field season. In addition to the species documented by the camera, coyote, snowshoe hare, mountain cottontail, unspecified canine/feline, and small mammal were found in the snow nearby at the end of the monitoring season.

**MP 219.5 (No structure)**

**Location:** west of Bakerville at Watrous Gulch

**Type:** at-grade

**Monitoring station(s): 2009 and 2010:** WB009 (north), EB009 (south)

**Associated Inventory ID:** Not applicable

**Description:** at-grade on both north and south side of highway

**2009 and 2010:** *Westbound:* camera set up at base of Watrous Gulch drainage; *EB009:* camera set up on flat area in aspen grove below chain-up area

**Dimensions:** Not applicable

**Wildlife fencing:** none

**Sampling period: 2009:** WB009: 6/22/2009 to 11/12/2009; EB009: 5/21/2009 to 11/11/2009; **2010:** WB009: 6/1/2010 to 11/12/2010; EB009: 6/1/2010 to 11/13/2010

**Species documented:**

**2009:** WB009: 3 bikes, 1 coyote, 4 elk, 16 humans, 24 mule deer and 1 rabbit/hare; most humans documented were on the roadway in the background and not in close proximity to the camera;

EB009: 5 coyotes, 50 elk, 116 mule deer, 1 rabbit/hare, 1 red fox and 1 unknown

**2010:** WB009: 1 coyote, 6 elk, 1 human and 84 mule deer; EB009: 1 bobcat, 3 coyotes, 20 elk, 1 human, 1 moose, 34 mule deer, 1 porcupine, 38 rabbit/hares, 1 red fox, and 4 unknown

**Summary:**

In both years, the westbound camera was set up at the base of the Watrous Gulch drainage, and the eastbound camera was set up on flat area in an aspen grove below the chain-up area. There is human activity associated with the chain-up areas adjacent to both monitoring stations.

**2009:** The two monitoring stations at this at-grade location west of Bakerville at Watrous Gulch were set up at the beginning of the season. Mule deer at the westbound (north) station may have lingered in front of the camera; thus the numbers originally reported (above) for this species may be inflated. Duplicates have been removed for analysis in this report.

**2010:** The two monitoring stations at this location were set up in the beginning of the season. Grazing animals lingered at both the west and east-bound cameras; thus the numbers originally reported (above) may be inflated for some species. Duplicates have been removed for analysis in this report. In addition to the animals documented on the cameras, coyote tracks were recorded at the location north of the highway, snowshoe hare, coyote and unspecified canine/feline tracks at the location to the south.

**MP 221.8 (No structure)**

**Location:** east of Bakerville

**Type:** fill slope; pipe present but not monitored

**Monitoring station(s): 2009:** not monitored; **2010:** WB035 (north)

**Associated Inventory ID:** JP071

**Description:** long, low fill with a slight depression between cliff sections

**Dimensions:** approx. 3 m (H) x 194 m (imprint of fill slope)

**Wildlife fencing:** none

**Sampling period: 2010:** 6/1/2010 to 11/12/2010

**Species documented:**

**2010:** WB035: 9 bighorn sheep, 40 elk, 111 mule deer, and 3 unknown

**Summary:**

**2010:** The one monitoring station at this fill slope east of Bakerville was set up in the beginning of the season. The camera was set up just beyond the base of the fill slope as the slope begins to climb again. A pipe with an ephemeral stream is located at base of fill but was not monitored. Clear Creek runs parallel to the highway on south side of the interstate. There is a game trail running parallel to the base of the fill. Several animals were caught lingering in front of the camera while grazing; thus the numbers listed above may be inflated for some species. Duplicates have been removed for the graphs in this report. In addition to the species documented by the cameras, coyote, ungulate, and rabbit tracks and elk, squirrel and bighorn sheep scat was also documented near this station.

### **MP 223.5 (Overpass)**

**Location:** west of Silver Plume

**Type:** bridge

**Monitoring station(s): 2009 and 2010:** WB021 (north), EB021 (south)

**Associated Inventory ID:** JP102

**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

**Sampling period: 2009:** 9/9/2009 to 11/11/2009; **2010:** 6/3/2010 to 8/3/2010

**Species documented:**

**2009:** 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:** 2 domestic dogs, 11 humans, and 1 motorcycle; **EB021:** 6 humans, 2 motorcycles, and 2 squirrels  
**2010:** **WB021:** 2 cars and 1 mule deer; **EB021:** 17 cars, 6 humans and 1 mule deer

**Summary:**

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.

**2009:** The two monitoring stations at this overpass bridge west of Silver Plume were set up late in the season. 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. Duplicates have been removed for the graphs in this report.

**2010:** The two monitoring stations were set up at the beginning of the season. Both cameras caught mostly cars using the bridge. The camera at EB021 was stolen some time between 7/7/2010 and 8/3/2010. The remaining camera was removed on 8/3/2010.

### **MP 236.2 (Underpass)**

**Location:** between Downieville and Fall River Road

**Type:** concrete box culvert; pipe present but not monitored

**Monitoring station(s): 2009:** WB010 (north); **2010:** not monitored

**Associated Inventory ID:** JP004

**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

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

**Species documented:**

**2009:** *WB010:* 6 bikes, 6 domestic dogs, 12 horses, 119 humans, and 1 motorcycle. This camera captured hundreds of pictures of cars or other forms of motorized vehicles. An exact total was not calculated.

**Summary:**

**2009:** 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 on the cliffs north of the interstate. However, heavy vehicle use 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): 2009:** WB011 (north), EB011 (south); **2010:** not monitored

**Associated Inventory ID:** JP016

**Description:** bridge where both the east- and westbound lanes of I-70 cross Clear Creek

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

**Wildlife fencing:** none

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

**Species documented:**

**2009:** *WB011:* 1 gray fox, 4 humans, 52 mule deer, 1 raccoon and 9 red foxes; *EB011:* 1 black bear, 8 humans, 141 mule deer, 6 raccoons, 15 red foxes and 5 unknown

**Summary:**

**2009:** 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 the creek. In addition to the animals documented with cameras, coyote, fox, 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): 2009 and 2010:** EB012 (south)

**Associated Inventory ID:** JP043

**Description:** large steep fill slope

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

**Wildlife fencing:** none

**Sampling period: 2009:** 5/21/2009 to 11/11/2009; **2010:** 6/1/2010 to 11/13/2010

**Species documented:**

**2009:** 16 humans, 120 mule deer and 1 unknown

**2010:** 6 elk, 8 humans, 16 mule deer, and 1 unknown

**Summary:**

There are scattered homes to the south of the highway. In both years, the camera was placed at various locations at the top of the fill slope. In 2009 and 2010, several humans were documented using the pull-out at the top of the fill slope.

**2009:** The one monitoring station at this fill slope 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.

**2010:** The one monitoring station at this location was set up at the beginning of the season. The camera was set up at the top, looking across the steep fill slope. Elk, fox, and small mammal tracks were also documented at this location.

### **MP 248.2 (Underpass)**

**Location:** near the Beaver Brook/Floyd Hill exit

**Type:** fill slope; pipe

**Monitoring station(s): 2009 and 2010:** WB017 (north), EB017 (south); **2010:** WB038 (north)\*, WB039 (north)\*, WB040 (north)\*, EB037 (south)\*, EB038 (south)\*, EB039 (south)\*, EB040 (south)\*

**Associated Inventory ID:** *Fill:* JP023

**Description:** fill slope on both north and south side of highway with ephemeral pipe at base

**Dimensions:** *WB017:* fill slope with larger imprint than EB017 (measurements only taken at EB017); *EB017 and EB037:* approx. 10 m (H) x 75 m (imprint of fill slope)

**Wildlife fencing:** none

**Sampling period:** **2009:** *WB017:* 6/10/2009 to 11/12/2009; *EB017:* 6/10/2009 to 11/11/2009; **2010:** *WB017 and EB017:* 6/1/2010 to 11/13/2010; *EB037:* 10/14/2010 to 11/13/2010; *EB038, EB039, EB040 and WB038, WB039, and WB040:* 11/18/2010 to 1/6/2011

#### **Species documented:**

**2009:** *WB017:* 5 elk, 1 human, 149 mule deer and 2 unknown; *EB017:* 1 mule deer and 1 unknown

**2010:** *WB017:* 1 coyote, 5 elk, 88 mule deer and 3 unknown; *EB017:* 40 bobcats, 8 coyotes, 30 elk, 46 mule deer, 3 raccoons and 5 unknown; *EB037\*:* 10 bobcats, 1 coyote, and 2 mule deer; *EB038\*:* 1 unknown; *EB039\*:* 13 bobcats, 1 mule deer, 1 rabbit/hare, 1 raccoon, and 8 squirrels; *EB040\*:* 1 bobcat and 1 unknown; *WB038\*:* 2 birds, 17 bobcats, 4 rabbit/hares, 29 squirrels, and 1 unknown; *WB039\*:* 1 rabbit/hare; *WB040\*:* 10 bobcats

#### **Summary:**

There is a house and parking area at the base of the fill slope that is north of the highway.

**2009:** The two monitoring stations near the Beaver Brook/Floyd Hill exit were set up at fill slopes at the beginning of the season. The westbound camera was set up at the bottom of the fill slope. The eastbound camera was set up two-thirds down the fill slope. A pipe with ephemeral flows at the base of the fill was not monitored. Equipment difficulties hindered data collection at EB017. 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. Duplicates have been removed for analysis in this report.

**2010:** The two monitoring stations at this location were set up at fill slopes at the beginning of the season. The westbound camera was set up partially down the fill slope. The eastbound camera was set up at the base of the fill slope in front of the pipe. Towards the end of the season, a second camera was placed at the entrance of the drainage pipe. Several photos were captured of bobcats entering and exiting the drainage pipe. After the official study season ended on November 14, several cameras were placed on the north and south entrance of the pipe in order to document any through passage. The northern entrance to the pipe, not monitored during the regular study period, was filled in with debris and it was crushed in on itself. Despite a small opening on this side, the cameras captured several bobcats entering and exiting both the north and south openings of this pipe. In addition to the wildlife documented with the cameras, bobcat tracks and mule deer and possible bobcat scat was documented near the station to the south of the highway, bobcat, mountain cottontail and mule deer tracks and mule deer scat near the station to the north.

*\* The data from these cameras is only included in this report anecdotally and is not presented in any of the graphs.*

### **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):** *2009:* WB016 (north), EB016 (south); *2010:* not monitored

**Associated Inventory ID:** JP024

**Description:** fill slope on both north and south side of highway

**Dimensions:**

*WB016:* measurements only taken at EB016

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

**Wildlife fencing:** none

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

**Species documented:**

**2009:**

*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:**

*2009:* 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. The westbound camera was set up halfway down fill slope; the eastbound camera was set up on small flat area at the base of a fill slope.

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):** *2009:* WB015 (north), EB015 (south); *2010:* WB015 (north)

**Associated Inventory ID:** JP025

**Description:** fill slope on both north and south side of highway

**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

**Sampling period:** *2009:* *WB015:* 6/10/2009 to 11/12/2009; *EB015:* 6/10/2009 to 11/11/2009; *2010:* *WB015:* 6/4/2010 to 10/12/2010

**Species documented:**

*2009:* *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

*2010:* *WB015:* 2 birds, 165 mule deer, and 5 unknown

**Summary:**

There are a few residences beyond the base of the fill slope that is north of the highway.

*2009:* The monitoring stations just east of the Evergreen Parkway exit (for the northern station) and just west of the Chief Hosa exit (for the southern station) were set up at fill slopes at the beginning of the season. The westbound camera was set up at base of fill slope; the eastbound camera was set up on top of broad fill with retaining wall across top. In addition to the animals documented with cameras, elk and mule deer tracks were detected near the station to the south of the highway. Several live deer were seen at the station to the north. Mule deer at the westbound (north) station may have lingered in front of the camera. Thus the numbers originally reported (above) for this species may be inflated. Duplicates have been removed for analysis in this report. Mule deer were seen on the north side of the highway.

**2010:** The one monitoring station was set up at the beginning of the season to the north of the highway. The camera was set up at the base of the fill slope. Towards the end of the season, the camera began to malfunction and was taken down due to lack of replacement cameras. Grazing mule deer lingered in front of the camera at times; thus numbers originally reported (above) for this species may be inflated. Duplicates have been removed for analysis in this report.

### **MP 254.5 (No structure)**

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

**Type:** fill slope; pipe present but not monitored

**Monitoring station(s):** **2009:** WB014 (north), EB014 (south); **2010:** EB014 (south)

**Associated Inventory ID:** JP026

**Description:** fill slope on both north and south side of highway; ephemeral pipe at base of fill slope

**Dimensions:**

*WB014:* measurements only taken at EB014

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

**Wildlife fencing:** none

**Sampling period:** **2009:** *WB014:* 6/10/2009 to 11/12/2009; *EB014:* 6/10/2009 to 11/11/2009; **2010:** *EB014:* 6/4/2010 to 11/13/2010

**Species documented:**

**2009:** *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

**2010:** *EB014:* 1 bird, 3 coyotes, 28 elk, 1 human, 27 mule deer, 1 raccoon, 6 red foxes, 3 striped skunks, and 1 unknown

**Summary:**

There are scattered residences to the north and south of the monitoring stations at this location.

**2009:** 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. The westbound camera was set up near the pipe culvert and stream adjacent to a large meadow at base of broad, open fill slope. The eastbound camera was set up near the pipe culvert and stream adjacent to large meadow at base of long, steep fill slope. In addition to the animals documented with cameras, elk tracks and scat were recorded near the station to the south of the highway.

**2010:** The one monitoring station at this location was set up at the beginning of the season. The camera was set up near the pipe culvert and stream adjacent to large meadow at base of long, steep fill slope. Most of the individuals documented were crossing a barbed wire fence set up south of the camera. Elk tracks were also recorded near this station.

### **MP 255.3 (No structure)**

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

**Type:** fill slope; pipe present but not monitored

**Monitoring station(s):** **2009:** WB013 (north), EB013 (south); **2010:** not monitored

**Associated Inventory ID:** *Westbound:* JP022; *Eastbound:* JP027

**Description:** fill slope on both north and south side of highway; ephemeral pipe at base of 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

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

**Species documented:**

**2009:** *WB013:* 1 bird, 3 elk, 3 humans and 21 mule deer; *EB013:* No animals detected

**Summary:**

**2009:** The monitoring stations just west of the Lookout Mountain/Cabrini Shrine exit were set up at fill slopes at the beginning of the season. The westbound camera was set up near a pipe culvert and stream at base of fill slope. The eastbound camera was set up midway down a steep fill slope. 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. Duplicates have been removed for analysis in this report. There are residences to the north of the highway.

**Results**

*All Species*

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 these study years do include monitoring locations on west Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now RMW) from 2006 to 2008.

**2009:** Between May 20, 2009 and November 12, 2009, the following species were documented throughout the study area: 1740 mule deer, 134 elk, 93 coyotes, 39 red foxes, 28 black bears, 28 rabbits/hares, 12 marmots, 10 raccoons, 7 squirrels, 5 badgers, 3 gray foxes, 2 porcupines, 2 bobcats, 2 striped skunks, 1 moose and 1 mountain lion (Figures 1, 4, 6, 8, 11, 13, 15, 17, 20 and 22; duplicate animals removed). Domesticated animals documented include dogs, cats, horses, donkeys/pack mules, cattle and goats.

**2010:** Between June 1, 2010 and November 13, 2010, the following species were documented throughout the study area: 1789 mule deer, 235 elk, 114 coyotes, 64 red foxes, 51 raccoons, 47 rabbits/hares, 42 bobcats, 22 squirrels, 13 marmots, 11 black bears, 9 mountain lions, 8 rodents, 6 porcupines, 4 moose, 3 striped skunks, 2 bighorn sheep, and 2 weasels (Figures 2, 3, 5, 7, 9, 10, 12, 14, 16, 18, 19, 21 and 23; duplicate animals removed). Domesticated animals documented include dogs, cats, horses, donkeys/pack mules, cattle, and sheep. See appendix 1 for sample photographs from various monitoring locations.

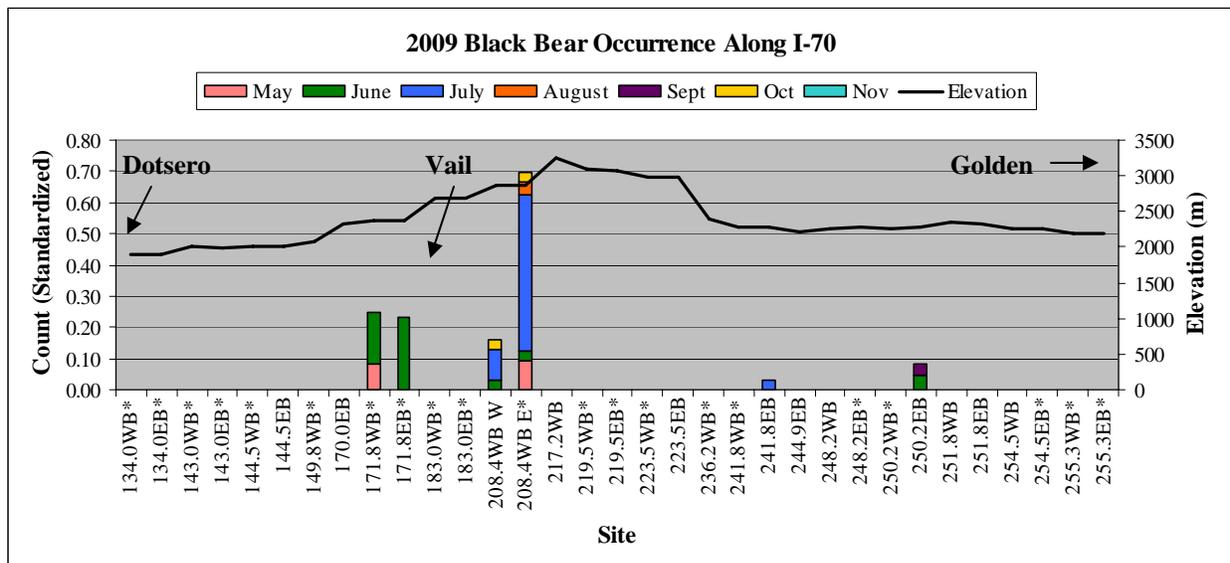


Figure 1 – Number of black bears detected in 2009

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

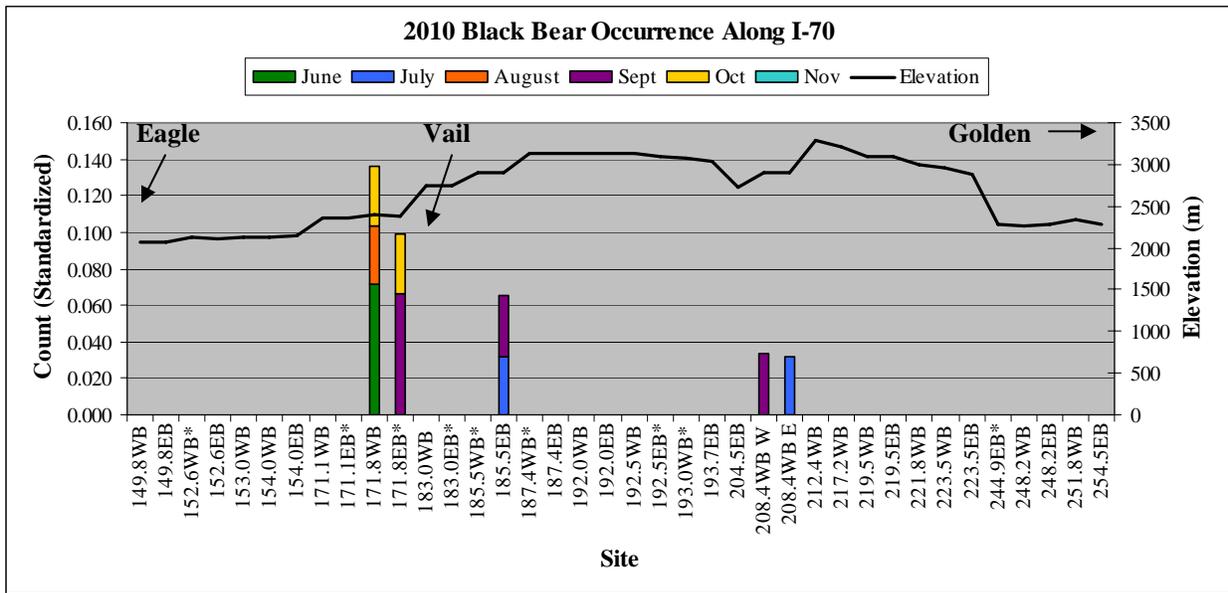


Figure 2 – Number of black bears detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

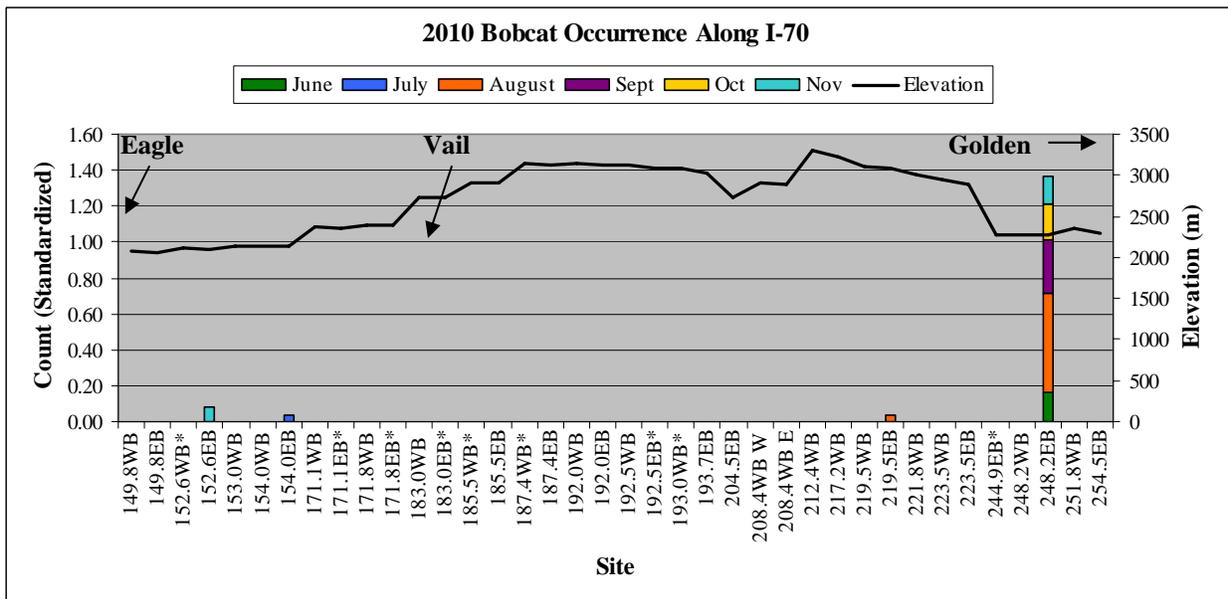


Figure 3 – Number of bobcats detected in 2010 (see Figure 22 for 2009 bobcat detections)

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

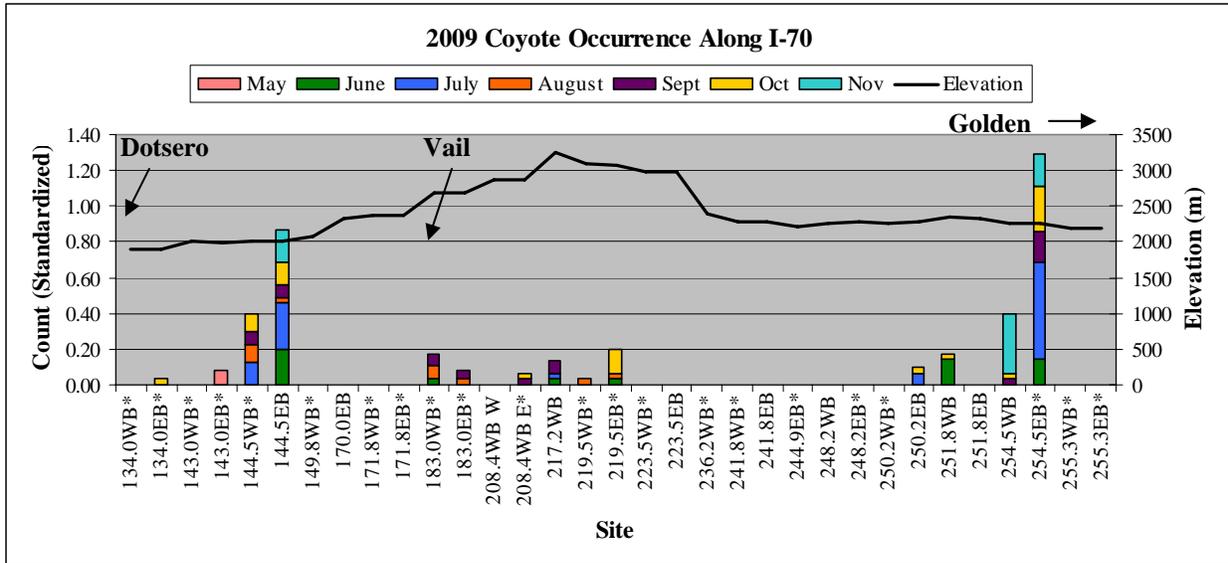


Figure 4 – Number of coyotes detected in 2009

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

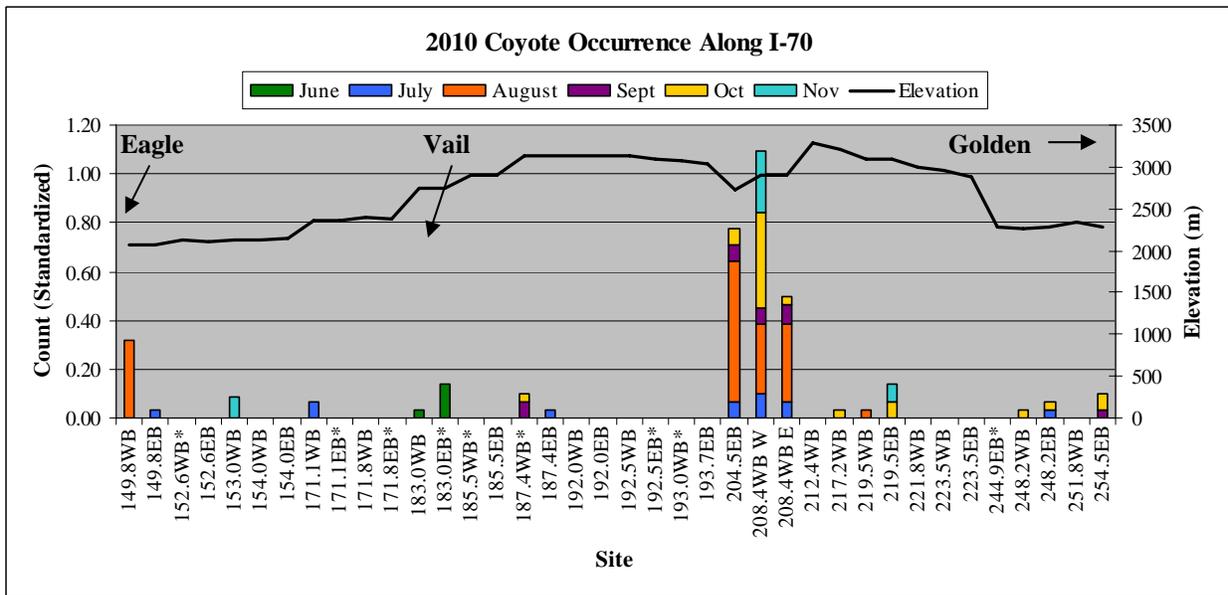


Figure 5 – Number of coyotes detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

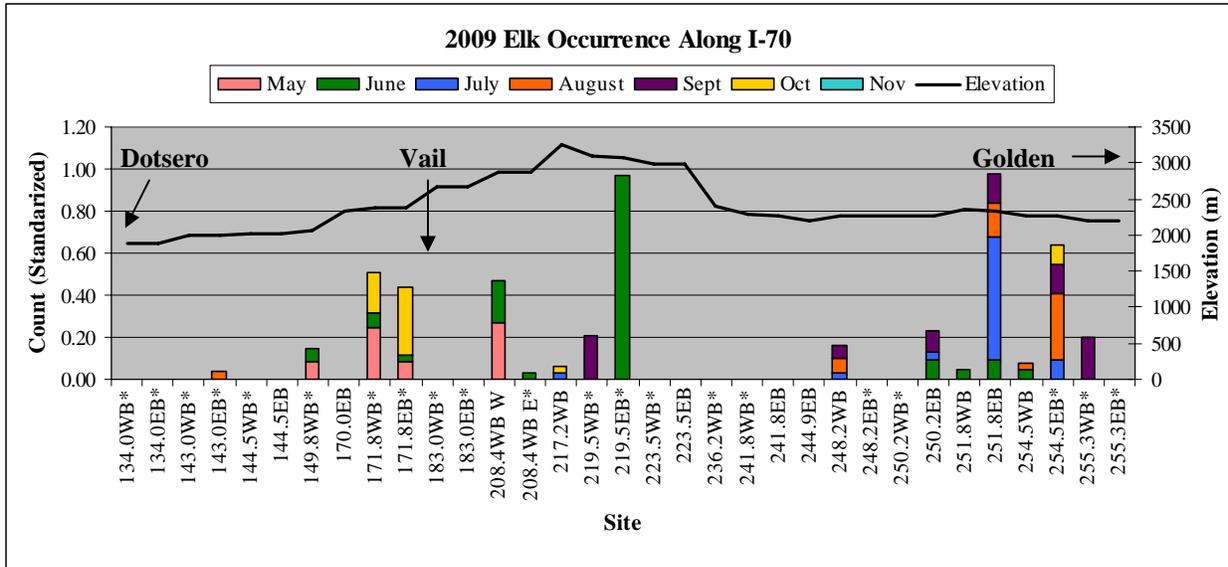


Figure 6 – Number of elk detected in 2009

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

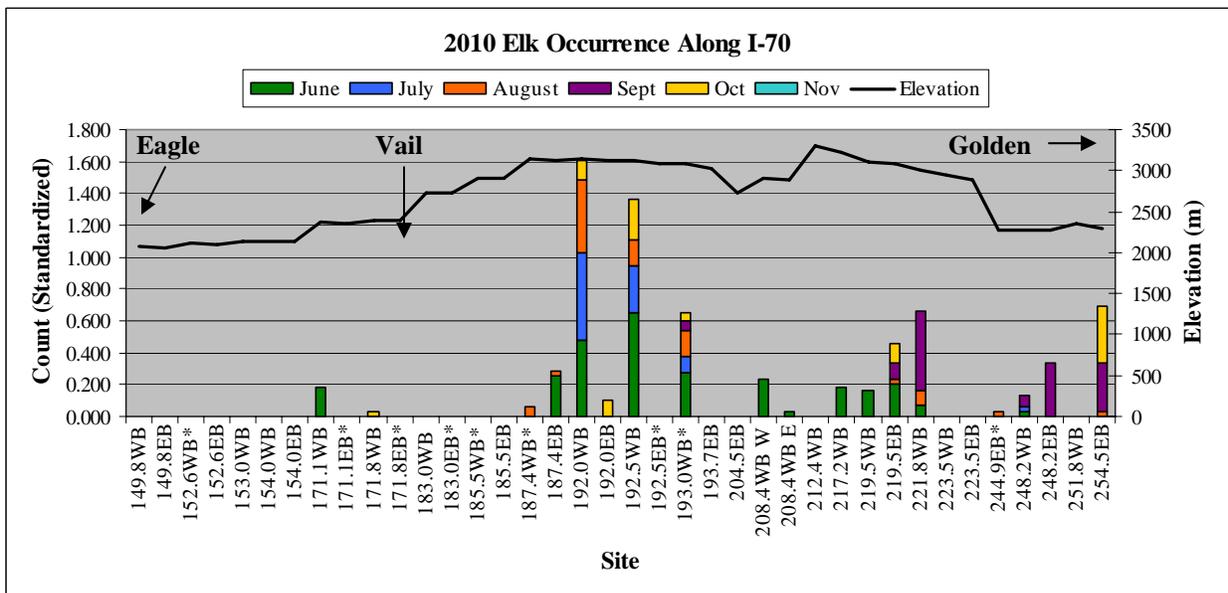


Figure 7 – Number of elk detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

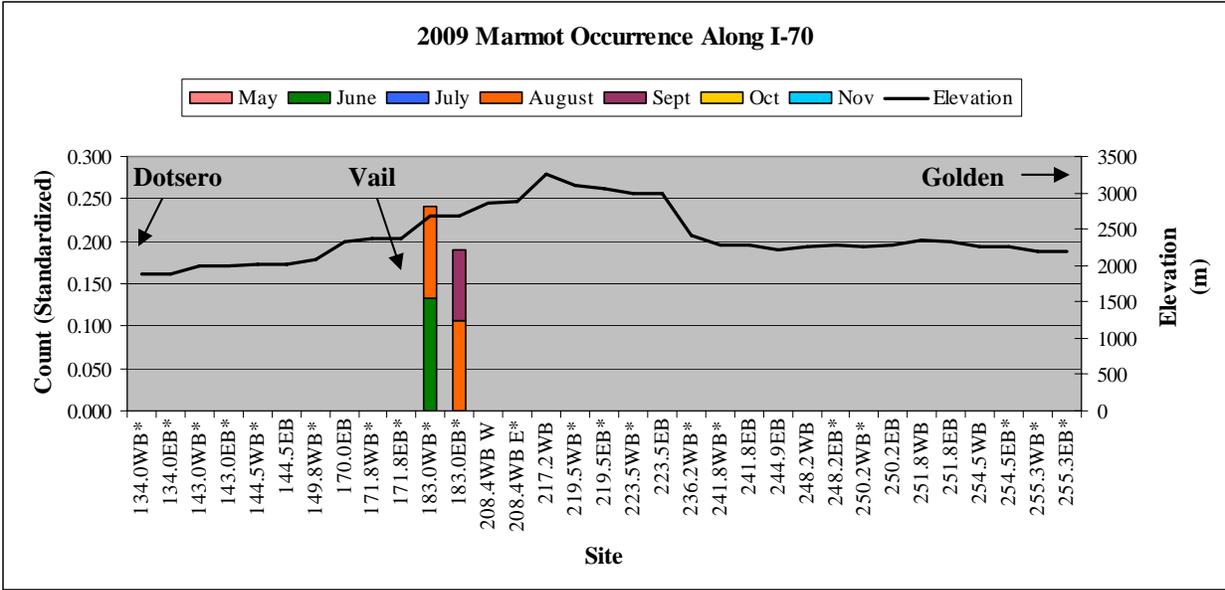


Figure 8 – Number of marmots detected in 2009

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

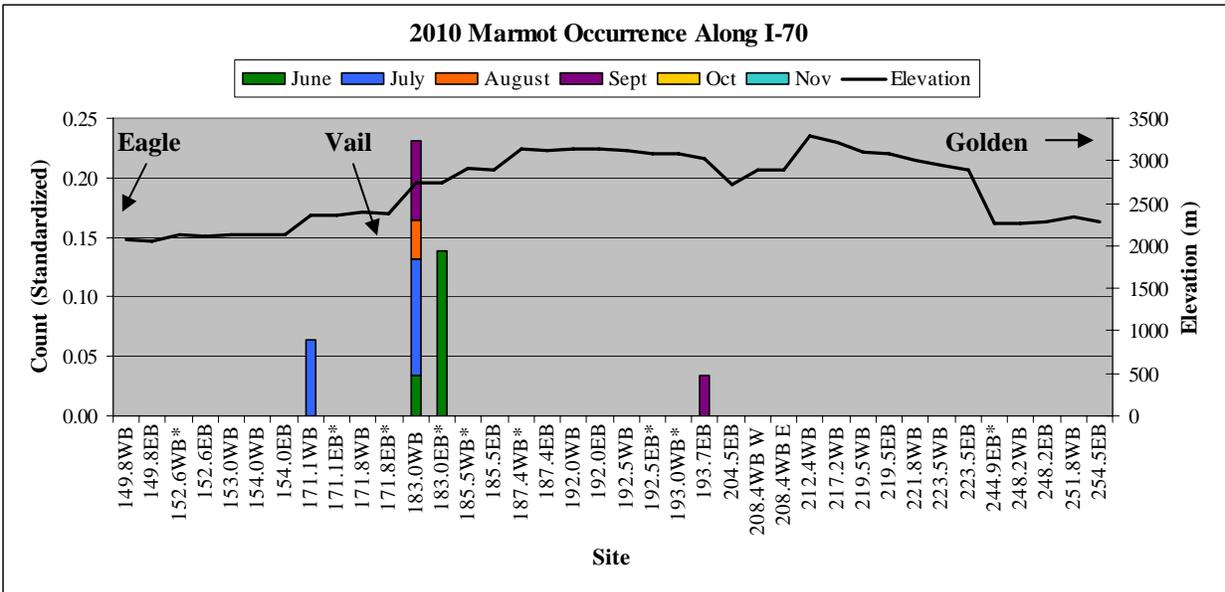


Figure 9 – Number of marmots detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

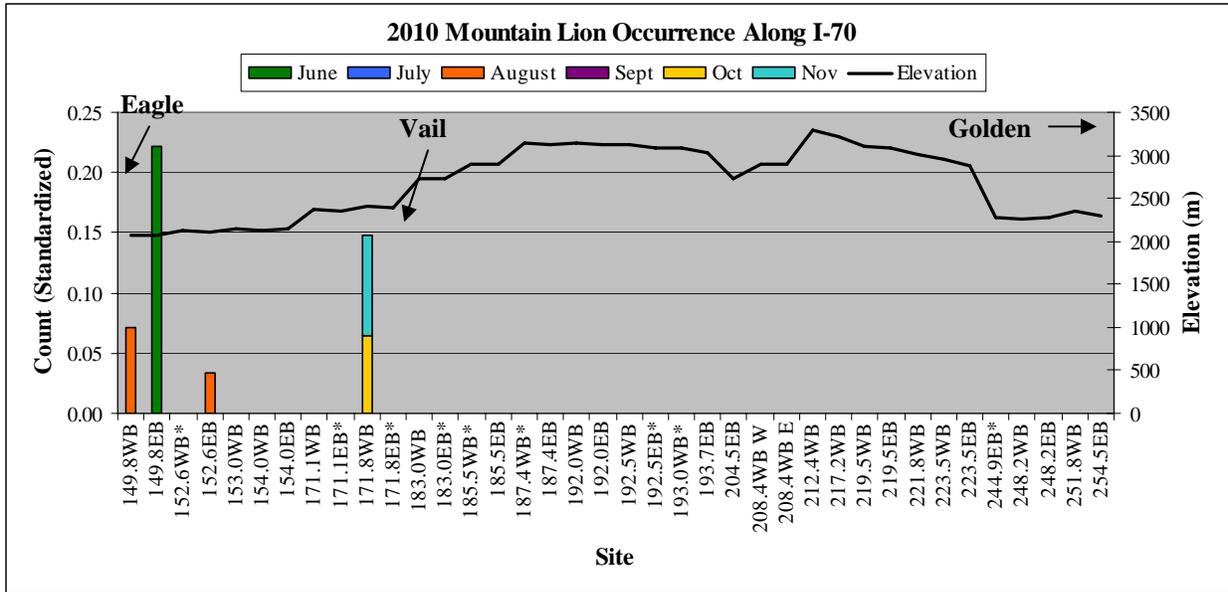


Figure 10 – Number of mountain lions detected in 2010 (see Figure 22 for 2009 mountain lion detections)  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

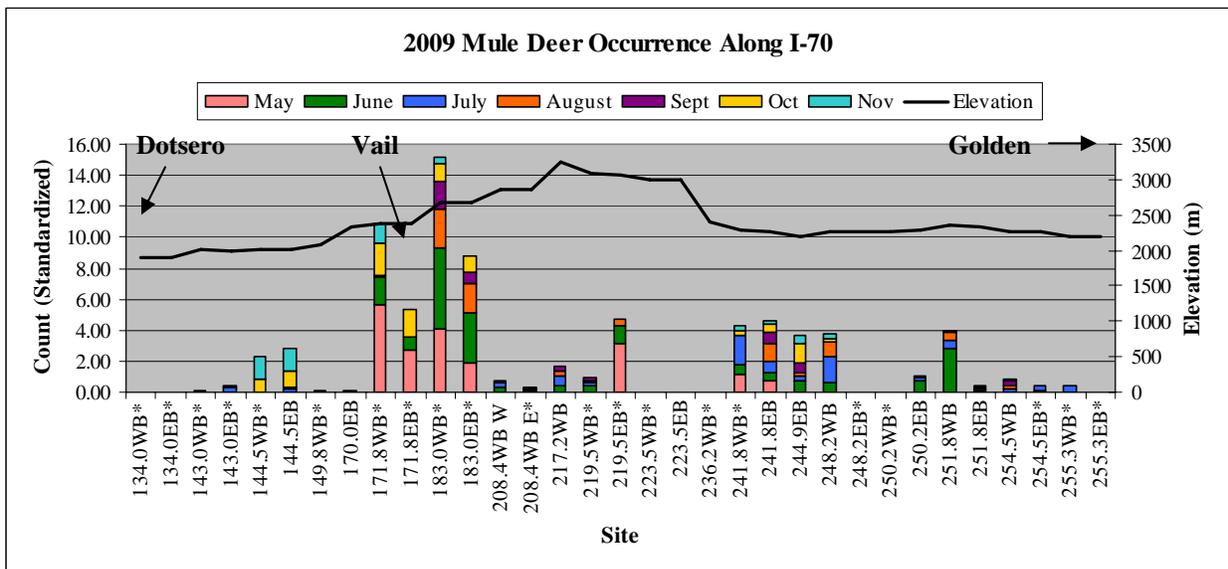


Figure 11 – Number of mule deer detected in 2009  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

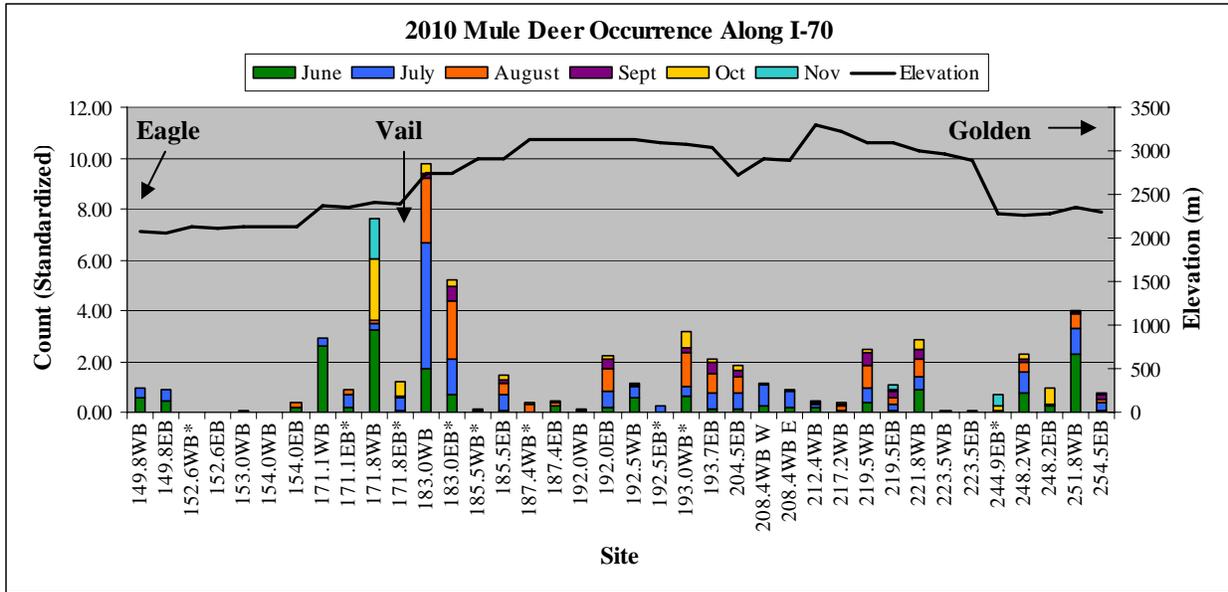


Figure 12 – Number of mule deer detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

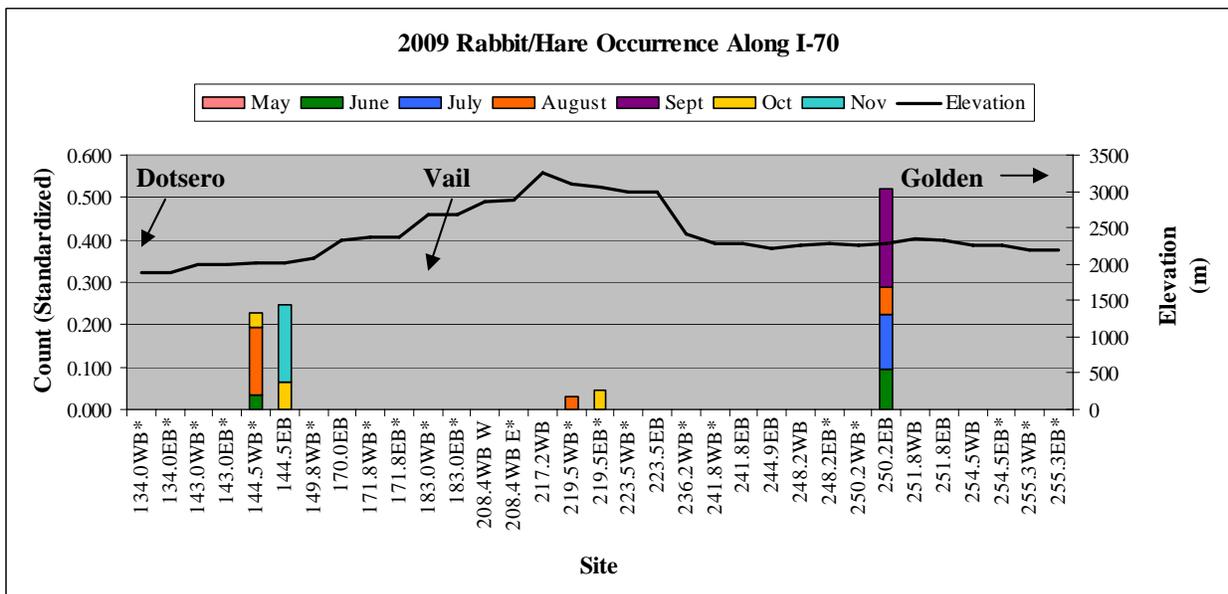


Figure 13 – Number of rabbits/hares detected in 2009

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

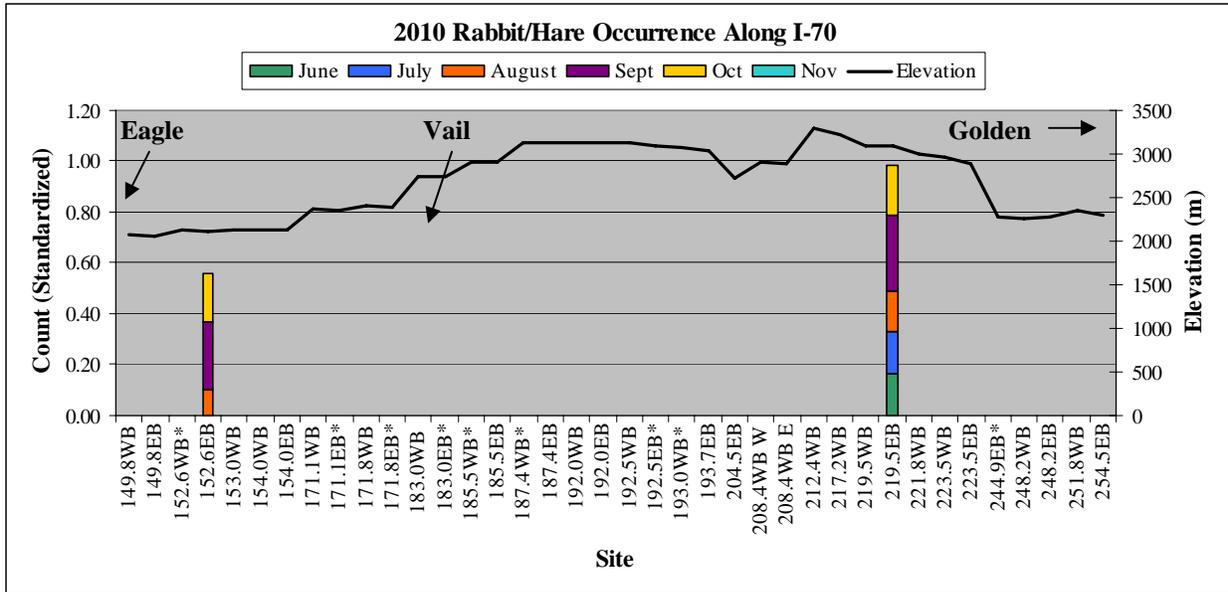


Figure 14 – Number of rabbits/hares detected in 2010  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

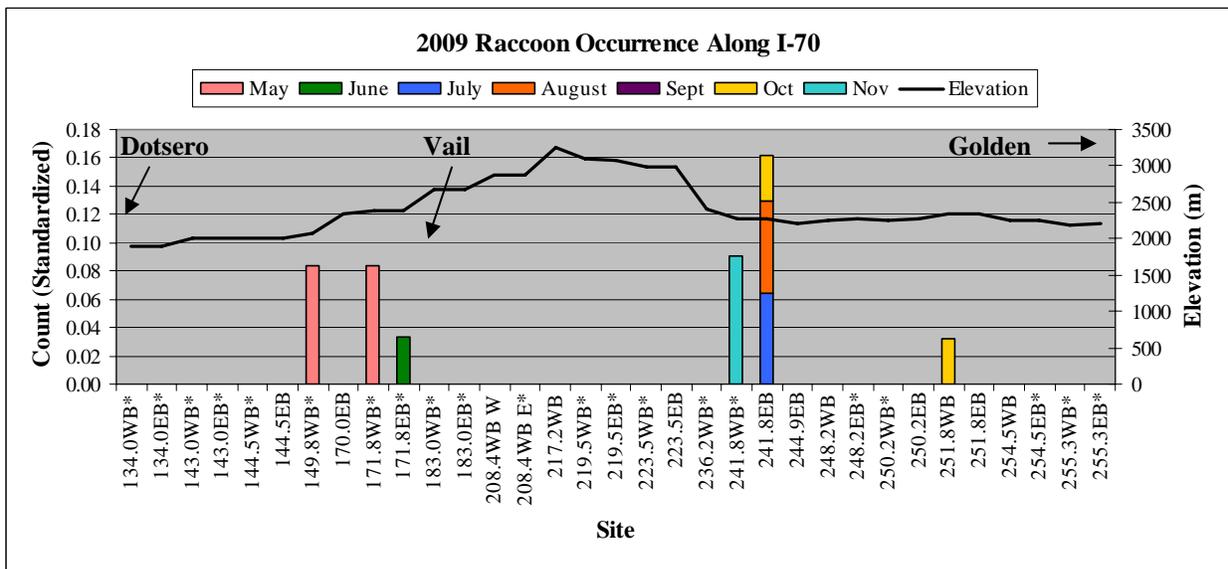


Figure 15 – Number of raccoons detected in 2009  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

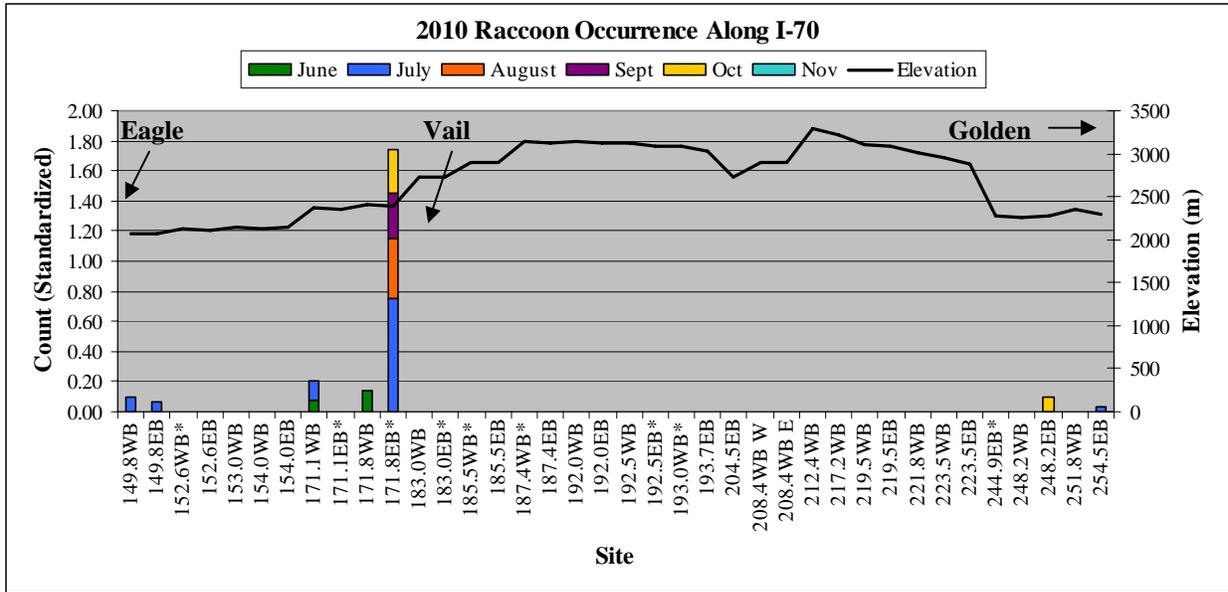


Figure 16 – Number of raccoons detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

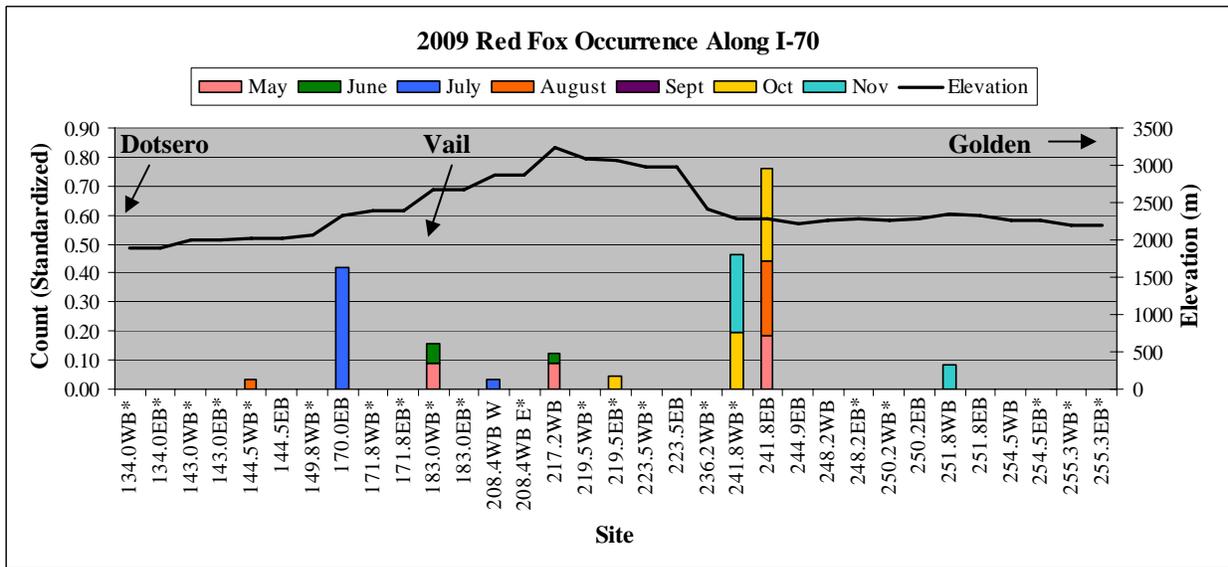


Figure 17 – Number of red foxes detected in 2009

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

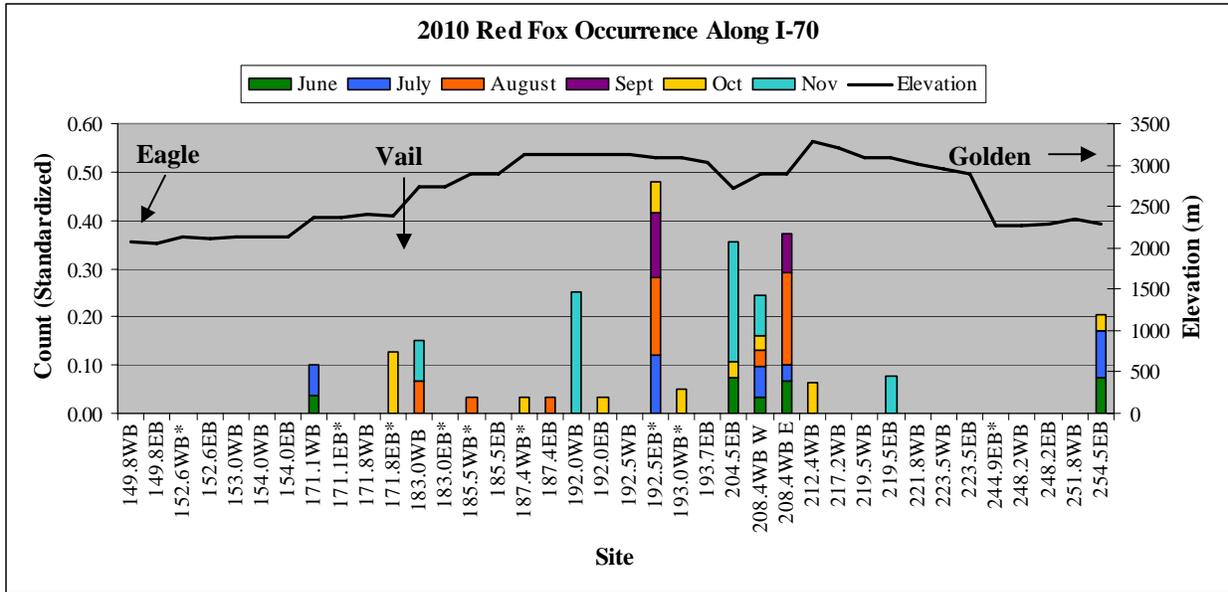


Figure 18 – Number of red foxes detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

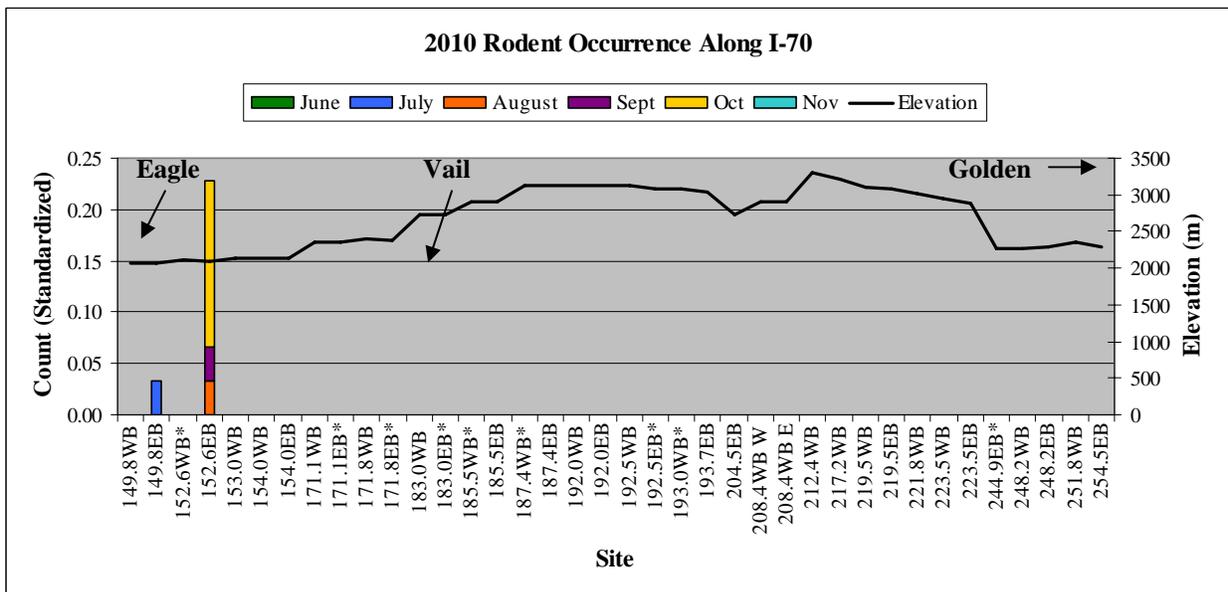


Figure 19 – Number of rodents detected in 2010

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

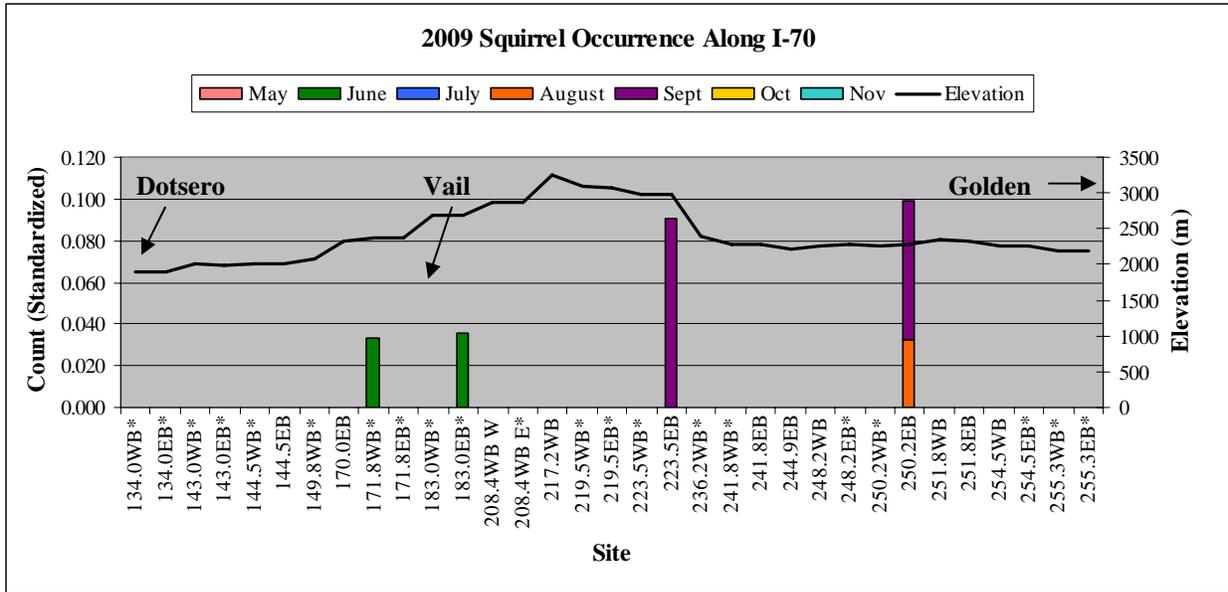


Figure 20 – Number of squirrels detected in 2009

\*The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

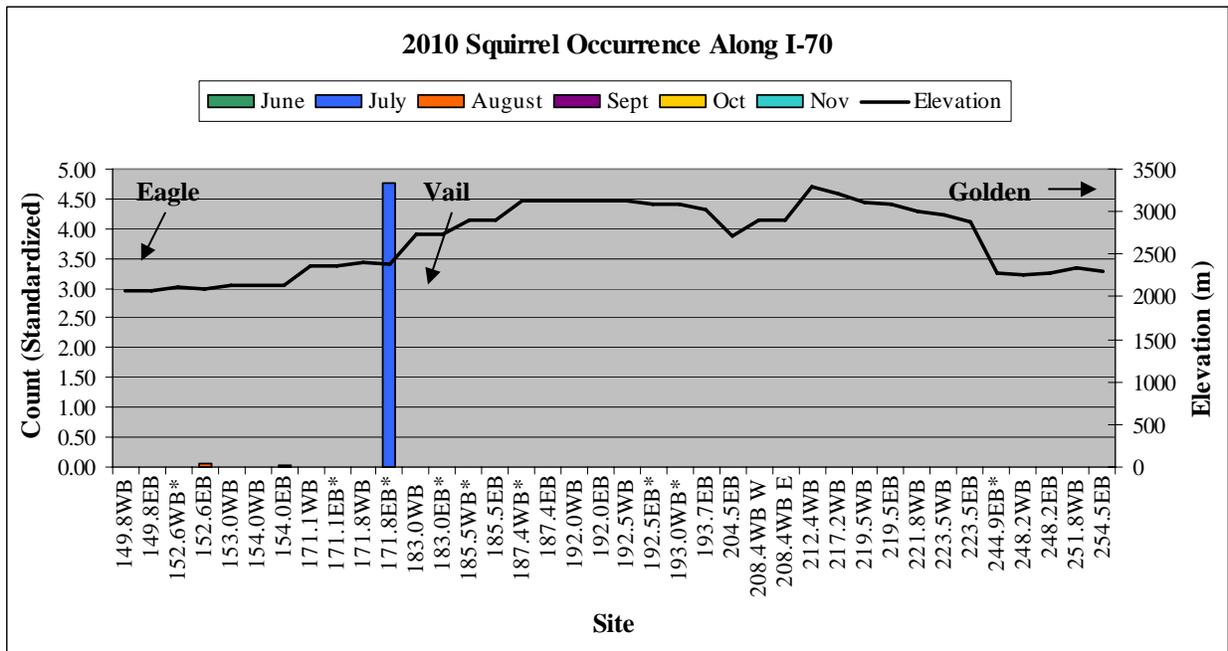


Figure 21 – Number of squirrels detected in 2010

\*The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

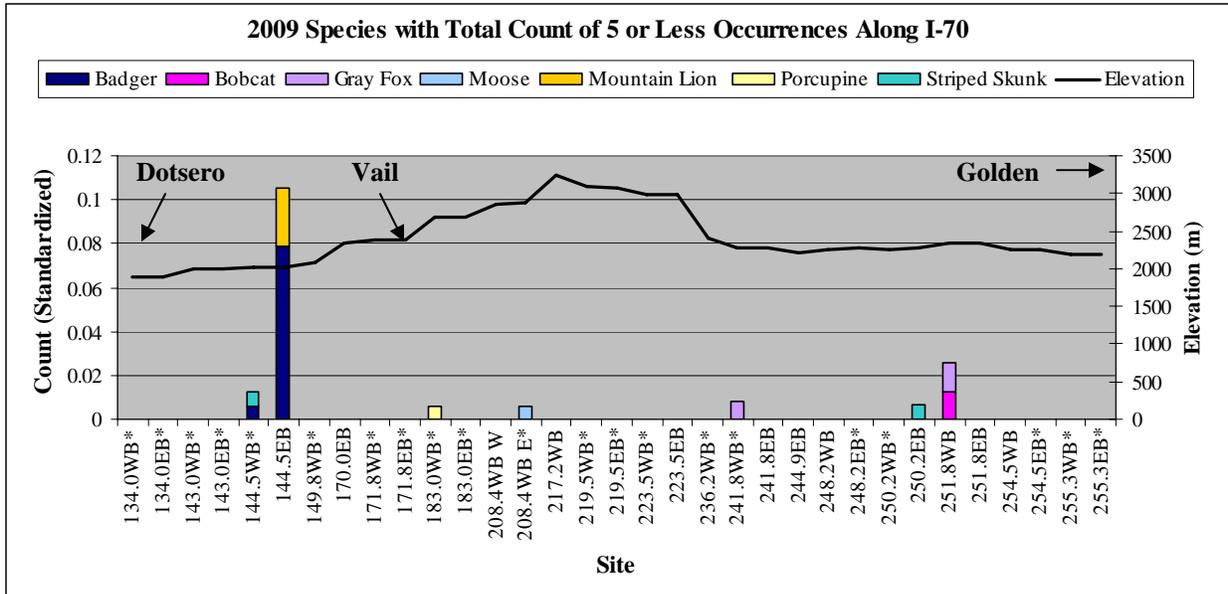


Figure 22 – Total count for species with 5 or less documented individuals over entire study period in 2009  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

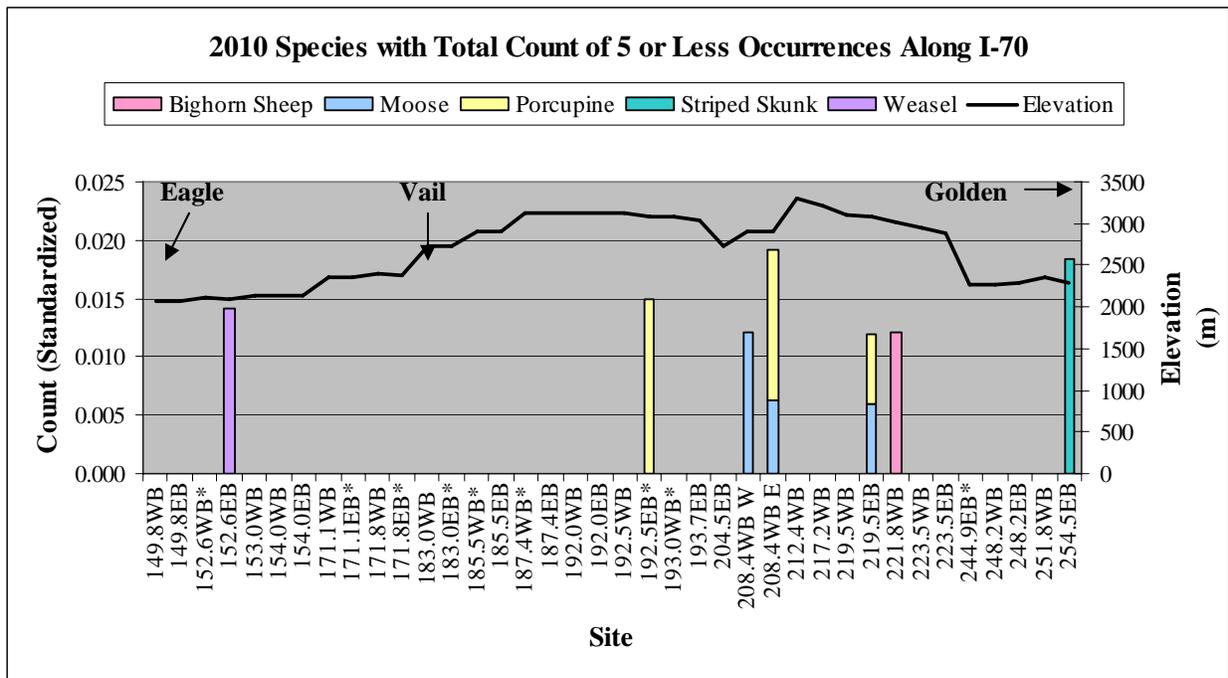


Figure 23 – Total count for species with 5 or less documented individuals over entire study period in 2010  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

*Mule Deer and Elk*

The following graphs show the number of mule deer and elk detected in 2009 and 2010 standardized by the number of sample nights. In 2009, 1740 mule deer were documented throughout the study area (duplicate animals removed). The largest percentage of mule deer, almost 20%, 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 had the second largest percentage of mule deer, about 12%. In 2010, 1789 mule deer were documented (duplicate animals removed). The largest percentage of mule deer, more than 15%, was documented again at the westbound (north) station at mile post 183. Most locations with monitoring stations in both years show some variation between years (Figure 24).

In 2009, 134 elk were documented throughout the study area (duplicate animals removed). The largest percentage of elk, slightly over 25%, was documented at mile post 219.5 at the eastbound (south) station. In 2010, 235 elk were documented (duplicate animals removed). At the westbound (north) station at mile post 192.0, the largest percentage of elk occurred accounting for over 20% of the total number of elk captured. Again, there is some variation between years at most locations with monitoring stations in both years (Figure 25).

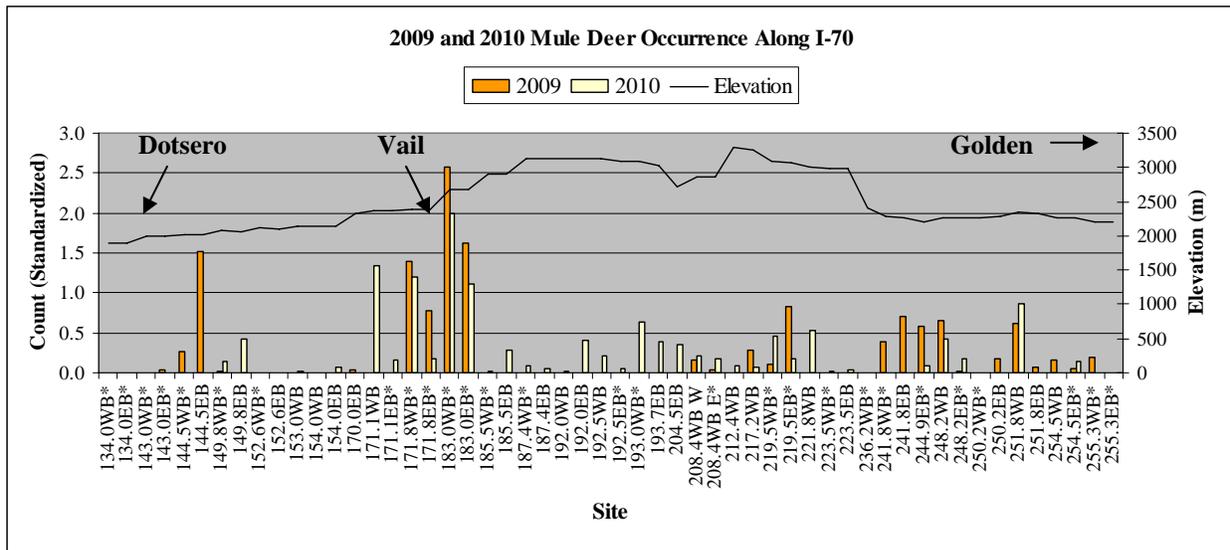


Figure 24 – Number of mule deer detected in 2009 and 2010  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

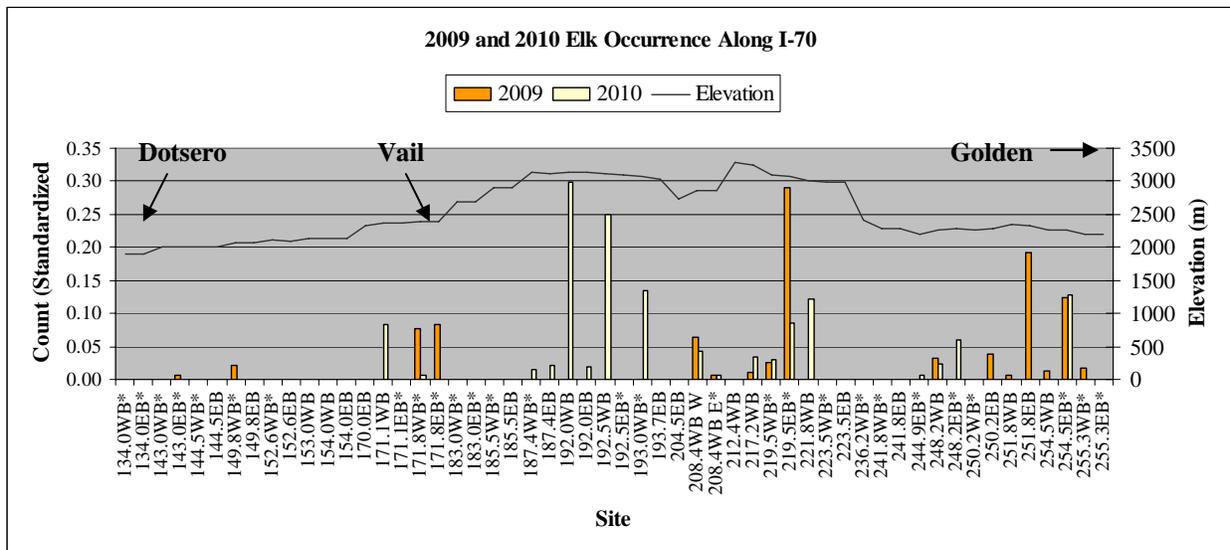


Figure 25 – Number of elk detected in 2009 and 2010  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

*Mule Deer - Structured Sites*

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. 2009: 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 had structures, either a bridge or a culvert, which were monitored on both sides of the highway.

There is no evident overall trend for mule deer activity for the 2009 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 171.8 had a peak early and late in the study session and number of detections varied between the east- (south) and westbound (north) stations (Figures 26-29).

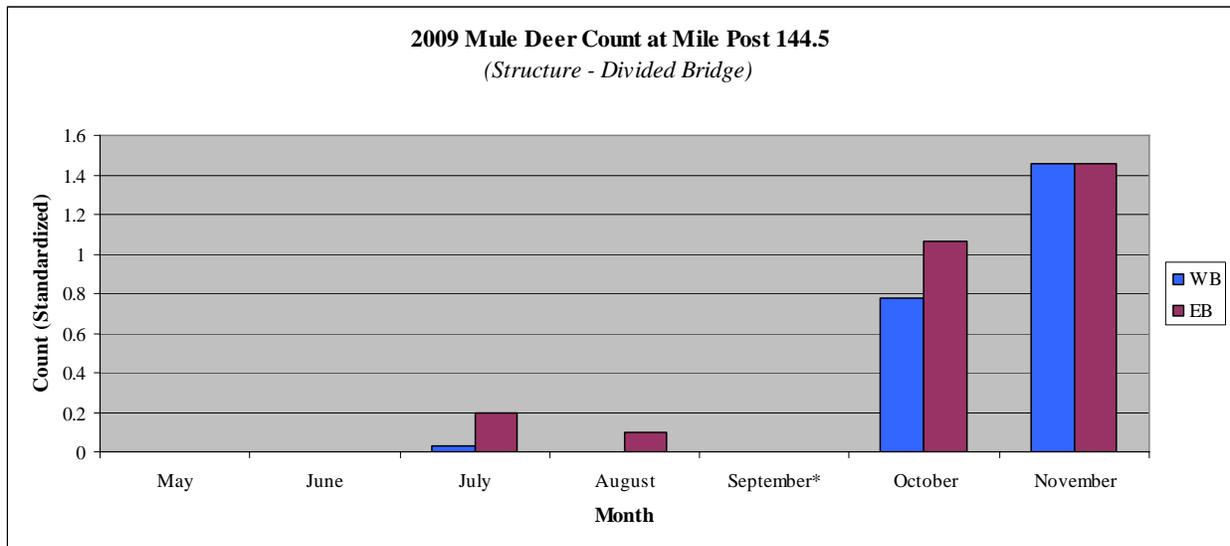


Figure 26 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 144.5 west of Eagle. Elevation – EB and WB approx. 2000m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

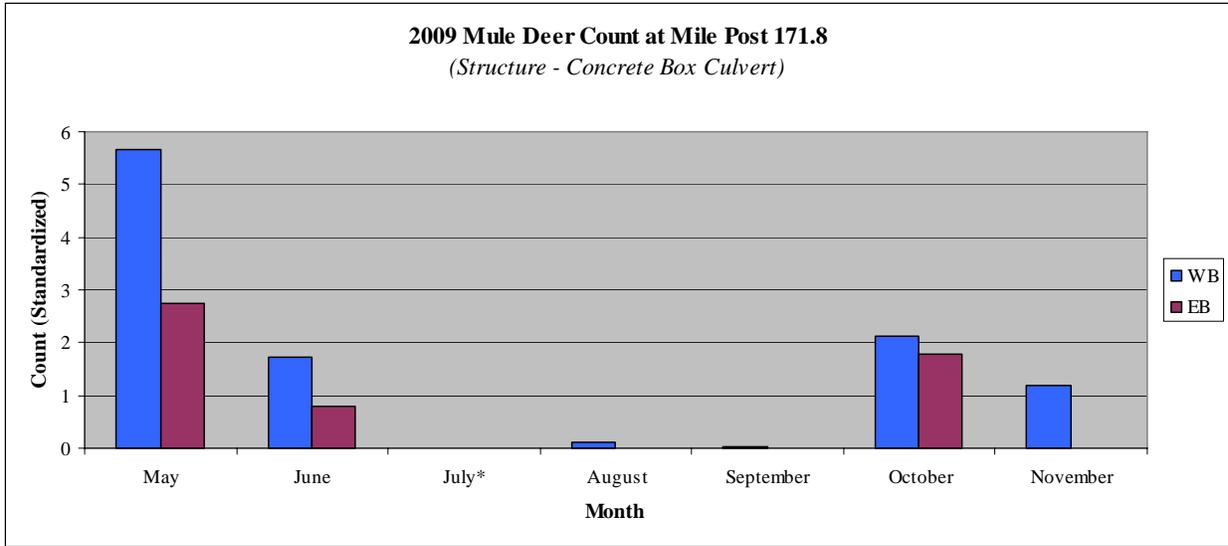


Figure 27 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 171.8 between Minturn and Vail at Dowd’s Junction. Elevation – EB and WB approx. 2400m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

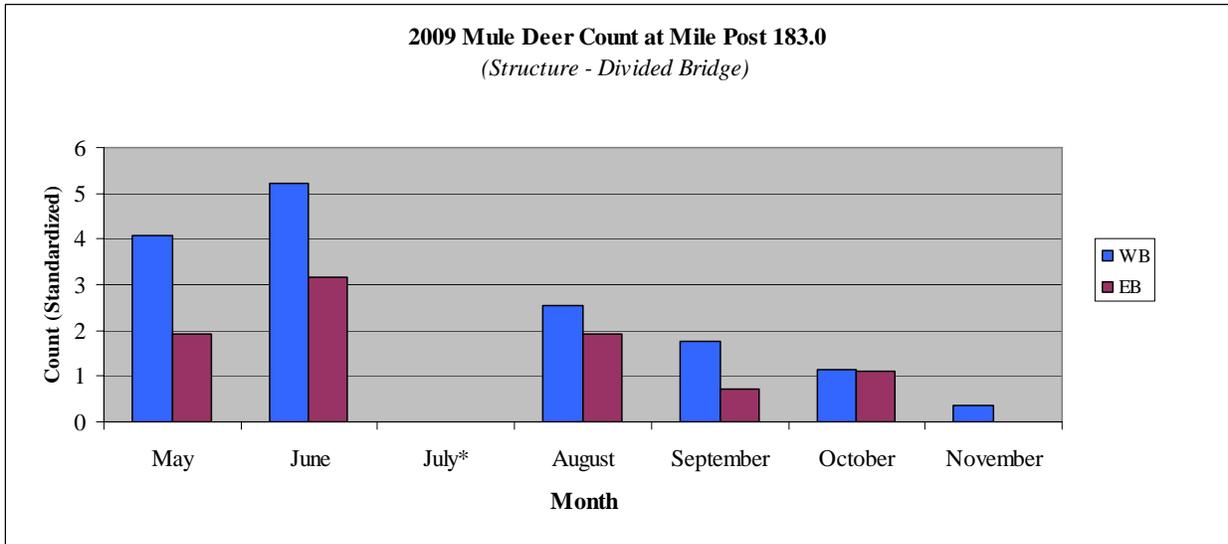


Figure 28 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 183.0 west of Vail about seven miles from the summit of Vail Pass. Elevation – approx. 2700m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

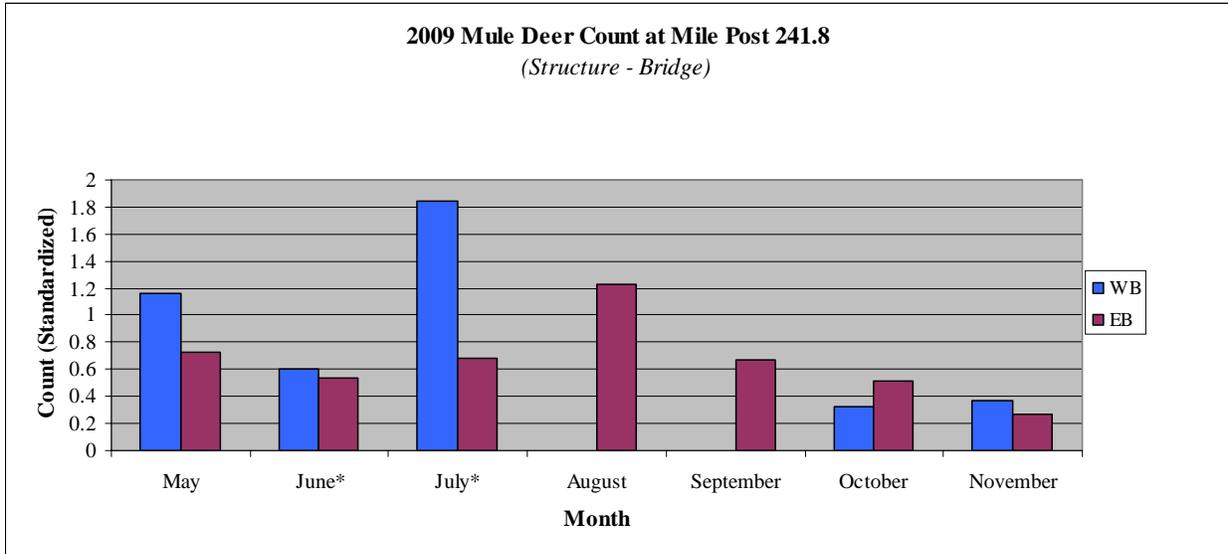


Figure 29 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 241.8 east of Idaho Springs. Elevation – approx. 2300m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

2010: 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 had structures, either a bridge or a culvert, which were monitored on both sides of the highway. One additional pipe was monitored on both sides of the highway, but the large median dividing each direction of traffic was not monitored so it is not included in the account above.

Again, there is no evident overall trend for mule deer activity for the 2010 sites with structures. Detections at the stations at MP 149.8 were relatively consistent at both the east- (south) and westbound (north) stations throughout the time both cameras were operational. MP 171.1 had detections throughout the time both cameras were operational but varied between the east- (south) and westbound (north) stations. MP 171.8 again had a peak early and late in the study session and number of detections varied between the east- (south) and westbound (north) stations. MP 183.0 and 185.5 both had a peak early in the season and varied between the east- (south) and westbound (north) stations throughout the study session (Figures 30-34).

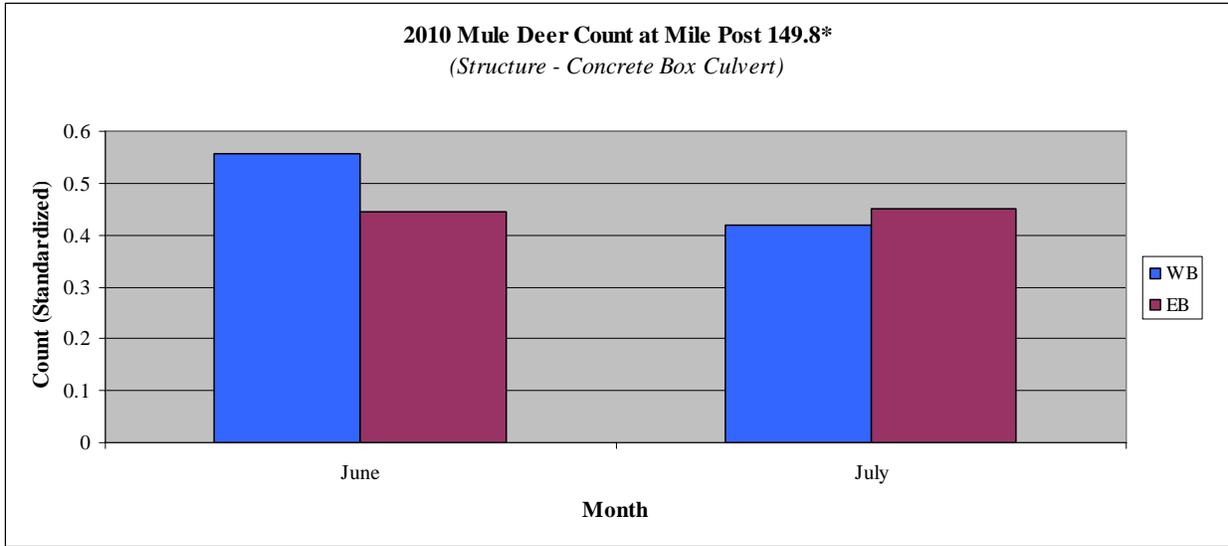


Figure 30 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 149.8 east of Eagle. Elevation – approx. 2100m

\* The camera at the eastbound monitoring site was stolen sometime between 8/2/2010 – 9/16/2010.

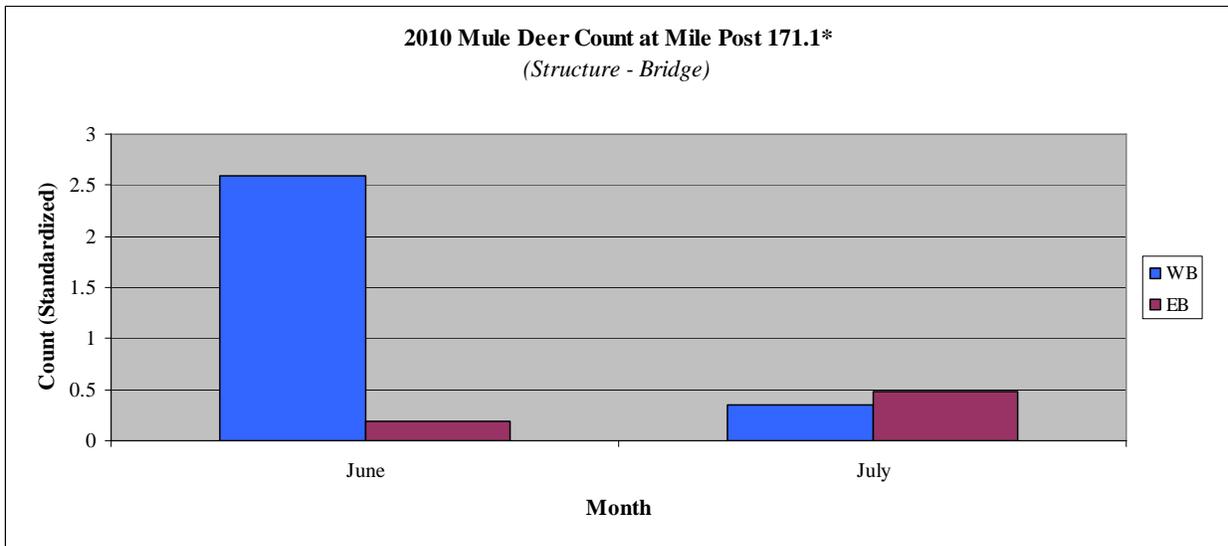


Figure 31 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 171.1 near Minturn. Elevation – EB and WB approx. 2400m

\* The camera at the westbound monitoring site was stolen sometime between 8/2/2010 – 9/16/2010.

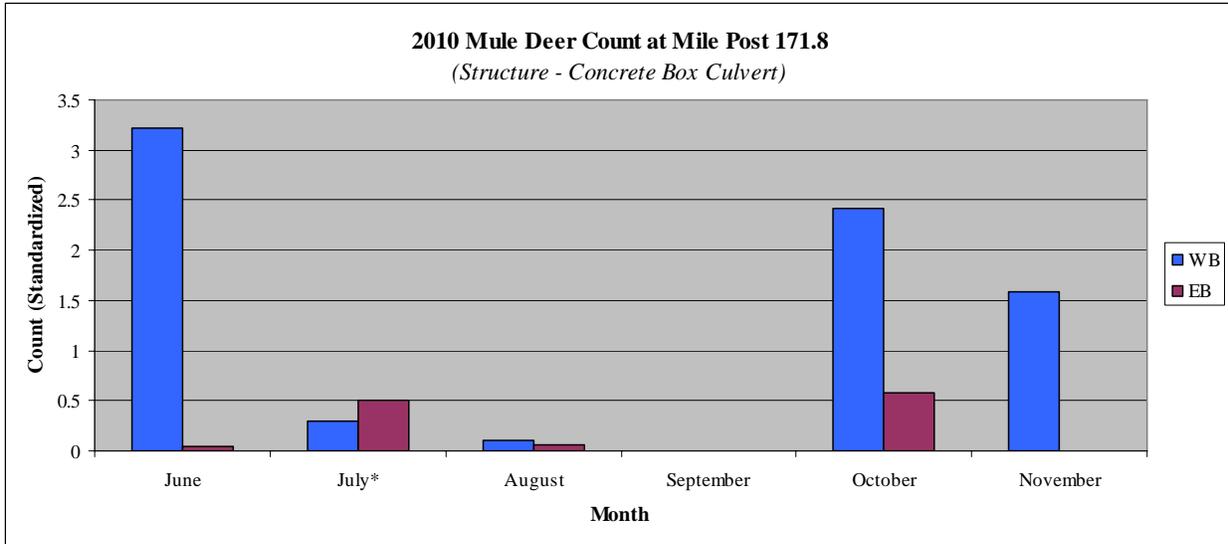


Figure 32 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 171.8 between Minturn and Vail at Dowd's Junction. Elevation – approx. 2400m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

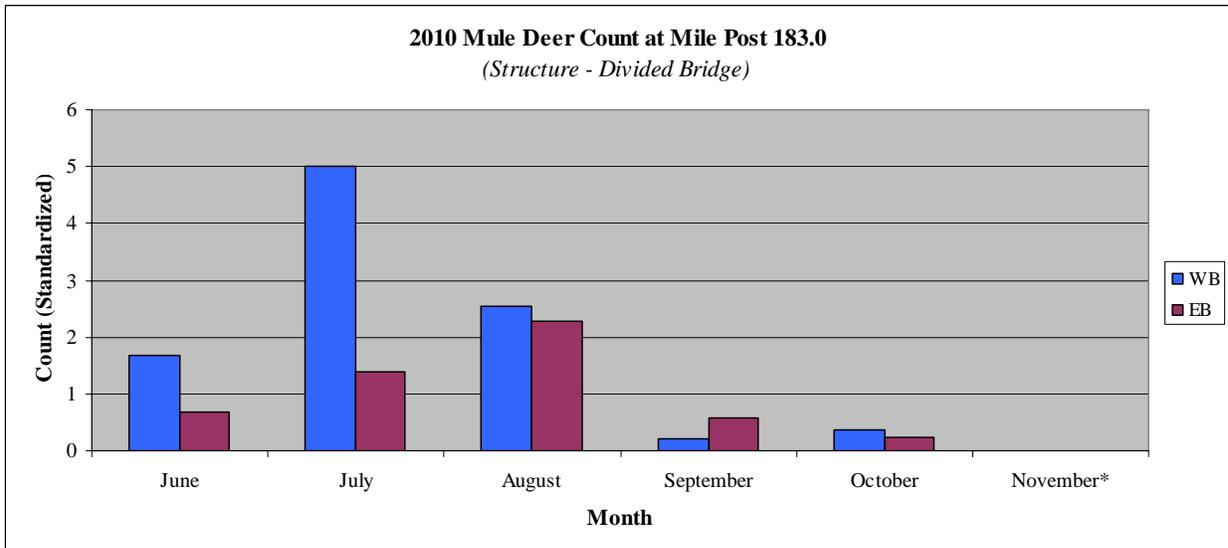


Figure 33 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 183.0 east of Vail about seven miles from the summit of Vail Pass. Elevation – approx. 2700m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

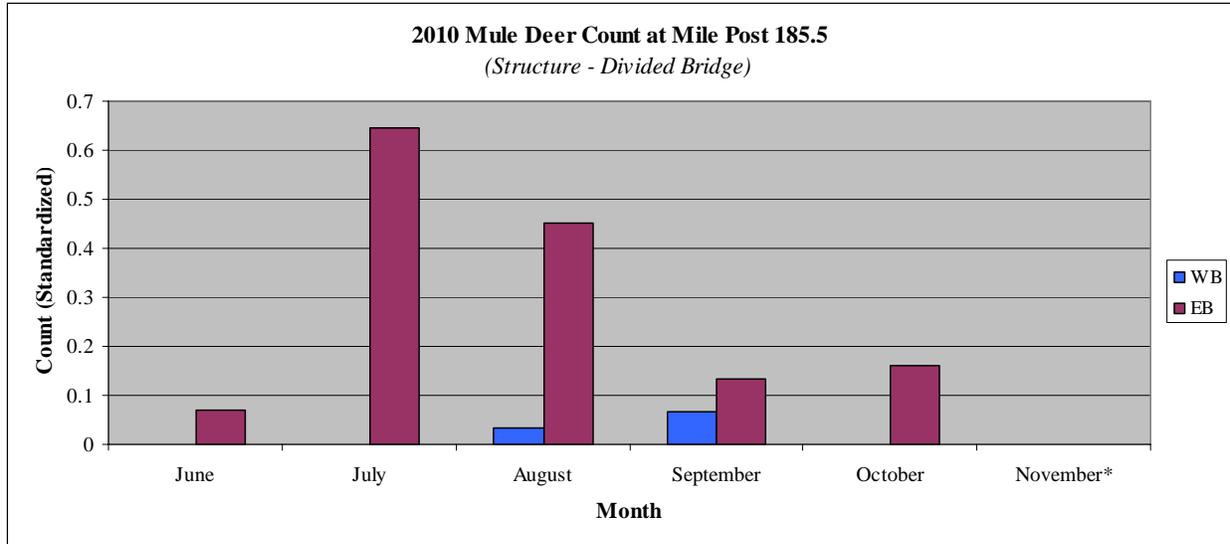


Figure 34 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 185.5 east of Vail about 4.5 miles from the summit of Vail Pass. Elevation – EB and WB approx. 2900m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

#### Mule Deer – Non-Structured Sites

2009: Six sites in 2009 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.

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 (Figures 35-38).

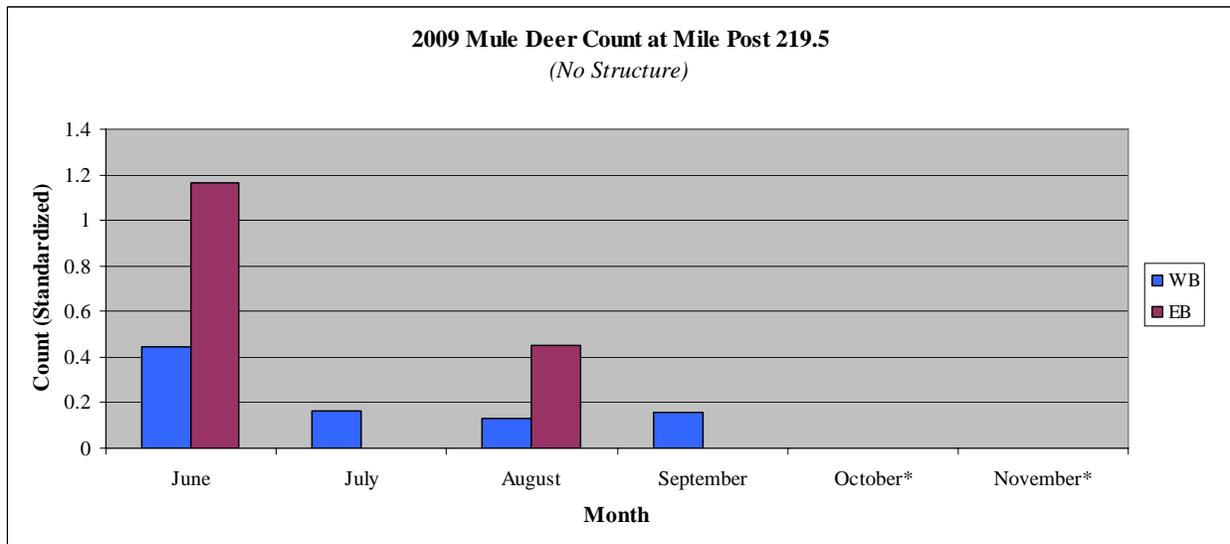


Figure 35 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 219.5 west of Bakerville at Watrous Gulch. Elevation – EB and WB approx. 3100m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

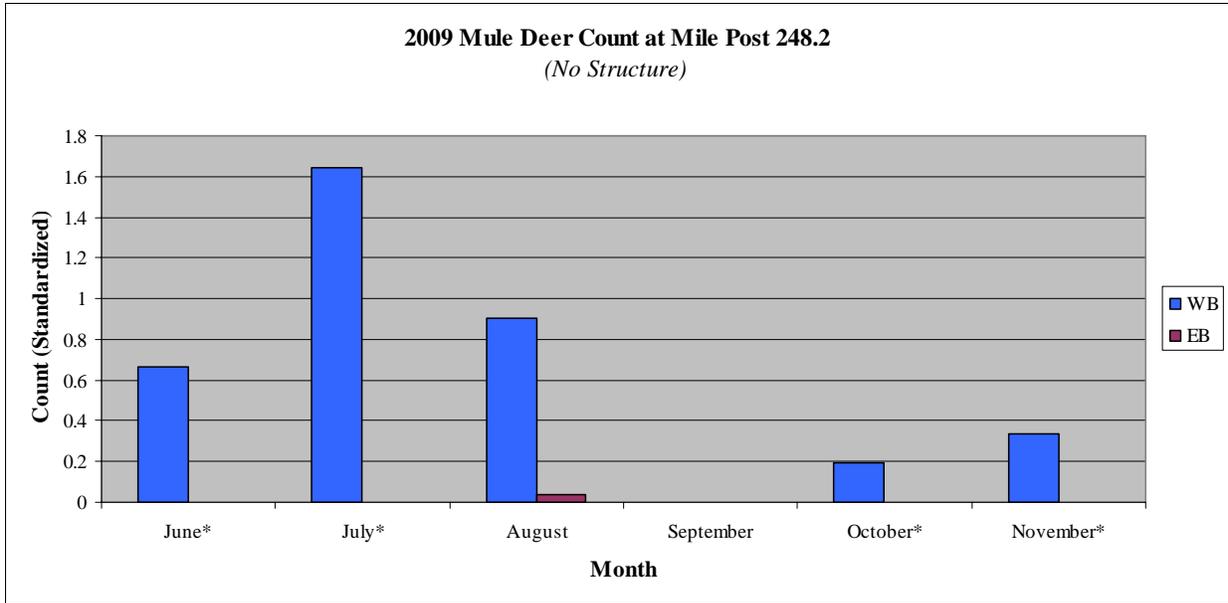


Figure 36 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 248.2 near the Beaver Brook/Floyd Hill exit. Elevation – EB and WB approx. 2300m  
 \* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

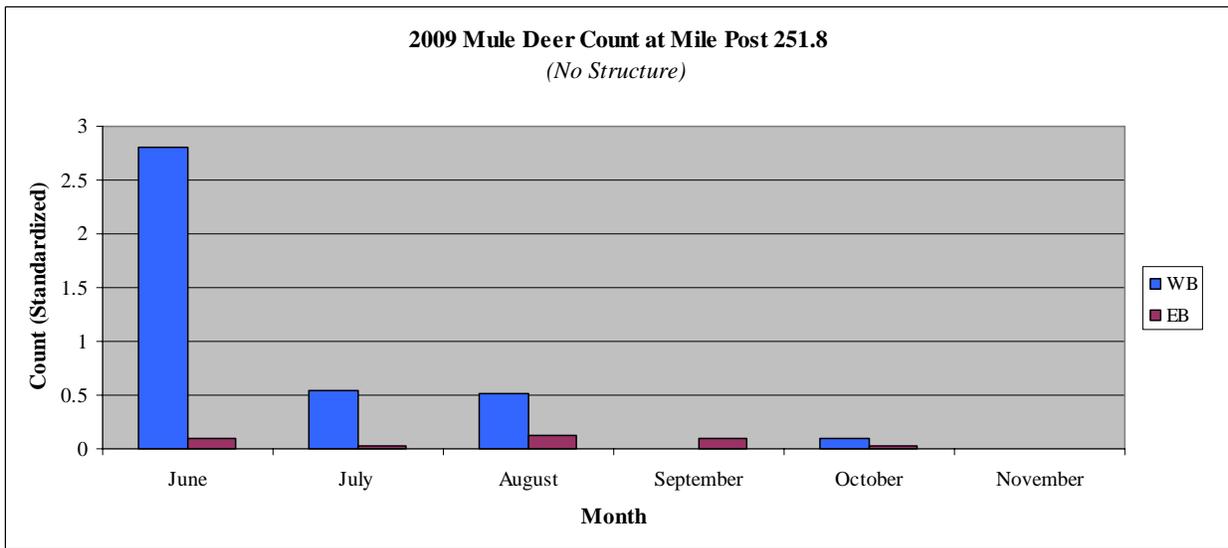


Figure 37 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 251.8 just west of Evergreen. Elevation –EB and WB approx. 2300m

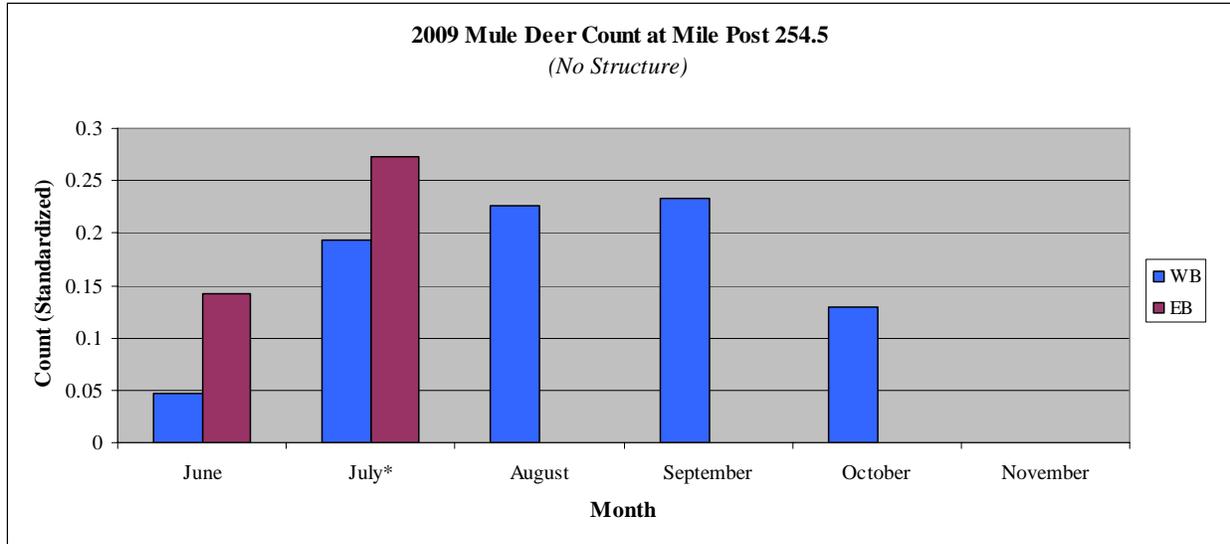


Figure 38 – Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 254.5 east of Genesee. Elevation – EB and WB approx. 2300m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

2010: Six sites in 2010 did not have a structure on both the east- and westbound lanes of traffic. 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.

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 (Figures 39-43).

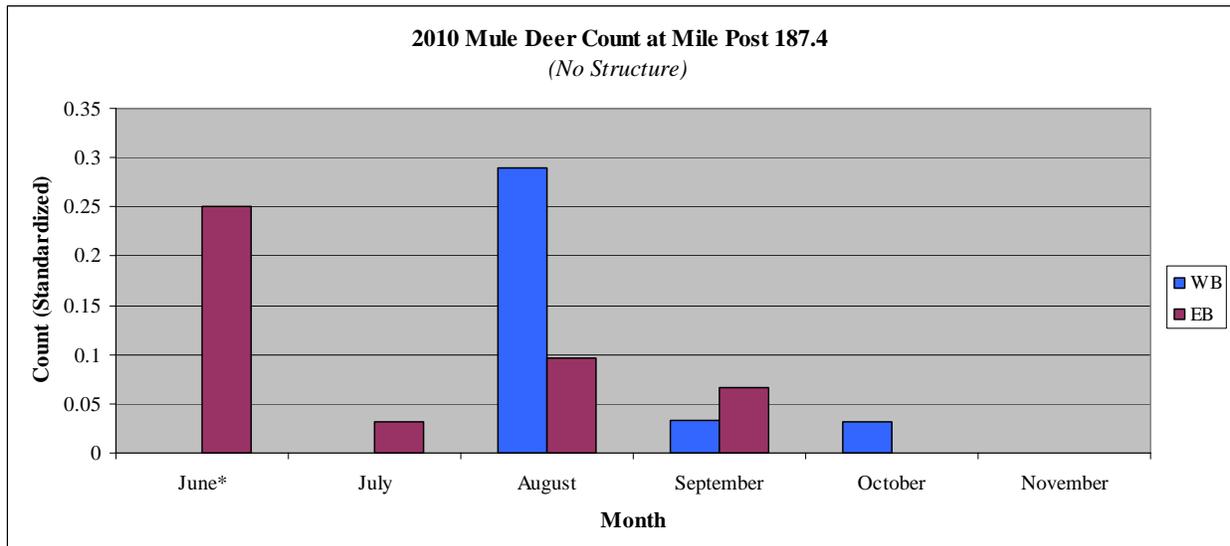


Figure 39 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 187.4 east of Vail about 2.6 miles from the summit of Vail Pass. Elevation – EB and WB approx. 3100m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

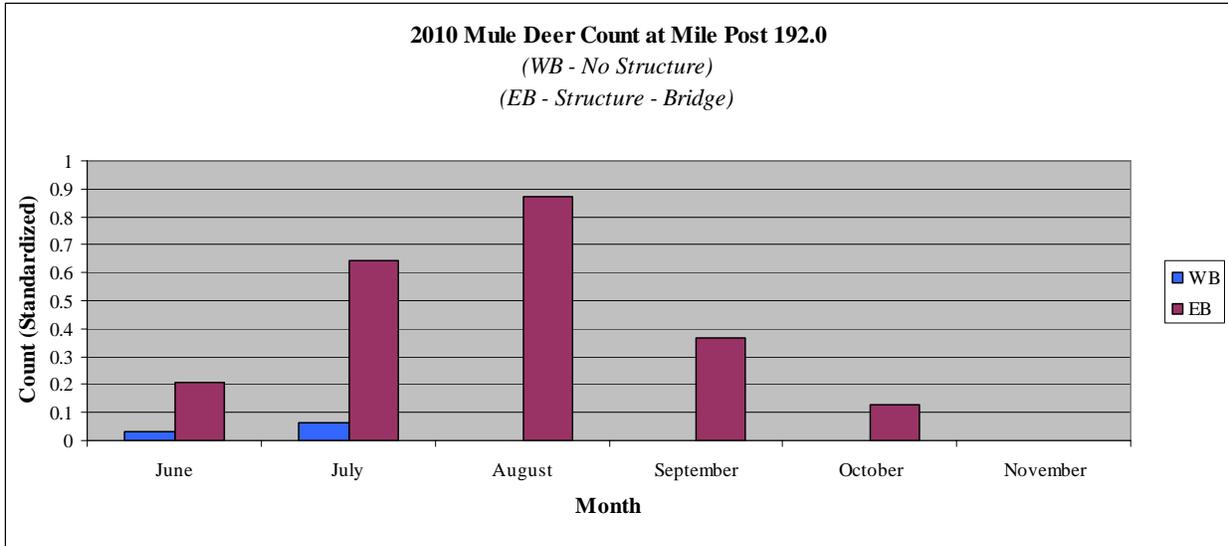


Figure 40 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 192.0 west of Copper Mountain about two miles from the summit of Vail Pass. Elevation – EB and WB approx. 3100m

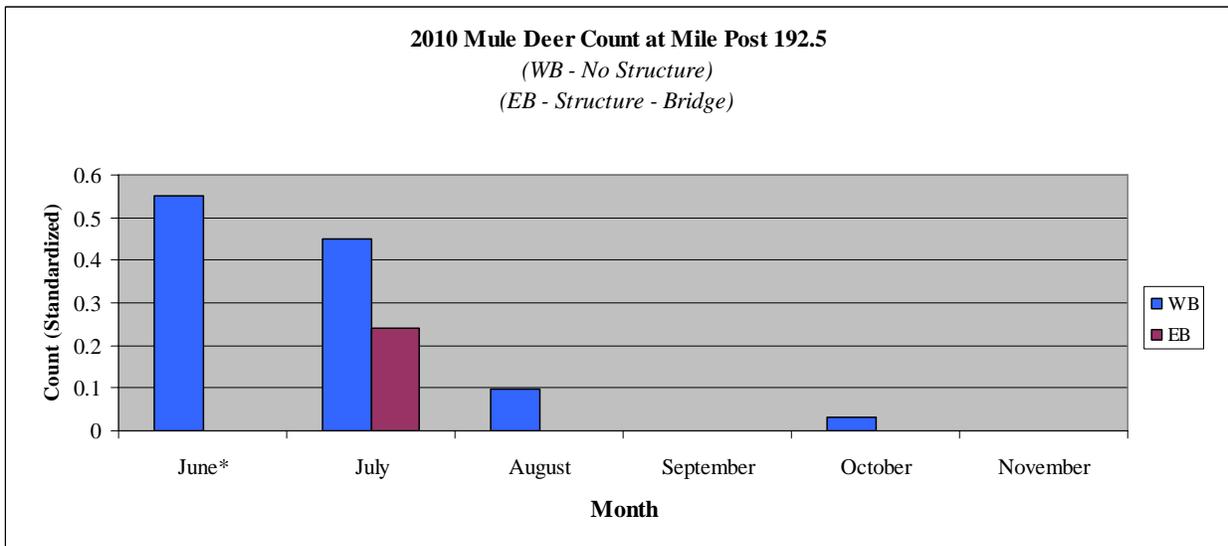


Figure 41 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 192.5 west of Copper Mountain about 2.5 miles from the summit of Vail Pass. Elevation – EB and WB approx. 3100m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

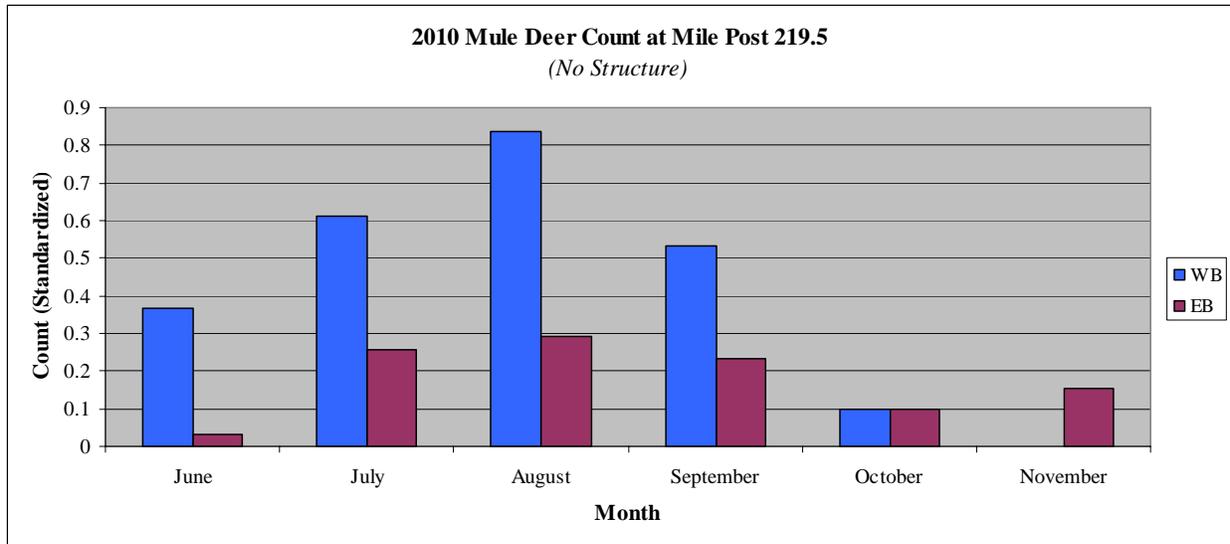


Figure 42 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 219.5 west of Bakerville at Watrous Gulch. Elevation – EB and WB approx. 3100m

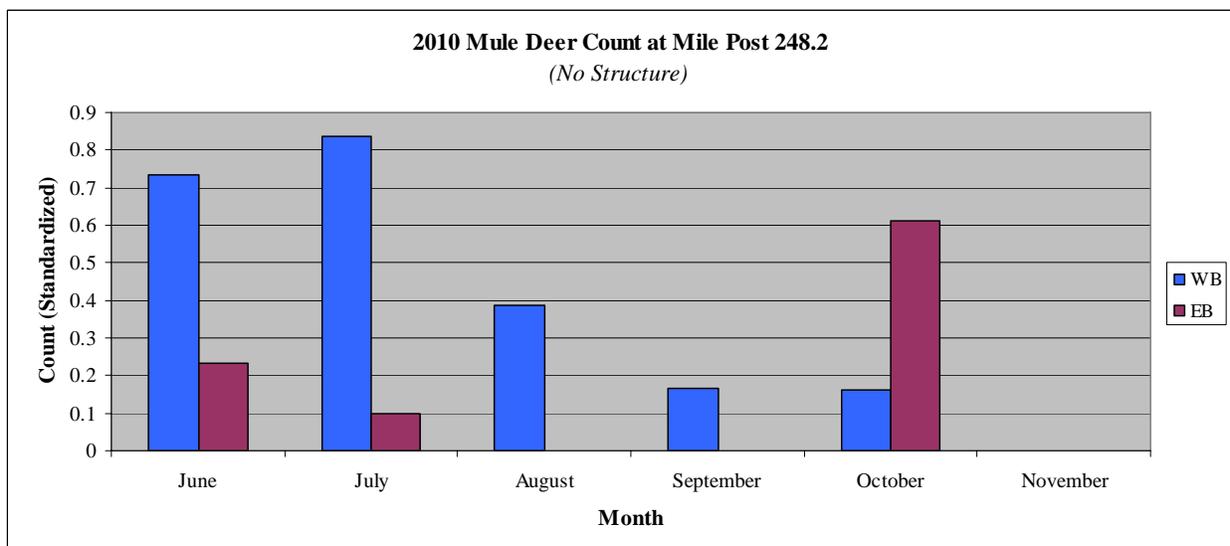


Figure 43 - Number of mule deer detected by month at the eastbound and westbound monitoring sites at mile post 248.2 near the Beaver Brook/Floyd Hill exit. Elevation – EB and WB approx. 2300m

*Totals*

The following graphs show the total number of mule deer by month documented at east- (south) and westbound (north) sites with structures in 2009 and 2010 (Figures 44-45). The number of animals detected have been standardized by the number of sample nights.

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. Both years saw a decrease of animals detected from spring and summer into fall.

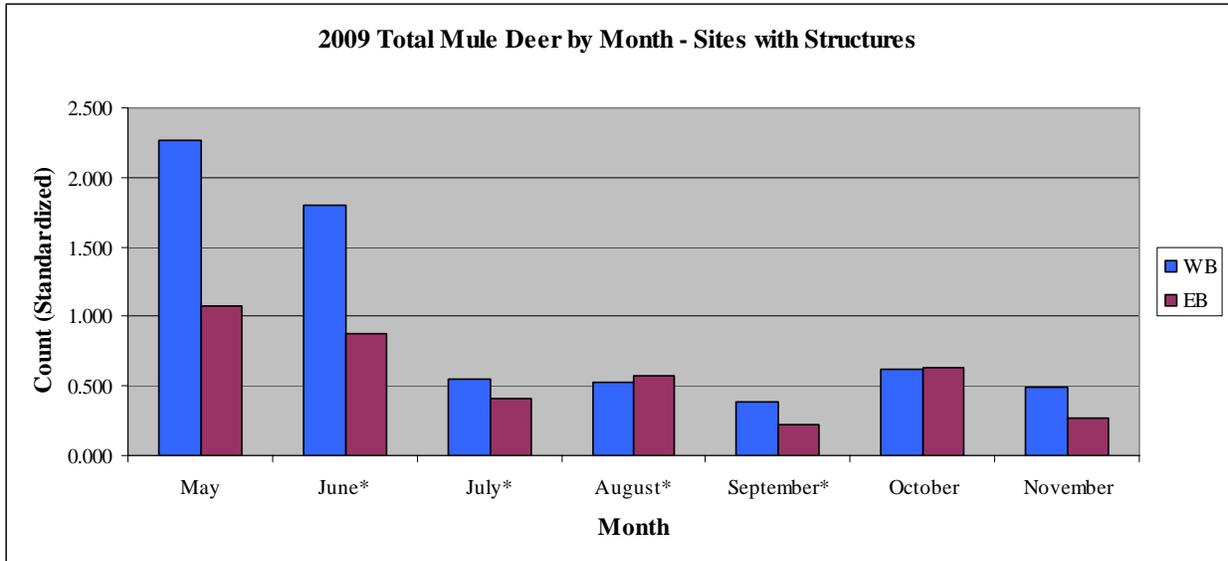


Figure 44 – Number of mule deer detected in 2009 by month at eastbound and westbound monitoring sites with structures

\*One or more study sites during this month had a camera that was functioning for less than 50% of the time.

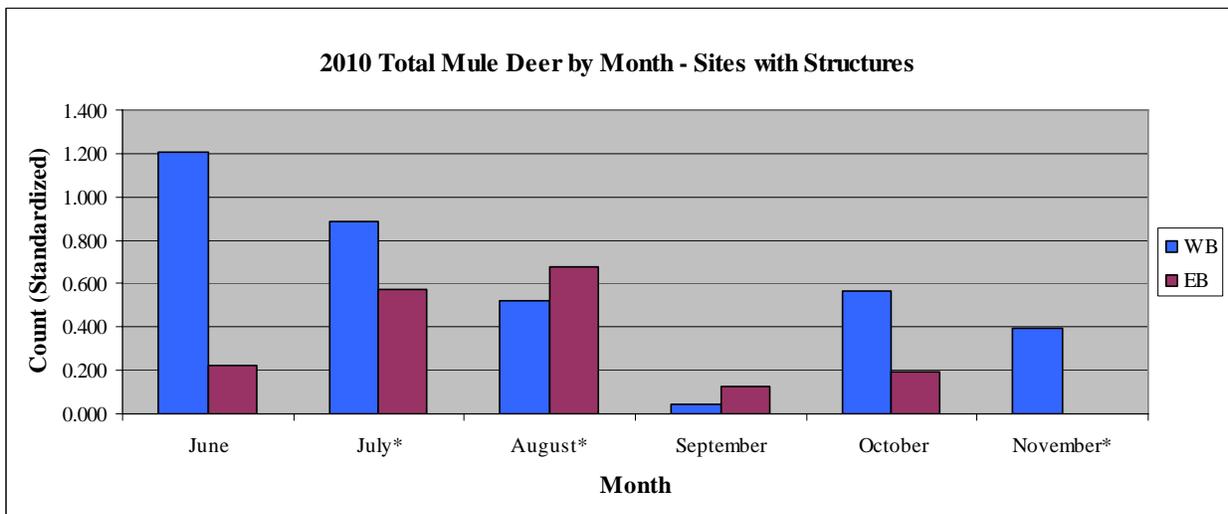


Figure 45 – Number of mule deer detected in 2010 by month at eastbound and westbound monitoring sites with structures

\*One or more study sites during this month had a camera that was functioning for less than 50% of the time.

When the data is compiled for the entire study period, the trends seen above are less obvious. The following graphs show the total number of mule deer documented at east- (south) and westbound (north) sites grouped by sites with structures and sites without structures for 2009 and 2010 (Figures 46-47). The number of animals detected have been standardized by the number of sample nights. For both types of sites for each year, more mule deer were documented on the westbound side (north) of the interstate than on the eastbound (south) side.

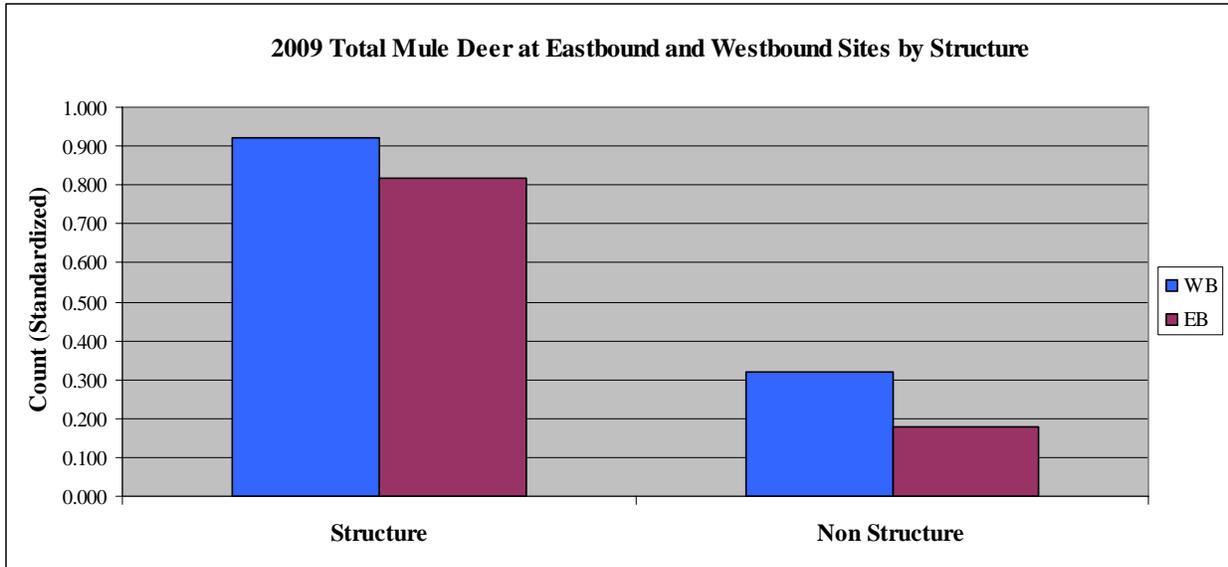


Figure 46 – Number of mule deer detected at eastbound and westbound monitoring sites with and without structures in 2009

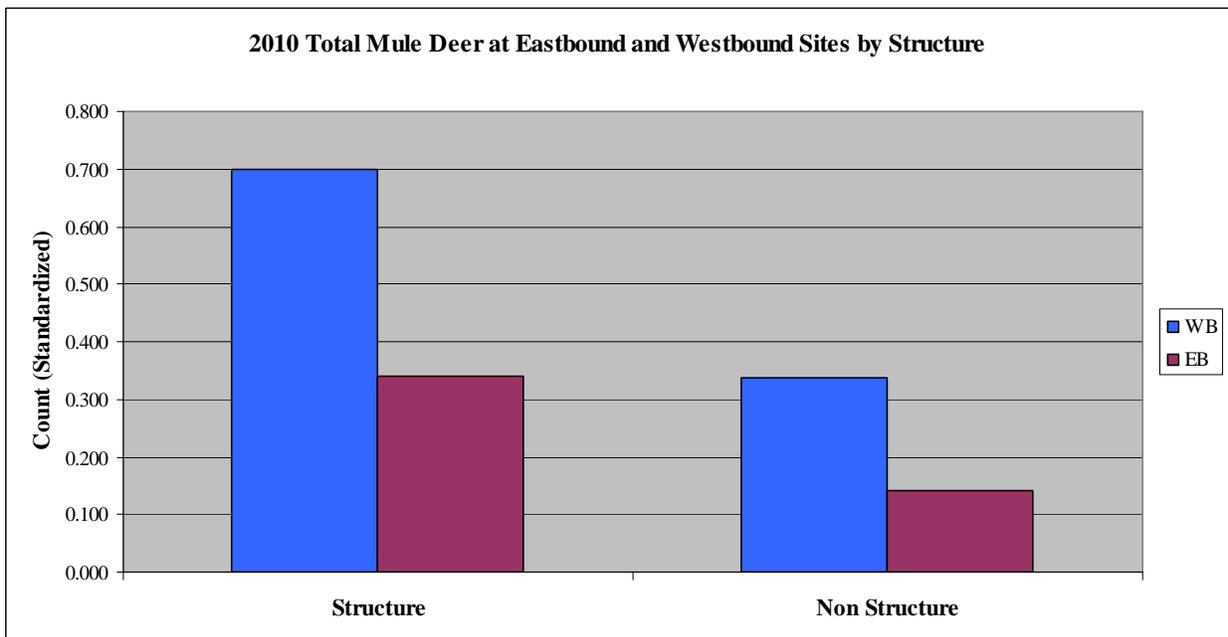


Figure 47 – Number of mule deer detected by month at eastbound and westbound monitoring sites with structures in 2010

### *Mule Deer by Season*

The following graph shows mule deer activity by season (Figures 48-49). These numbers have been standardized by sampling night. Though this study does include some monitoring locations on Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now RMW) from 2006 to 2008.

In general for both years, mule deer in the 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.

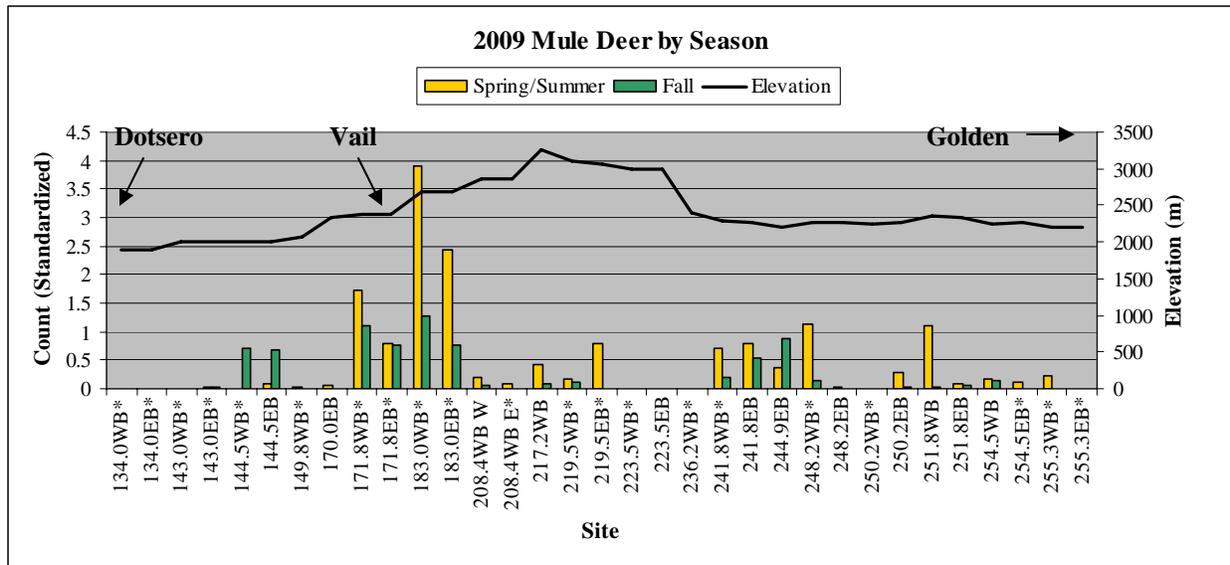


Figure 48 – Number of mule deer detected in the spring/summer and fall of 2009  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

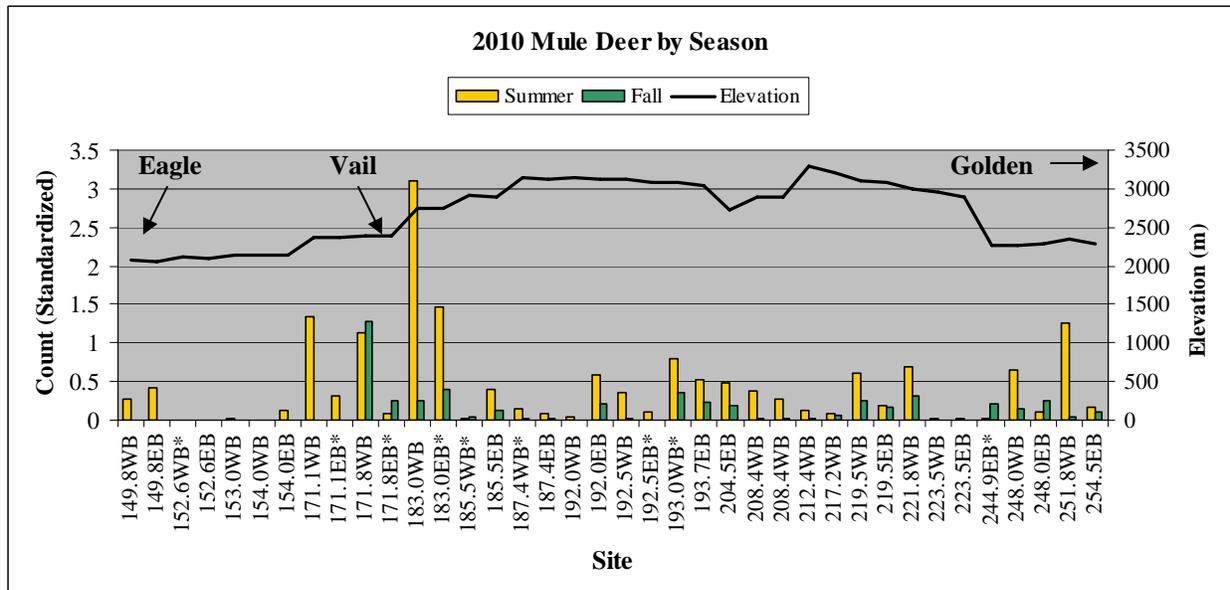


Figure 49 – Number of mule deer detected in the summer and fall of 2010  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

**Mule Deer by Hour**

The following graphs show mule deer activity by hour (2009: Figures 50-64; 2010: Figures 65-81). These numbers have not been standardized by sampling night. In general, mule deer in the study area tended to be more active in the morning and evening hours in both the spring/summer and fall. 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 the field season).

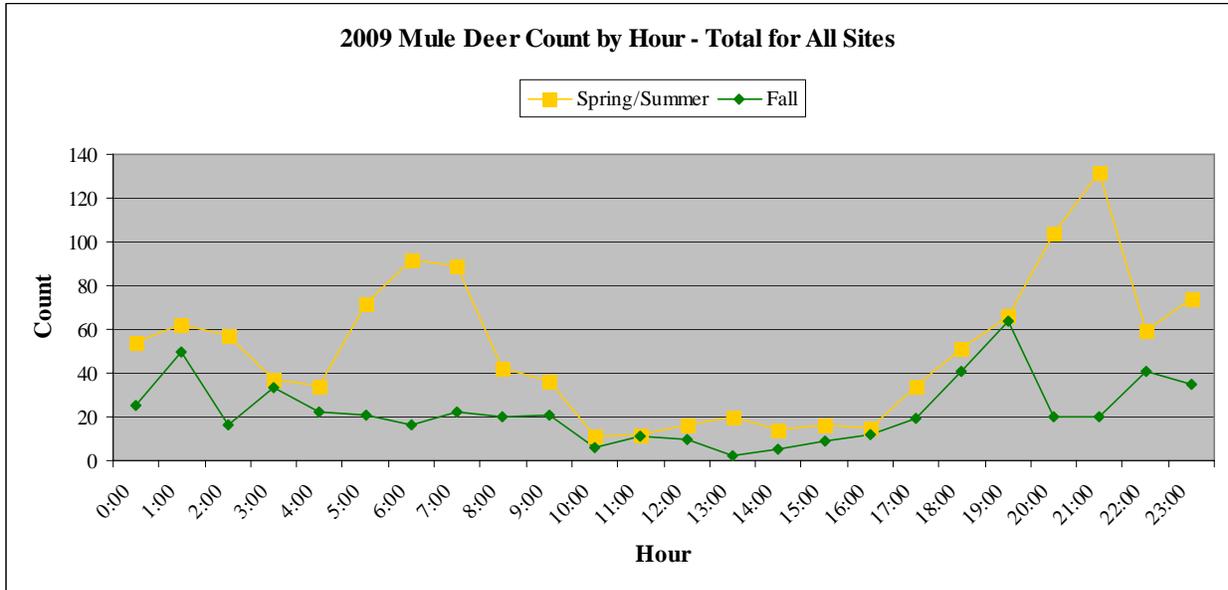


Figure 50 – Number of mule deer detected by hour across all sites in 2009

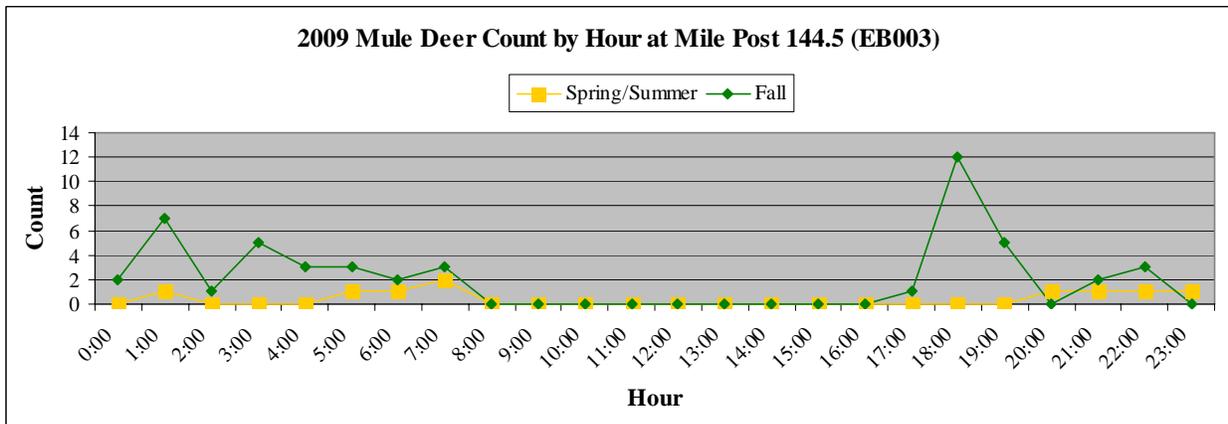


Figure 51 – Number of mule deer detected by hour at EB003, MP 144.5

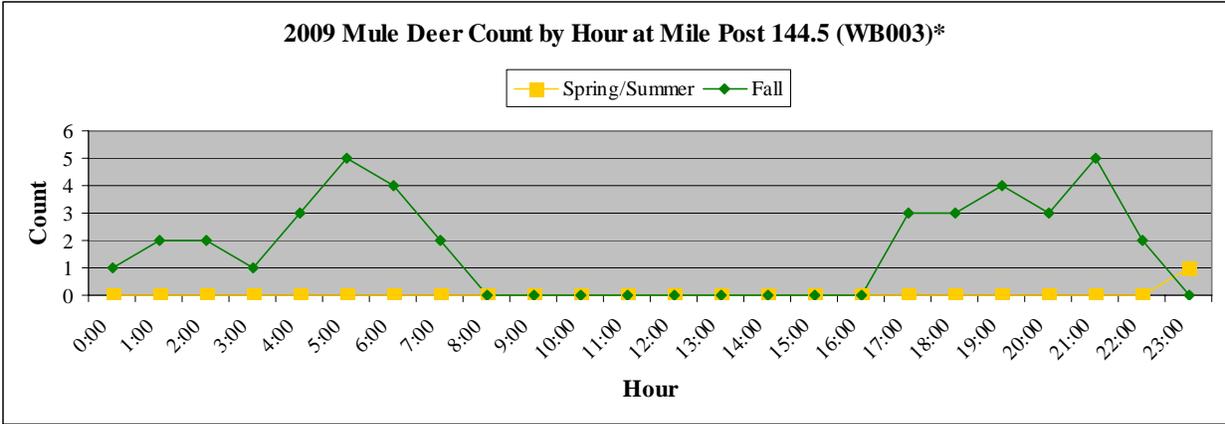


Figure 52 - Number of mule deer detected by hour at WB003, MP 144.5  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

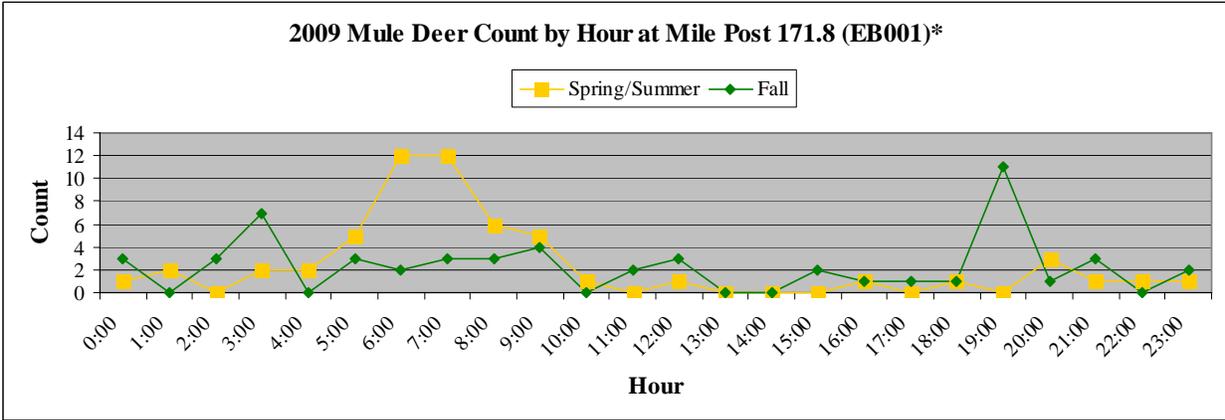


Figure 53 - Number of mule deer detected by hour at EB001, MP 171.8  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

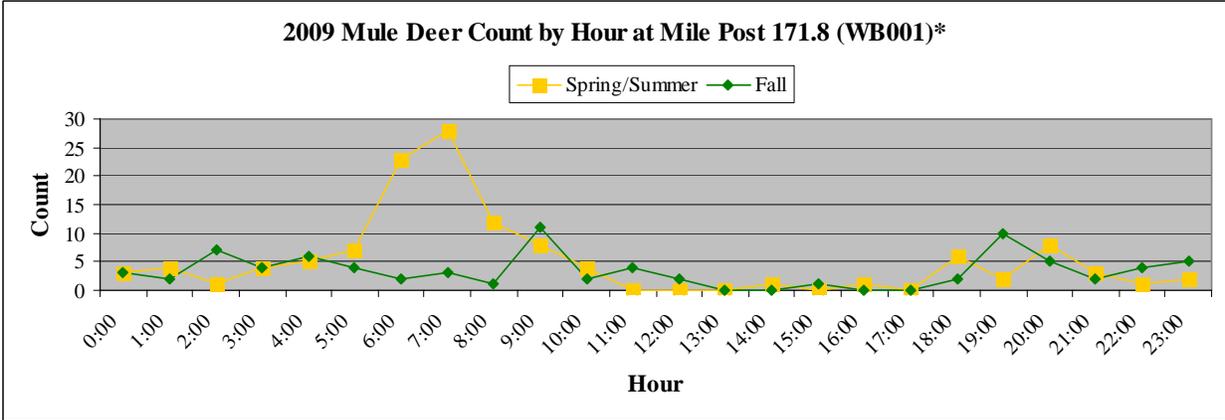


Figure 54 - Number of mule deer detected by hour at WB001, MP 171.8.  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

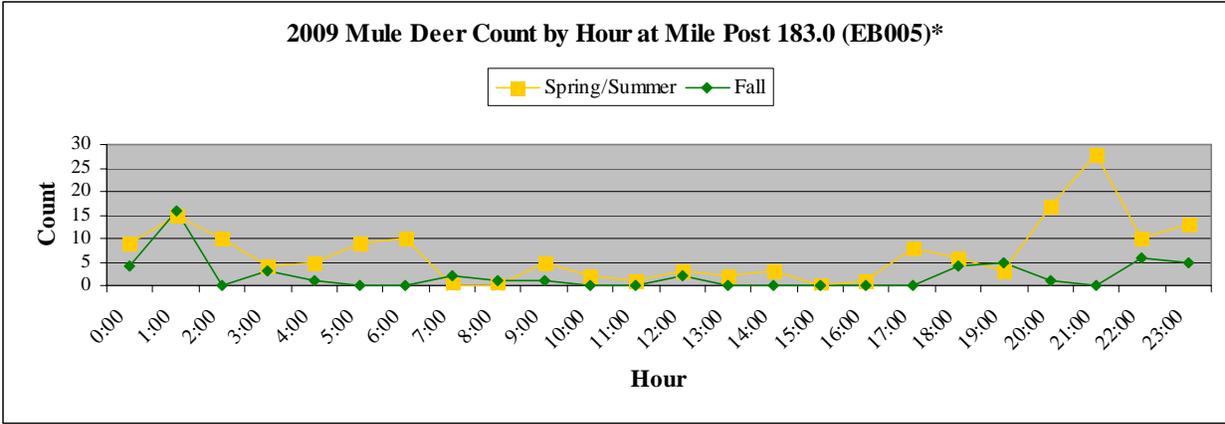


Figure 55 - Number of mule deer detected by hour at EB005, MP 183.0  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

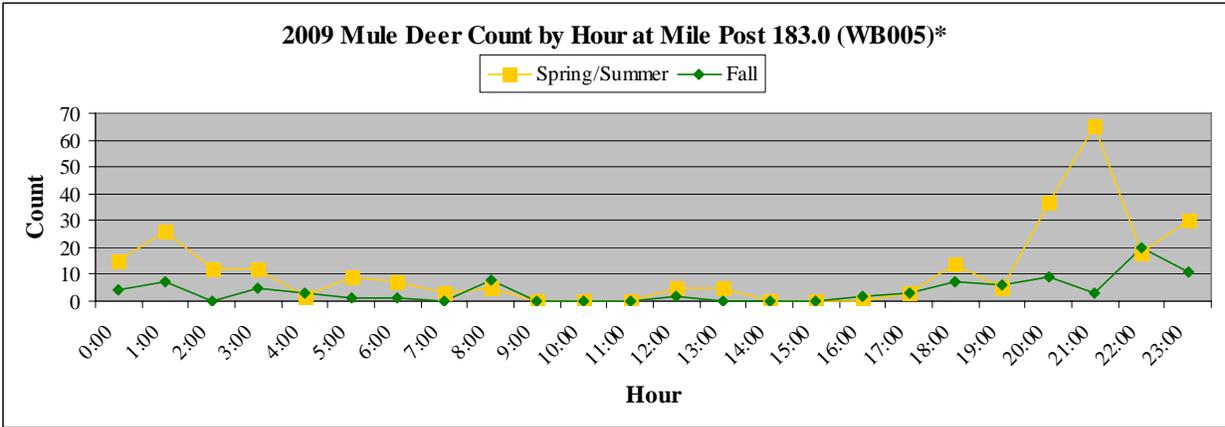


Figure 56 - Number of mule deer detected by hour at WB005, MP 183.0  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

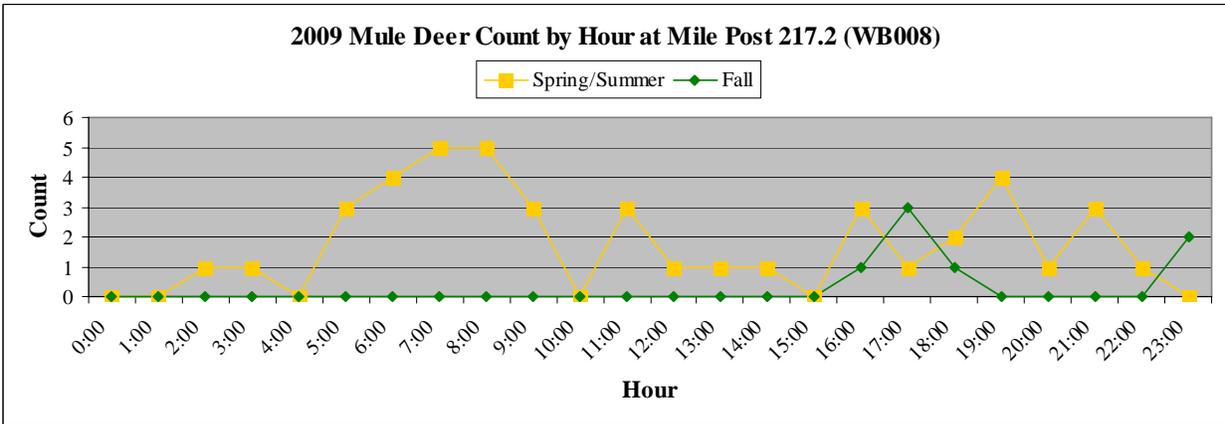


Figure 57 - Number of mule deer detected by hour at WB008, MP 217.2

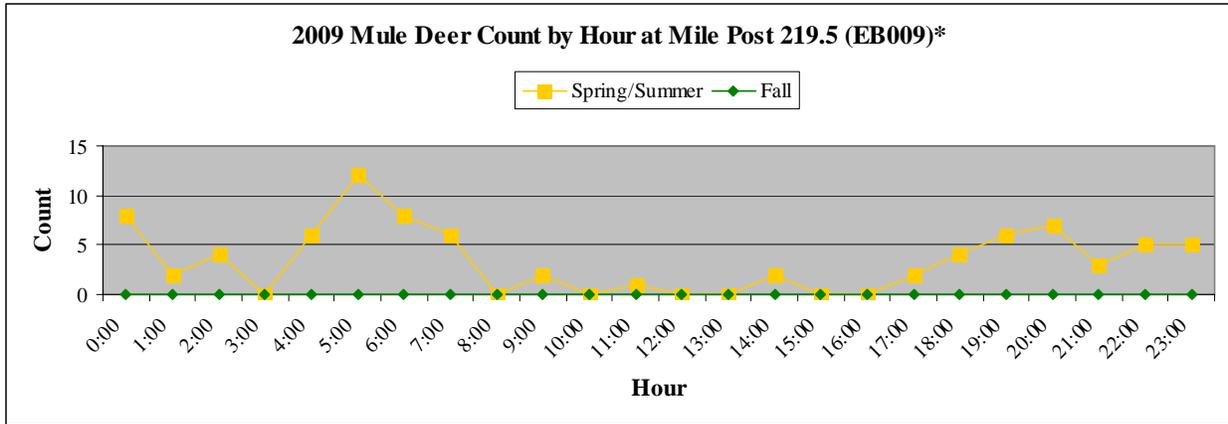


Figure 58 - Number of mule deer detected by hour at EB009, MP 219.5  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

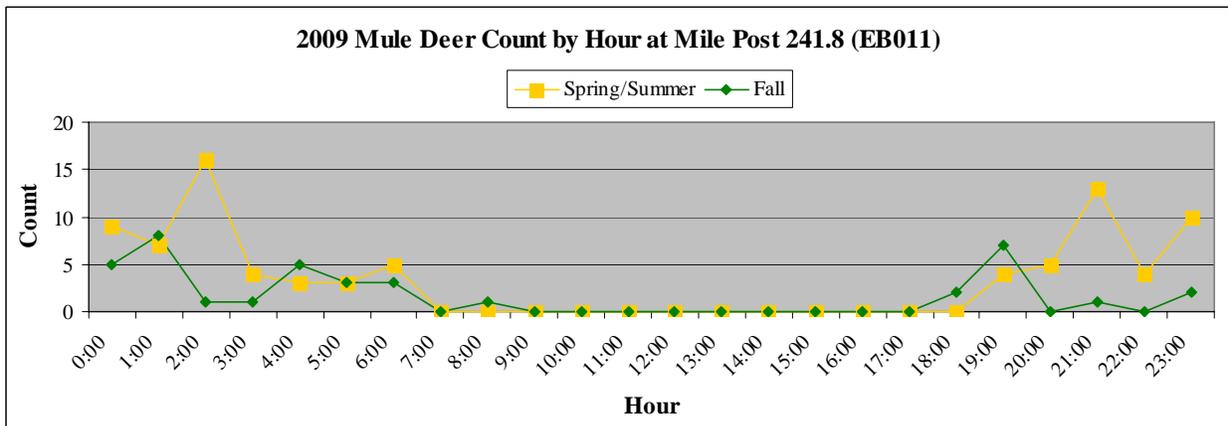


Figure 59 - Number of mule deer detected by hour at EB011, MP 241.8

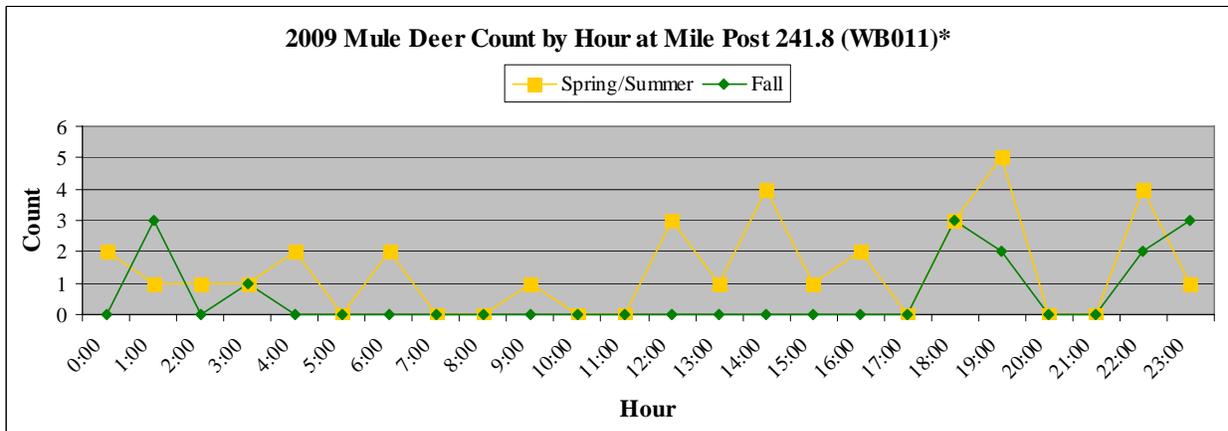


Figure 60 - Number of mule deer detected by hour at WB011, MP 241.8  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

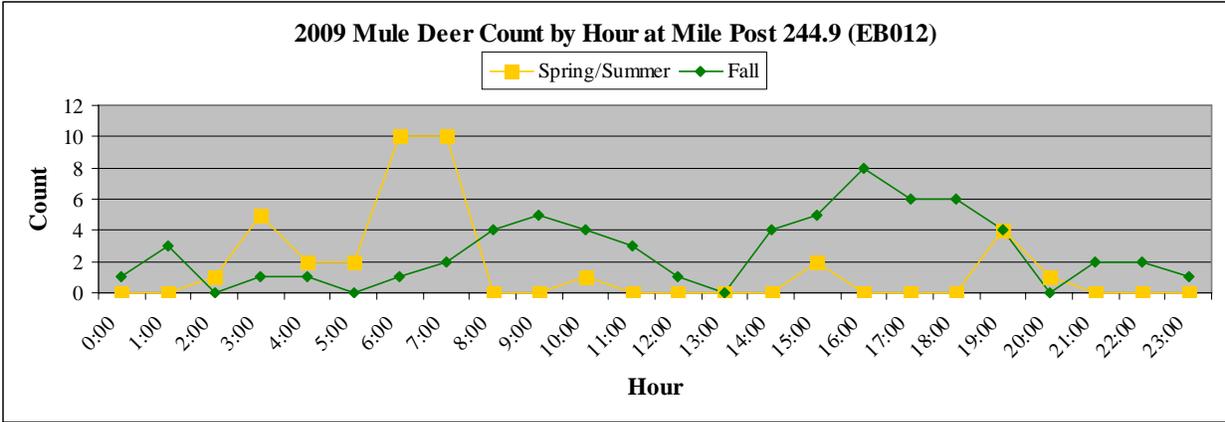


Figure 61 - Number of mule deer detected by hour at EB012, MP 244.9

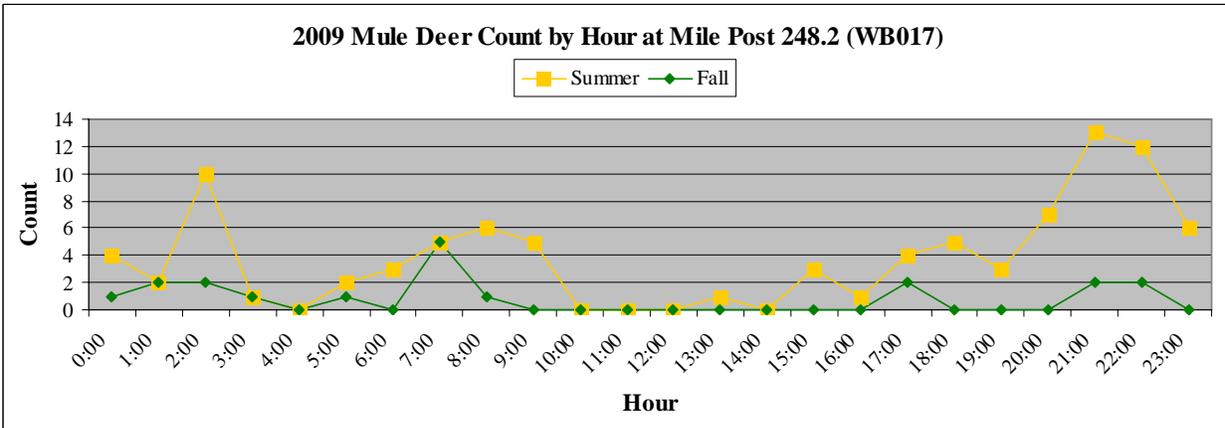


Figure 62 - Number of mule deer detected by hour at WB017, MP 248.2

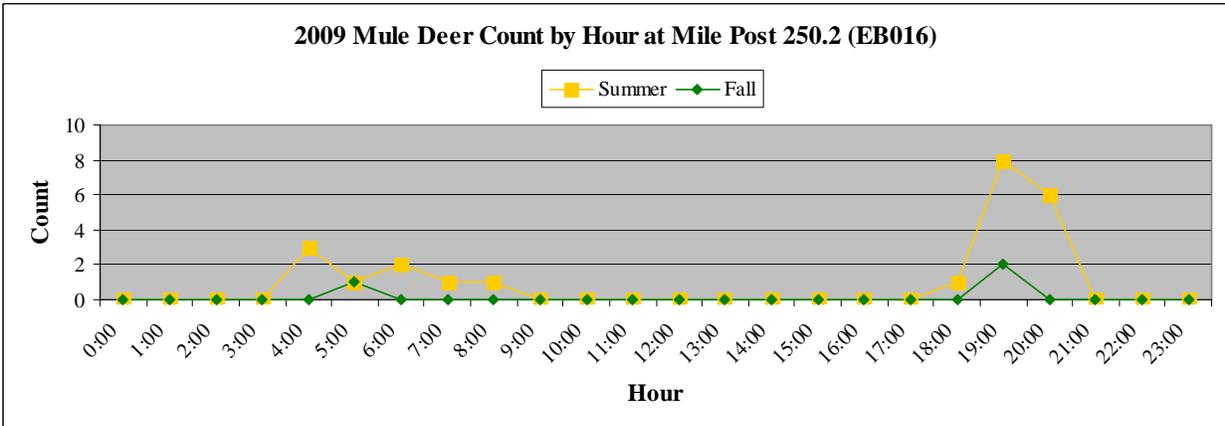


Figure 63 - Number of mule deer detected by hour at EB016, MP 250.2

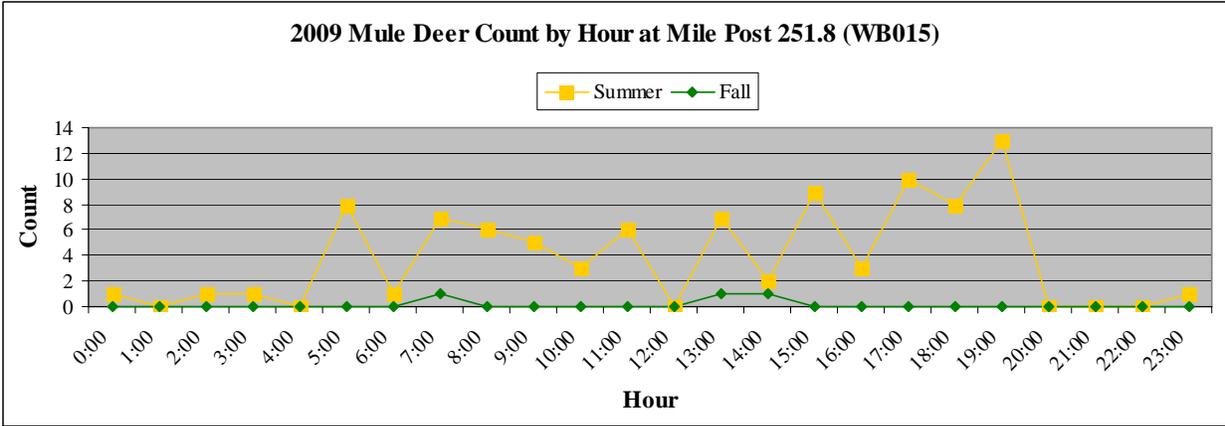


Figure 64 - Number of mule deer detected by hour at WB015, MP 251.8

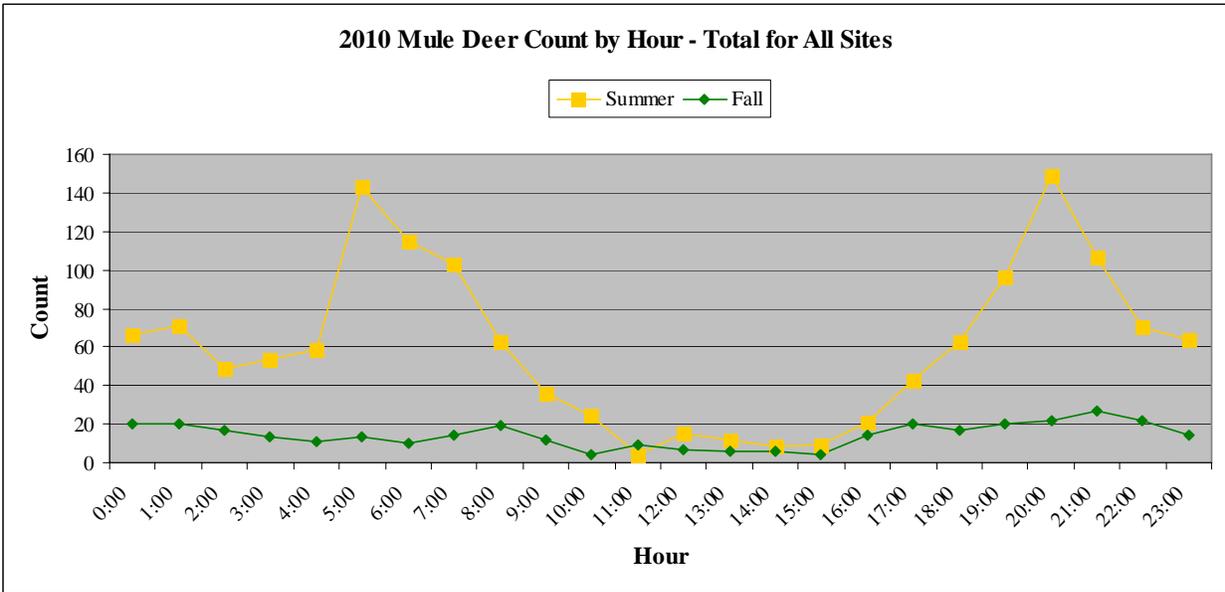


Figure 65 - Number of mule deer detected by hour across all sites in 2010

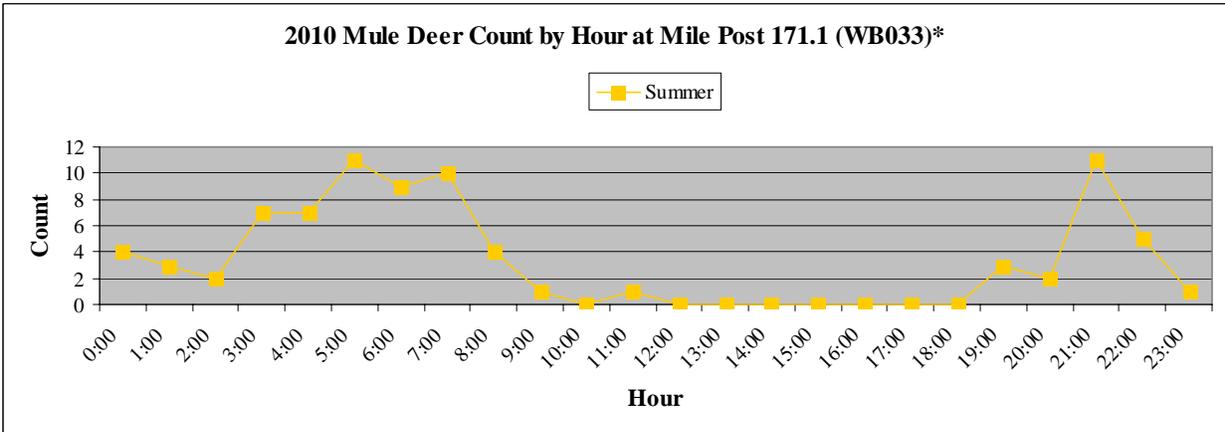


Figure 66 - Number of mule deer detected by hour at WB033, MP 171.1  
 \* The camera at this monitoring site was stolen sometime between 8/2/2010 – 9/16/2010.

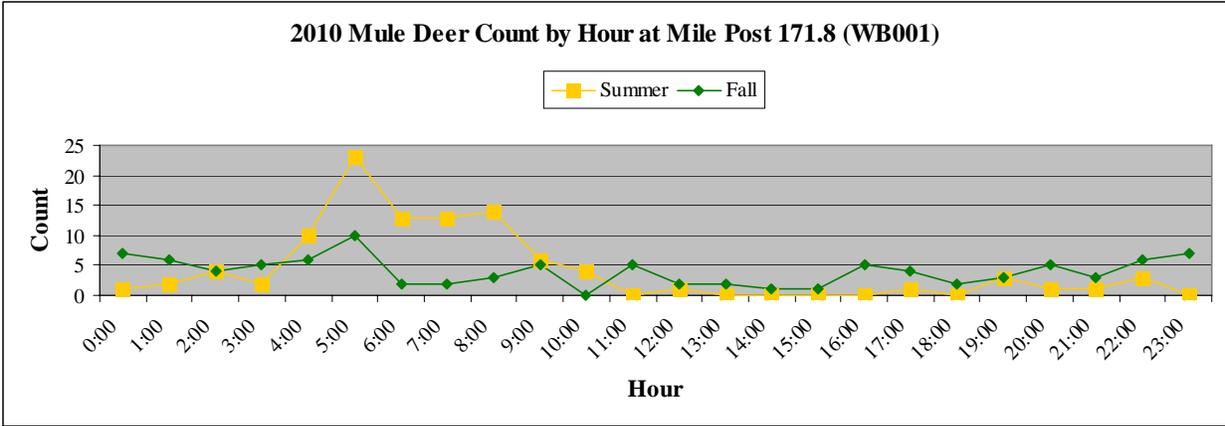


Figure 67 - Number of mule deer detected by hour at WB001, MP 171.8

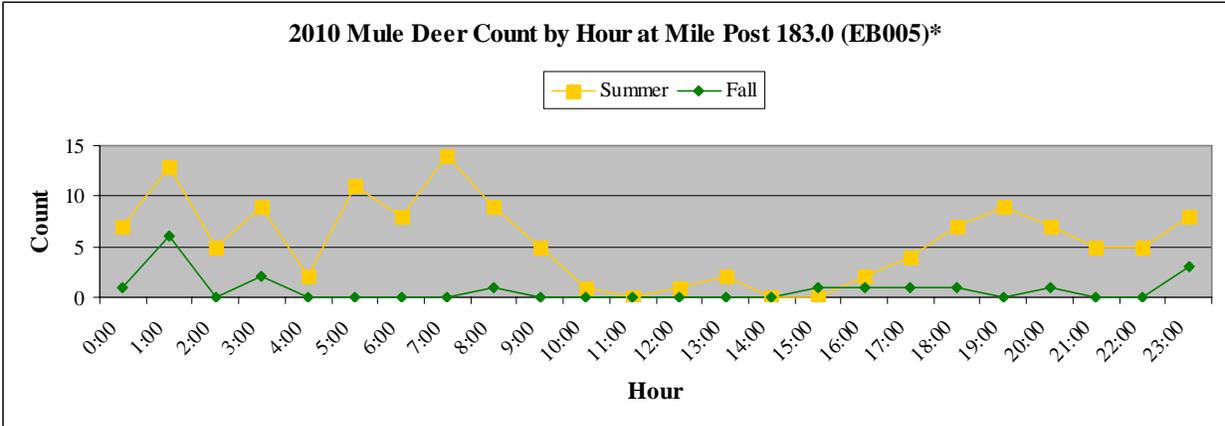


Figure 68 - Number of mule deer detected by hour at EB005, MP 183.0

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

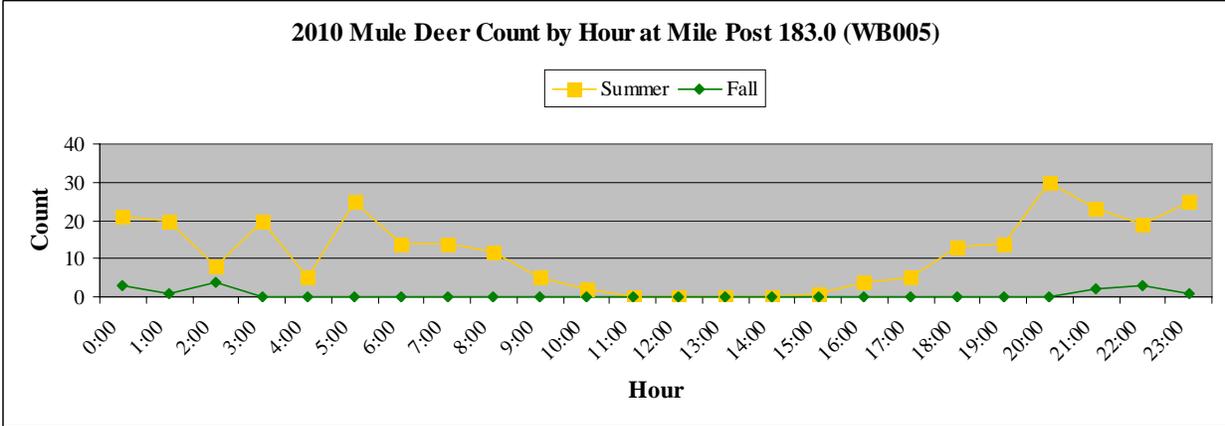


Figure 69 - Number of mule deer detected by hour at WB005, MP 183.0

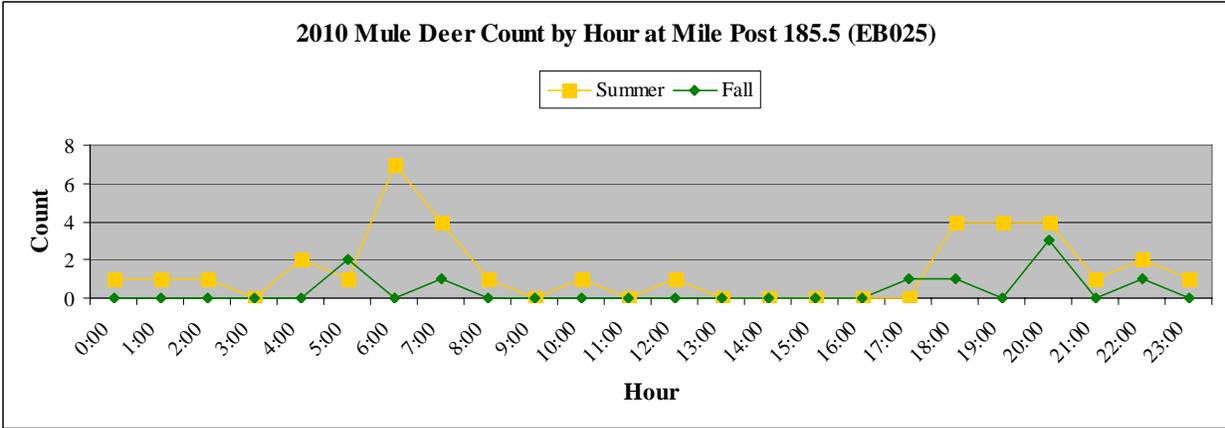


Figure 70 - Number of mule deer detected by hour at EB025, MP 185.5

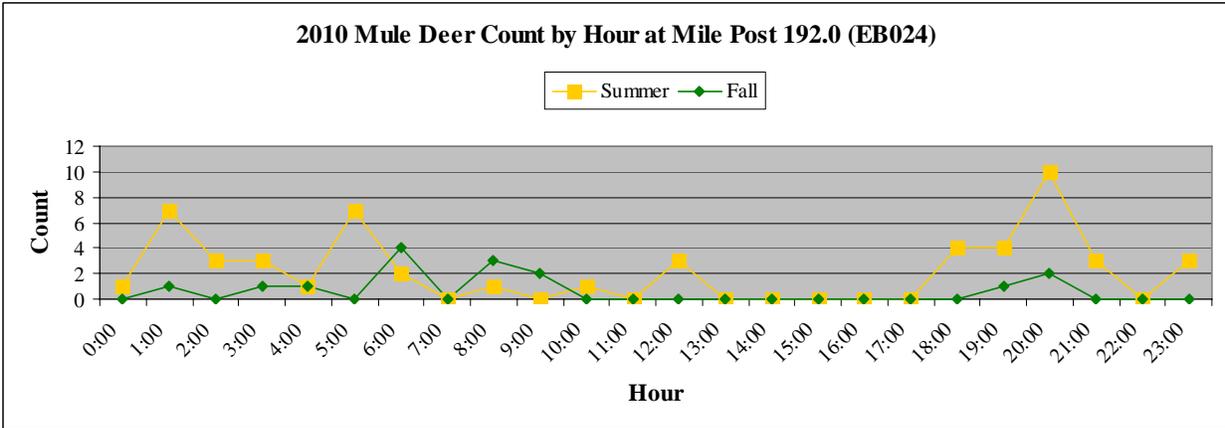


Figure 71 - Number of mule deer detected by hour at EB024, MP 192.0

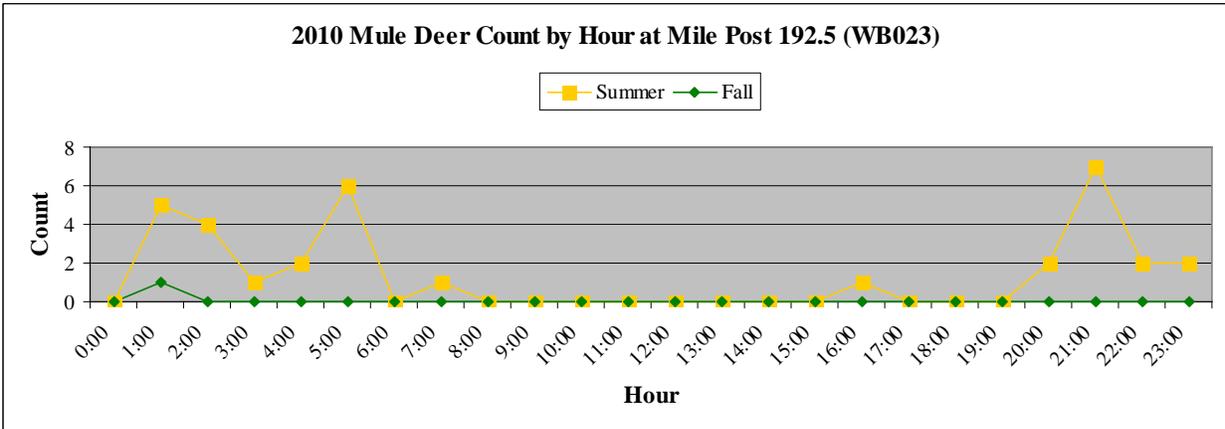


Figure 72 - Number of mule deer detected by hour at WB023, MP 192.5

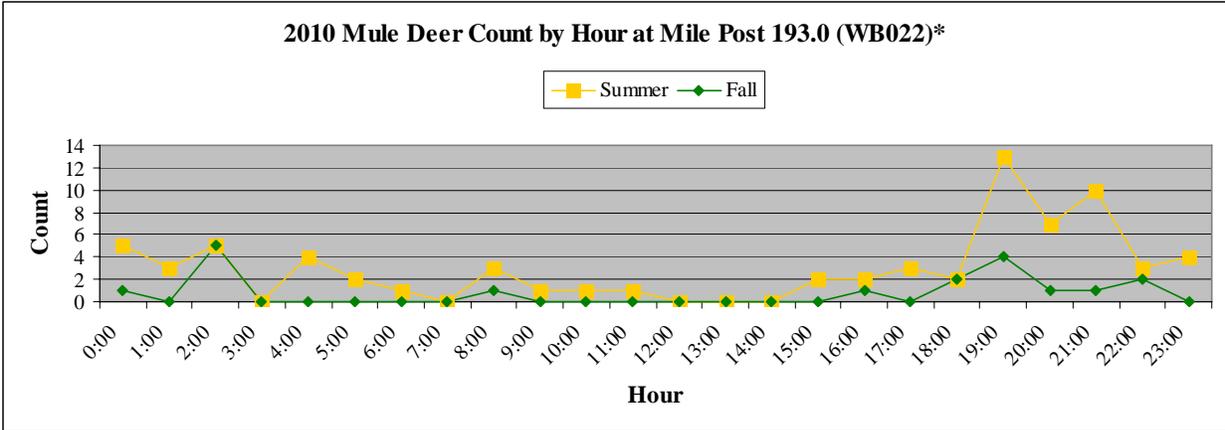


Figure 73 - Number of mule deer detected by hour at WB022, MP 193.0  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

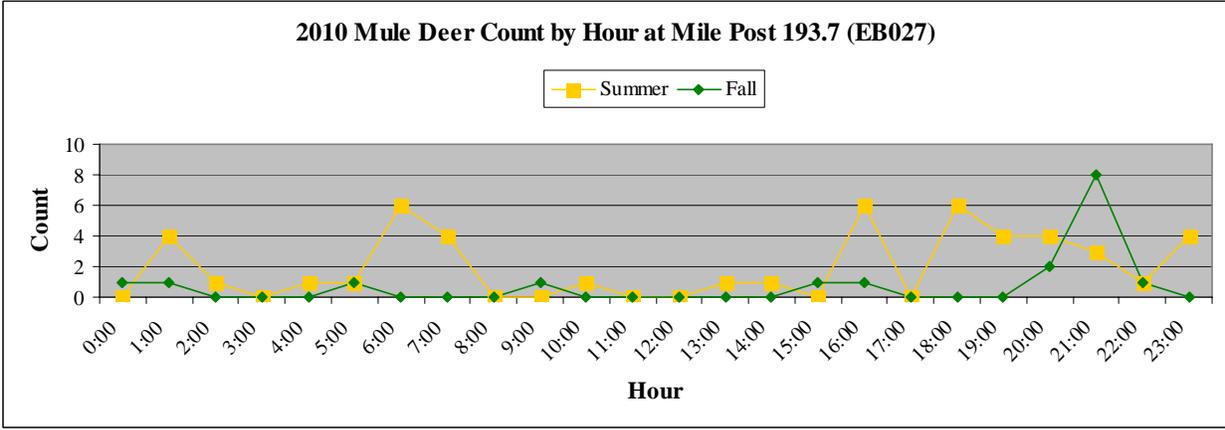


Figure 74 - Number of mule deer detected by hour at EB027, MP 193.7

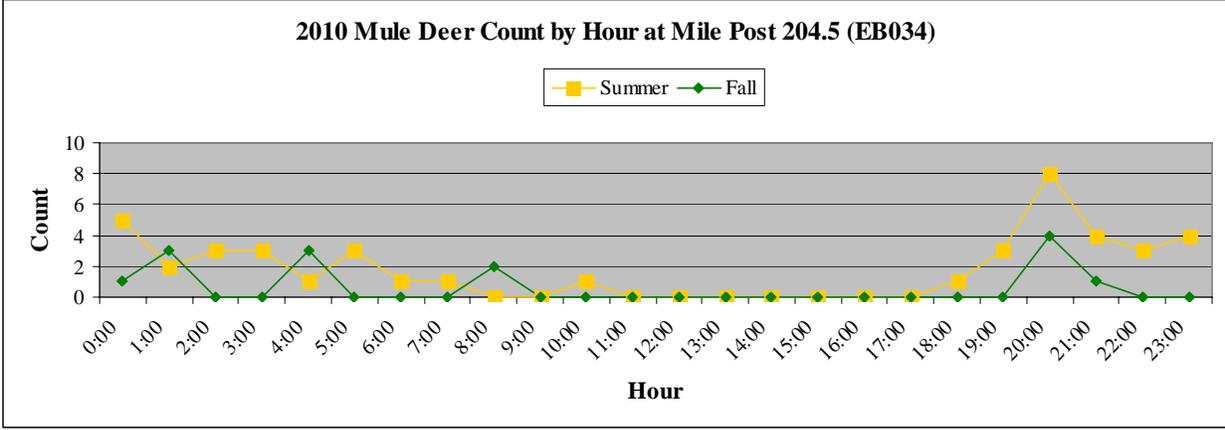


Figure 75 - Number of mule deer detected by hour at EB034, MP 204.5

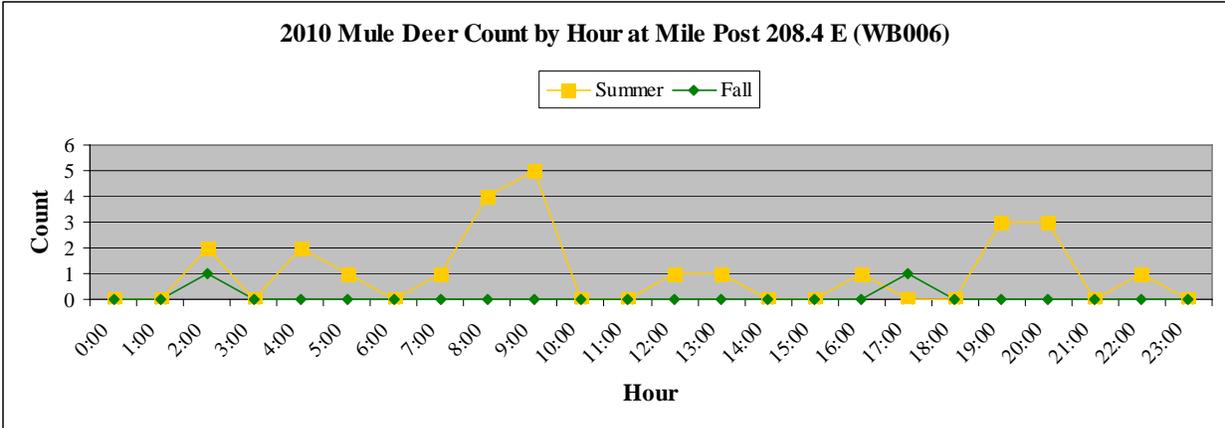


Figure 76 - Number of mule deer detected by hour at WB006, MP 208.4

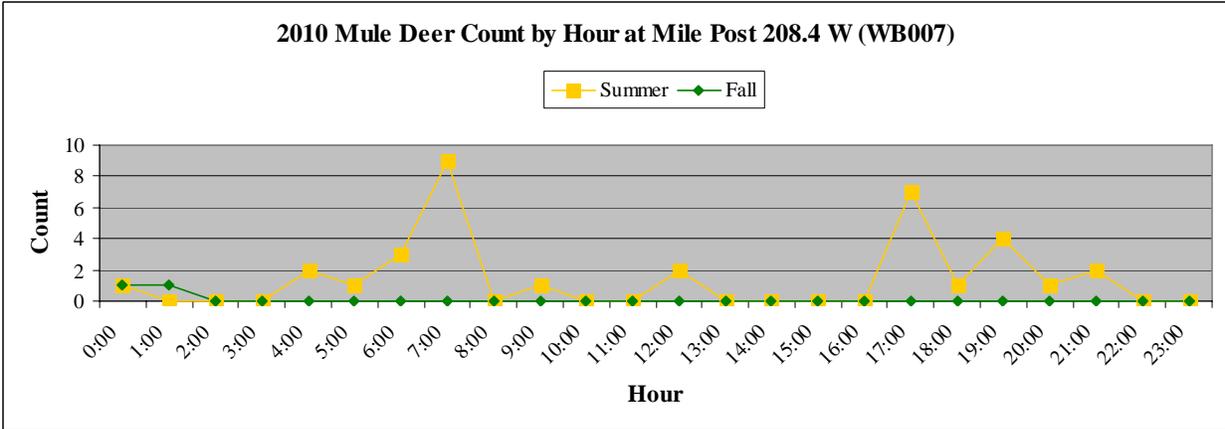


Figure 77 - Number of mule deer detected by hour at WB007, MP 208.4

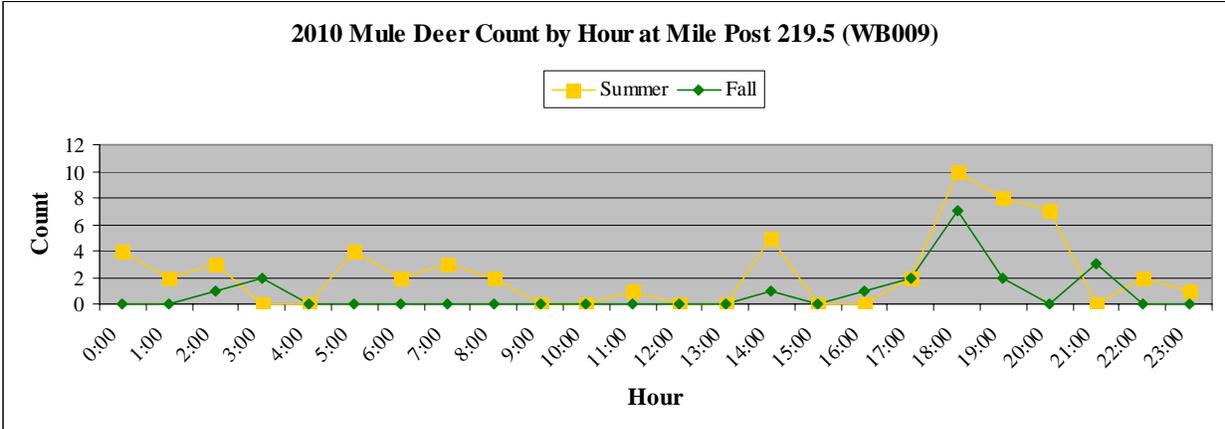


Figure 78 - Number of mule deer detected by hour at WB009, MP 219.5

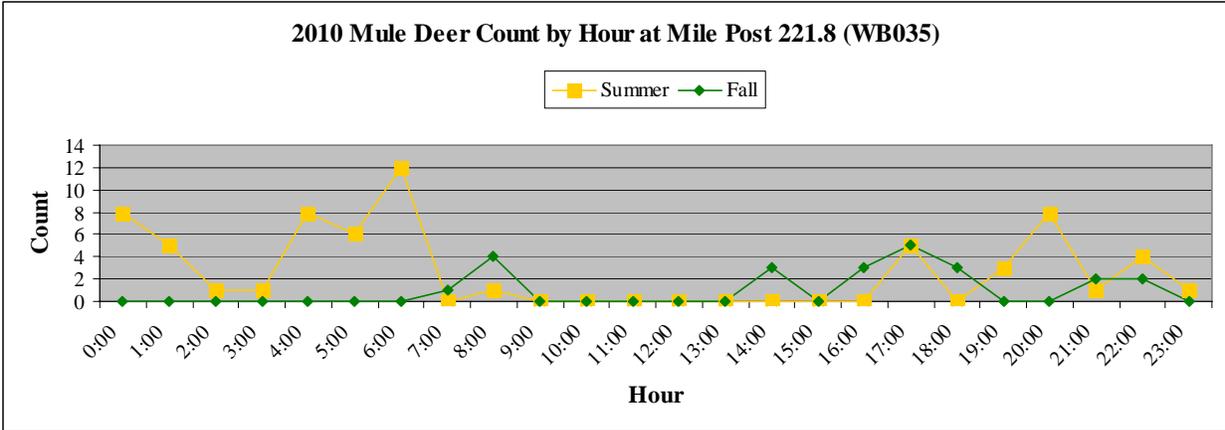


Figure 79 - Number of mule deer detected by hour at WB035, MP 221.8

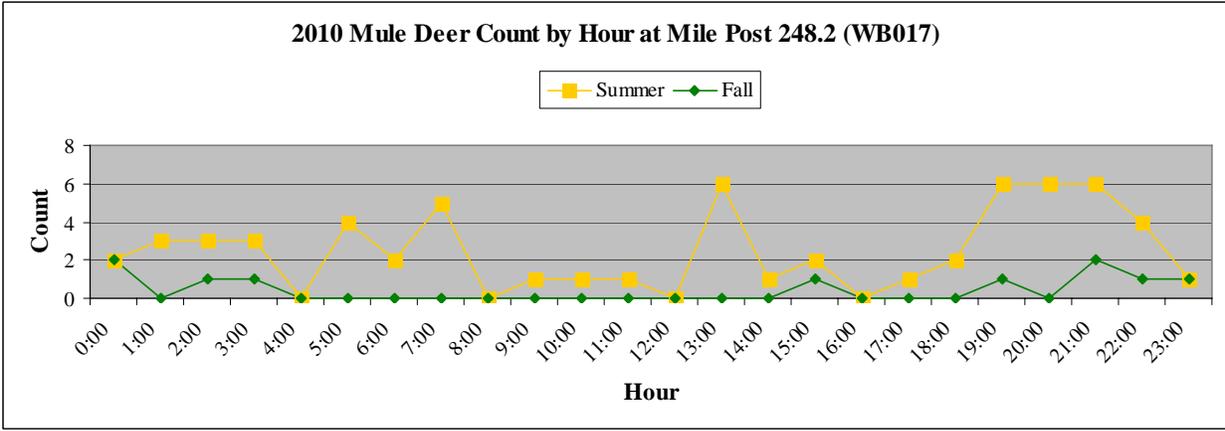


Figure 80 - Number of mule deer detected by hour at WB017, MP 248.2

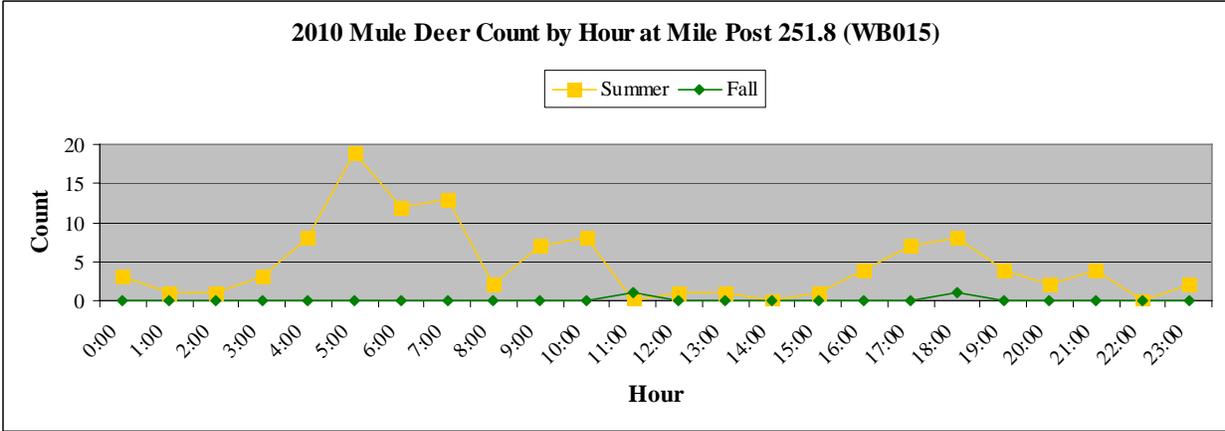


Figure 81 - Number of mule deer detected by hour at WB015, MP 251.8

*Elk - Structured and Non-Structured Sites*

2009: 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 in 2009 (Figures 82-85). The number of animals have been standardized by the number of sample nights.

One site represented, MP 171.8, 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 compared to the sites without structures.

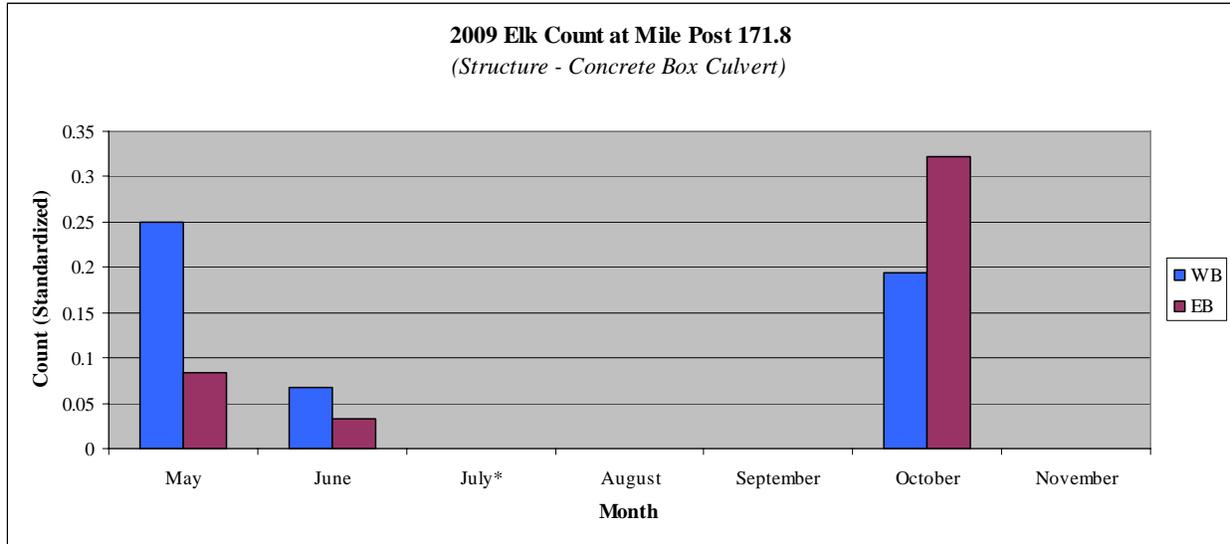


Figure 82 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 171.8 between Minturn and Vail at Dowd’s Junction. Elevation – EB and WB approx. 2400m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

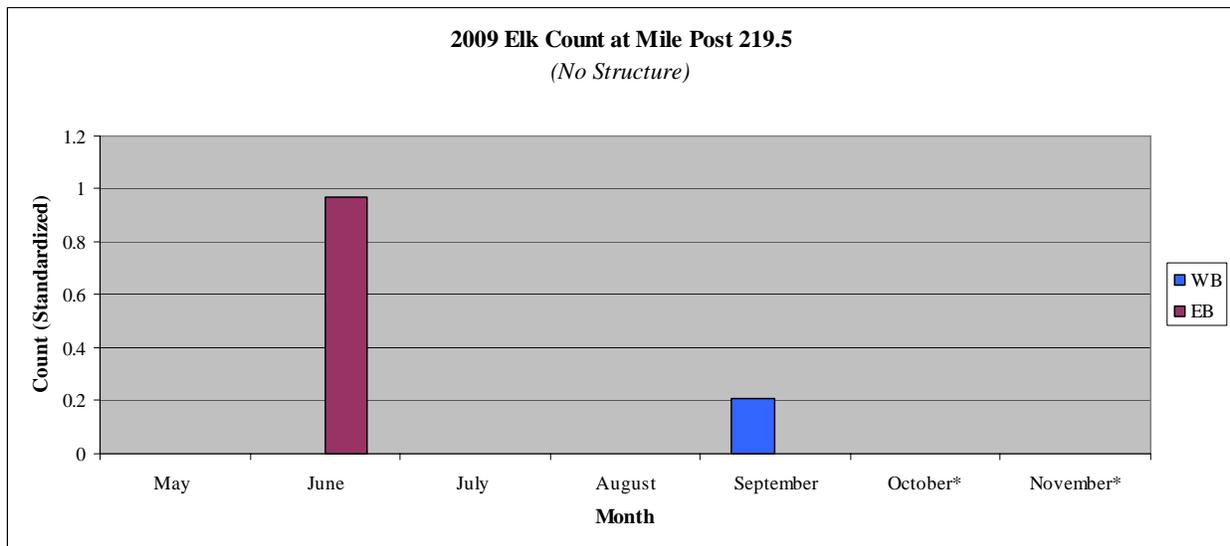


Figure 83 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 219.5 west of Bakerville at Watrous Gulch. Elevation – EB and WB approx. 3100m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

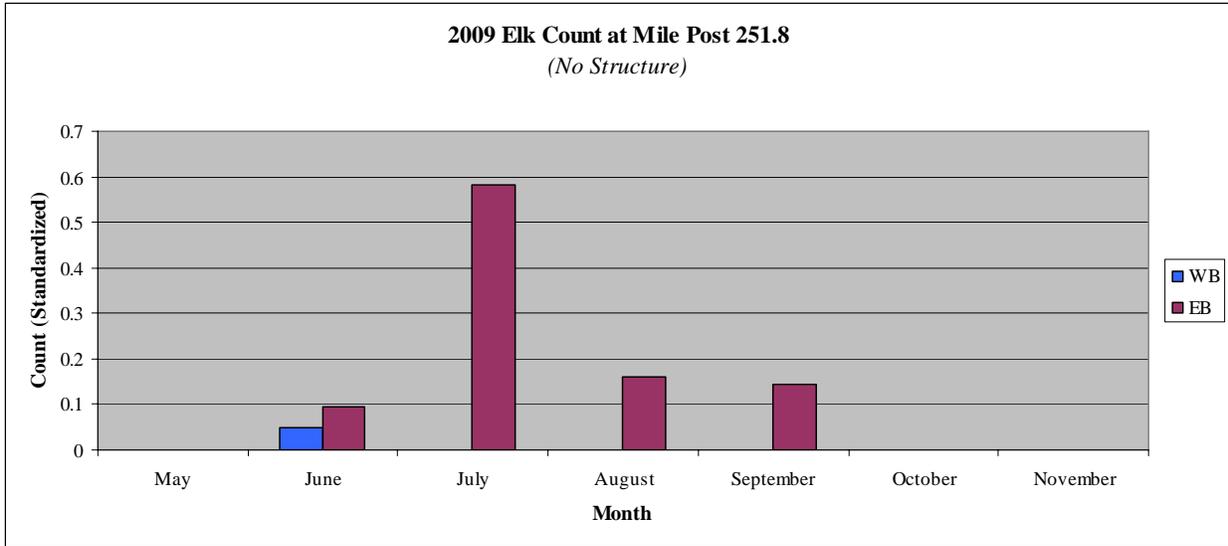


Figure 84 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 251.8 just west of Evergreen. Elevation –EB and WB approx. 2300m

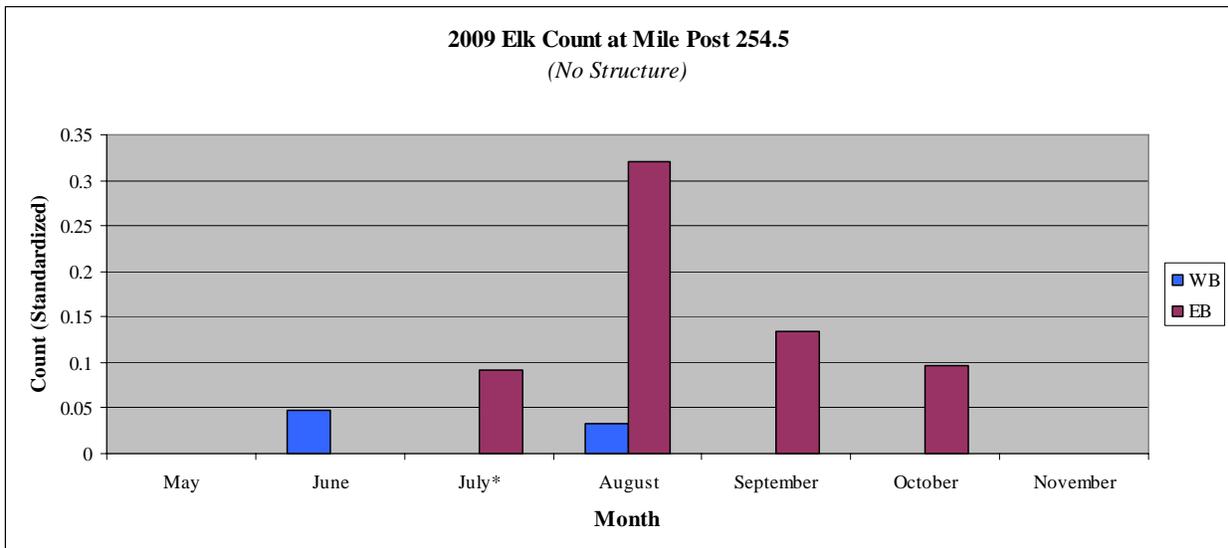


Figure 85 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 254.5 east of Genesee. Elevation – EB and WB approx. 2300m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

2010: The following graphs compare the number of elk detected at each site where elk were detected on both the west- (north) and eastbound (south) sides of the highway in 2010 (Figures 86-90). The number of animals have been standardized by the number of sample nights.

In 2010, elk were not documented in ample numbers at any sites with structures; the remaining sites had no structure. At all of the non-structured sites, there is a lot of variation between the west- (north) and eastbound (south) sides of the highway.

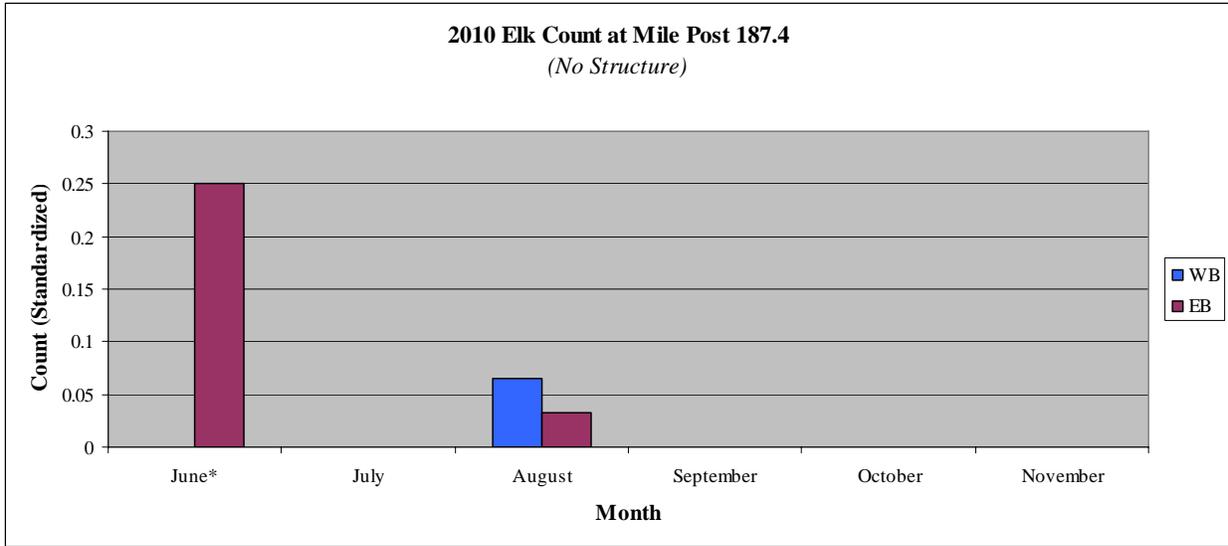


Figure 86 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 187.4 east of Vail about 2.6 miles from the summit of Vail Pass. Elevation – EB and WB approx. 3100m

\* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

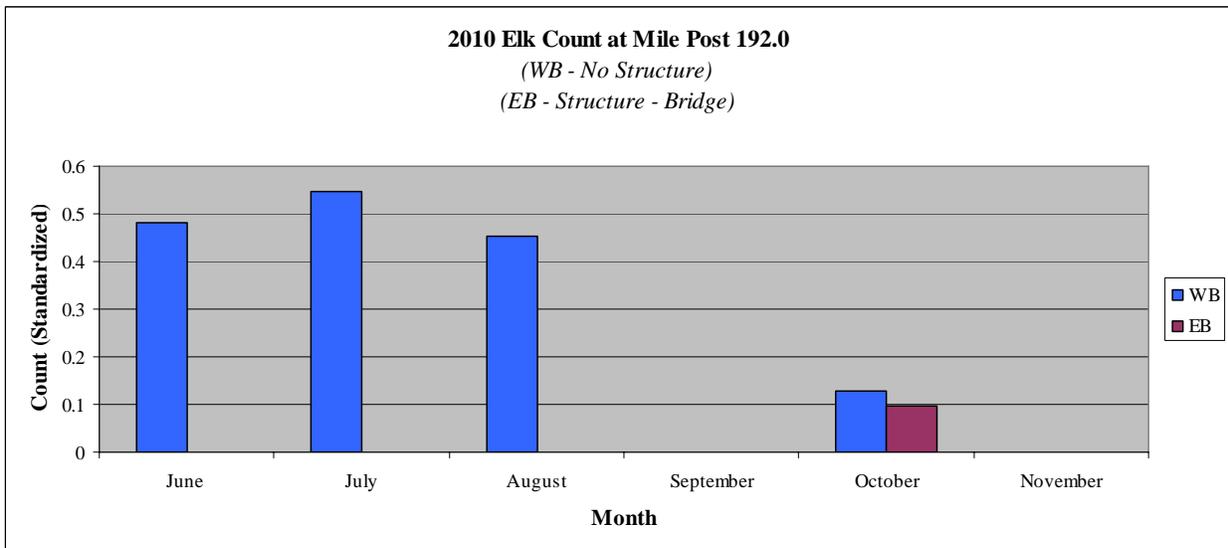


Figure 87 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 192.0 west of Copper Mountain about two miles from the summit of Vail Pass. Elevation – EB and WB approx. 3100m

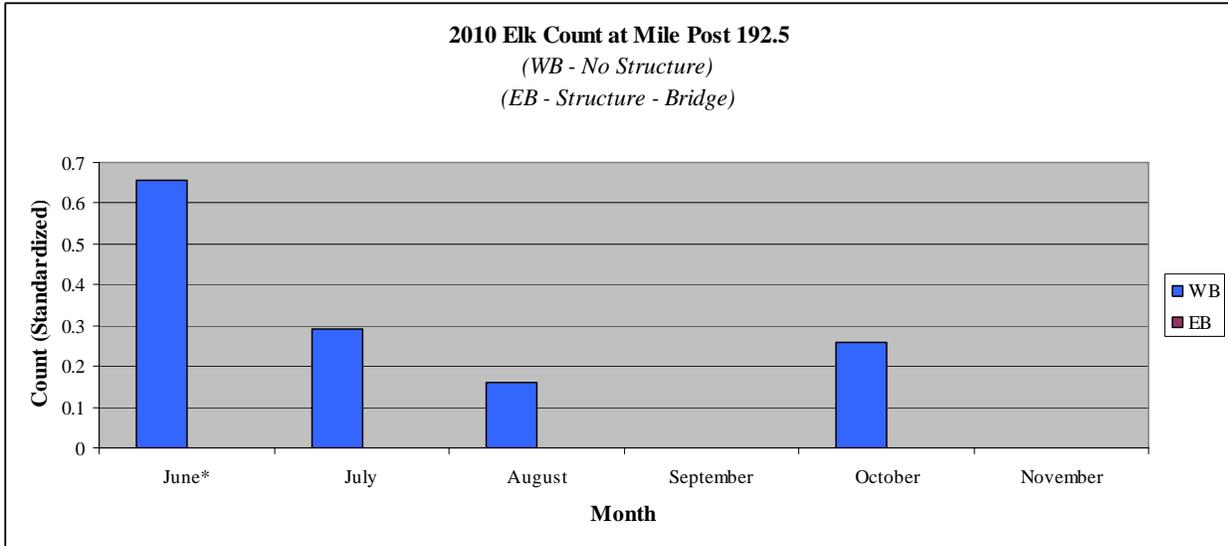


Figure 88 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 192.5 west of Copper Mountain about 2.5 miles from the summit of Vail Pass. Elevation – EB and WB approx. 3100m  
 \* The eastbound and/or westbound camera was functioning for less than 50% of the time during this month.

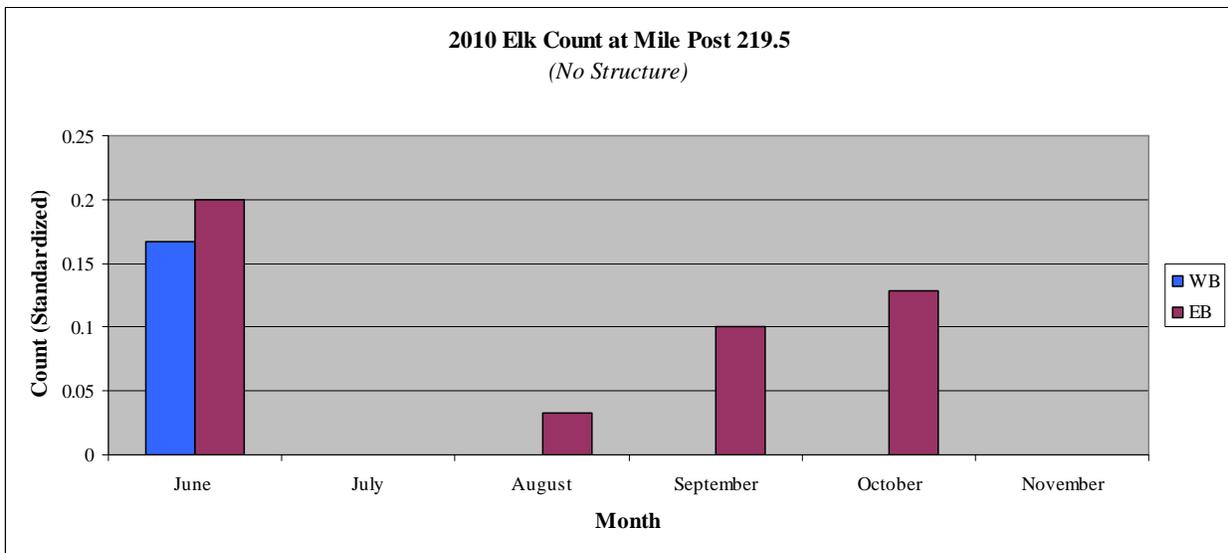


Figure 89 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 219.5 west of Bakerville at Watrous Gulch. Elevation – EB and WB approx. 3100m

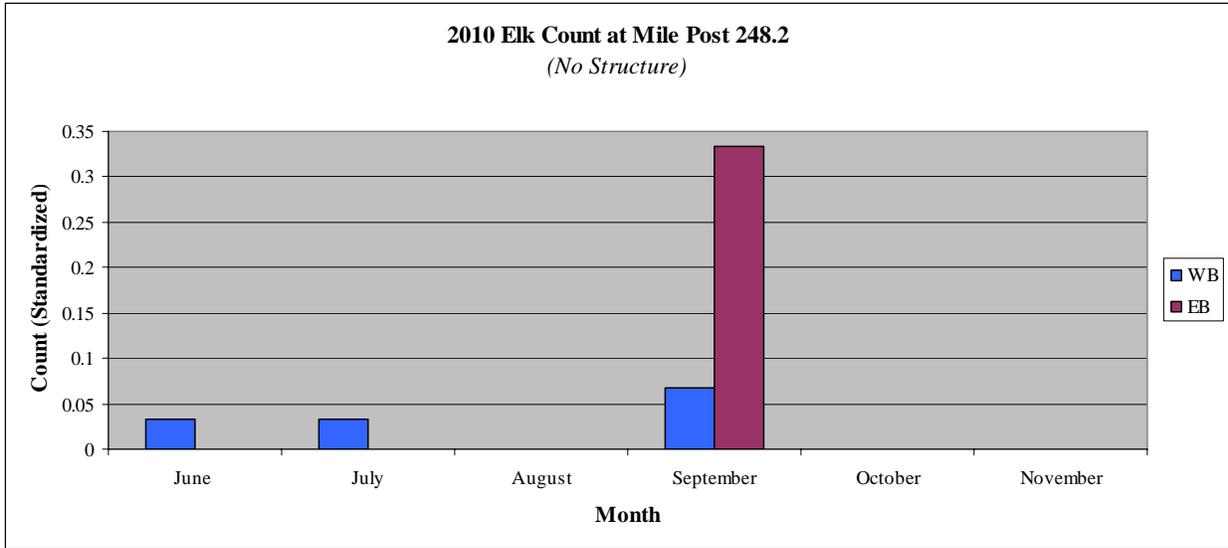


Figure 90 – Number of elk detected at the eastbound and westbound monitoring sites at mile post 248.2 near the Beaver Brook/Floyd Hill exit. Elevation – EB and WB approx. 2300m

*Elk by Season*

The following graphs shows elk activity by season (Figures 91-92). These numbers have been standardized by sampling night. Though this study does include several monitoring locations on Vail Pass, this report does not include the three years of baseline information collected by the Southern Rockies Ecosystem Project (now RMW) from 2006 to 2008.

In general, elk in the 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.

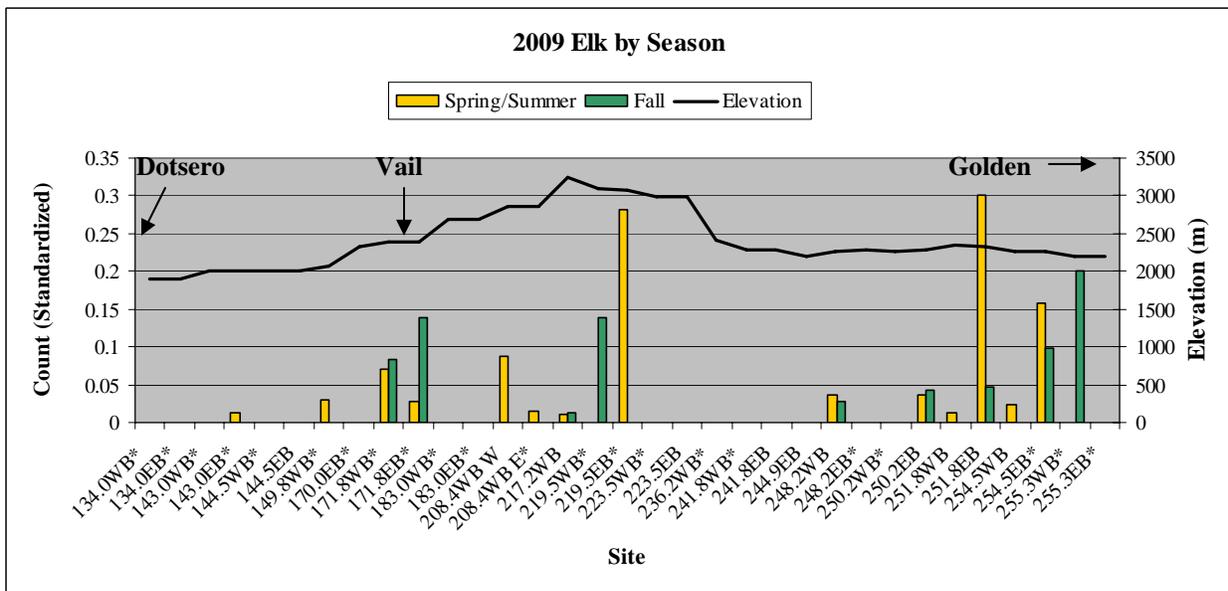


Figure 91 – Number of elk detected in the spring/summer and fall of 2009

\* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

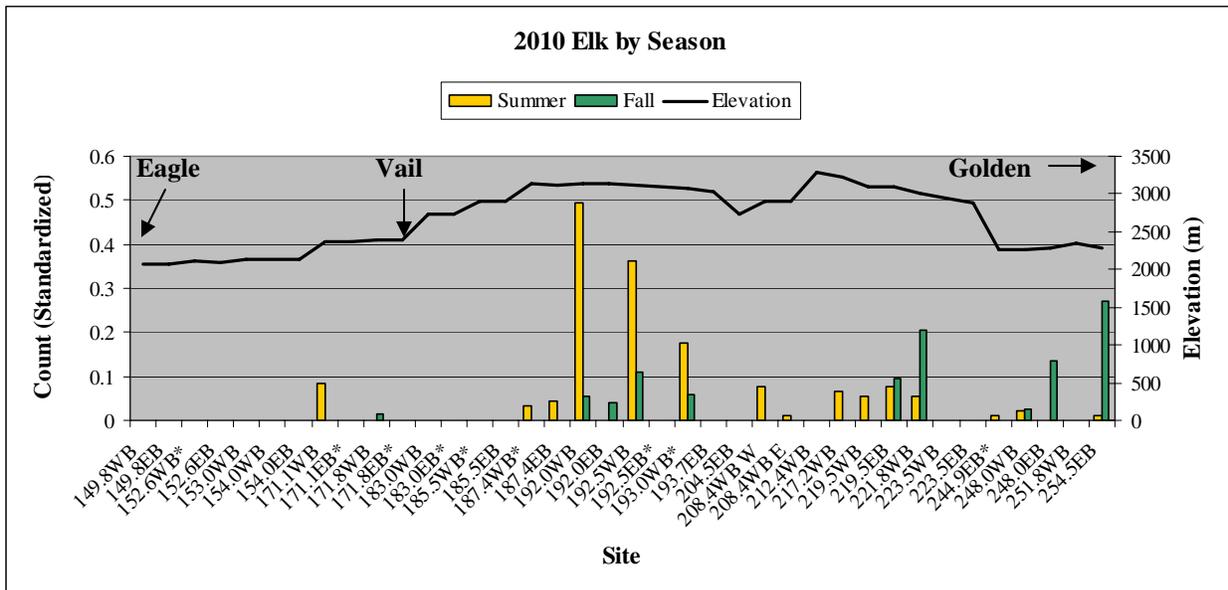


Figure 92 – Number of elk detected in the summer and fall of 2010  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

*Elk by Hour*

The following graphs show elk activity by hour (2009: Figures 93-99; 2010: Figures 100-111). 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).

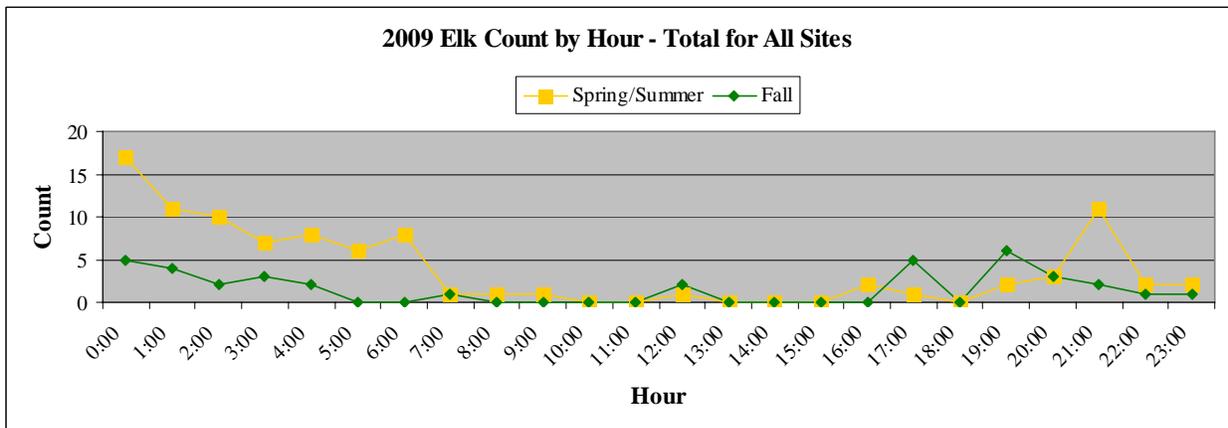


Figure 93 – Number of elk detected by hour at all sites in 2009

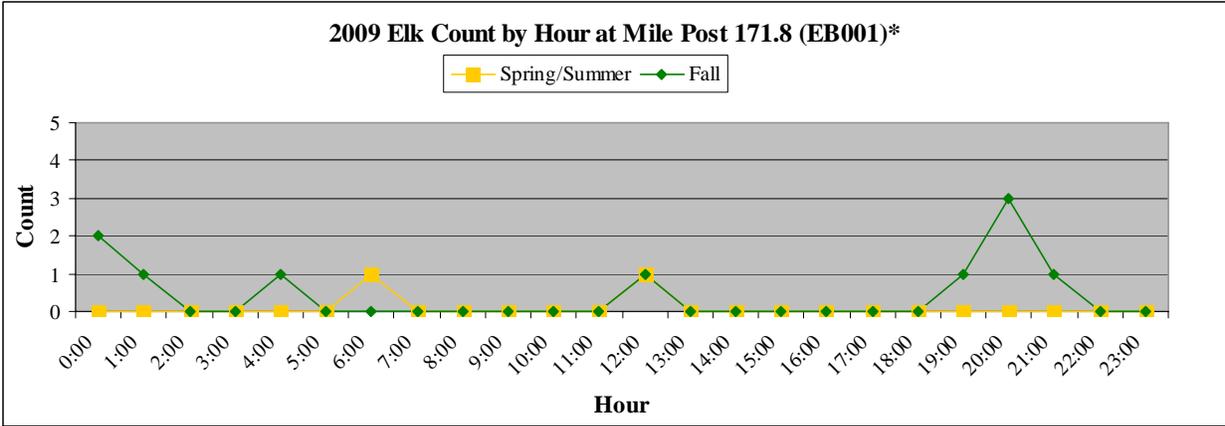


Figure 94 – Number of elk detected by hour at EB001, MP 171.8  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

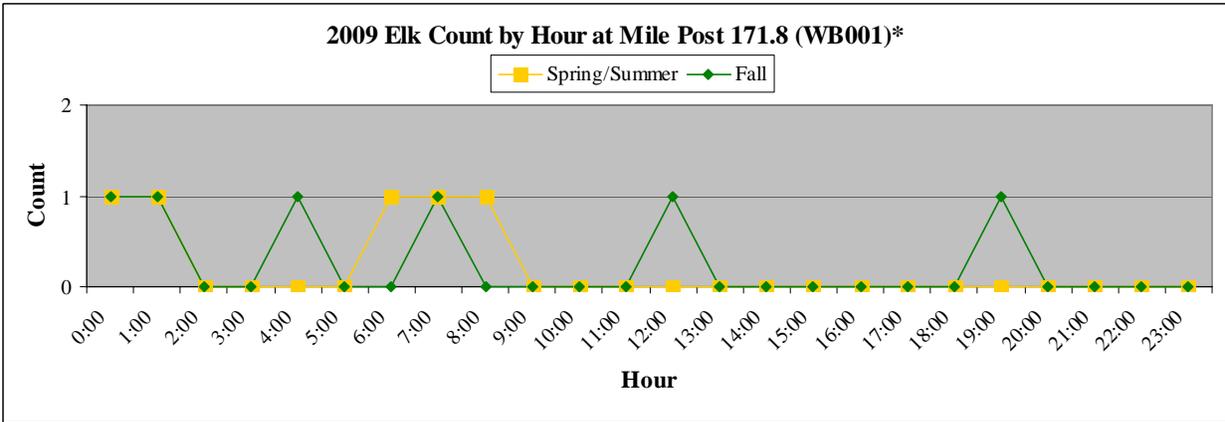


Figure 95 – Number of elk detected by hour at WB001, MP 171.8.  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

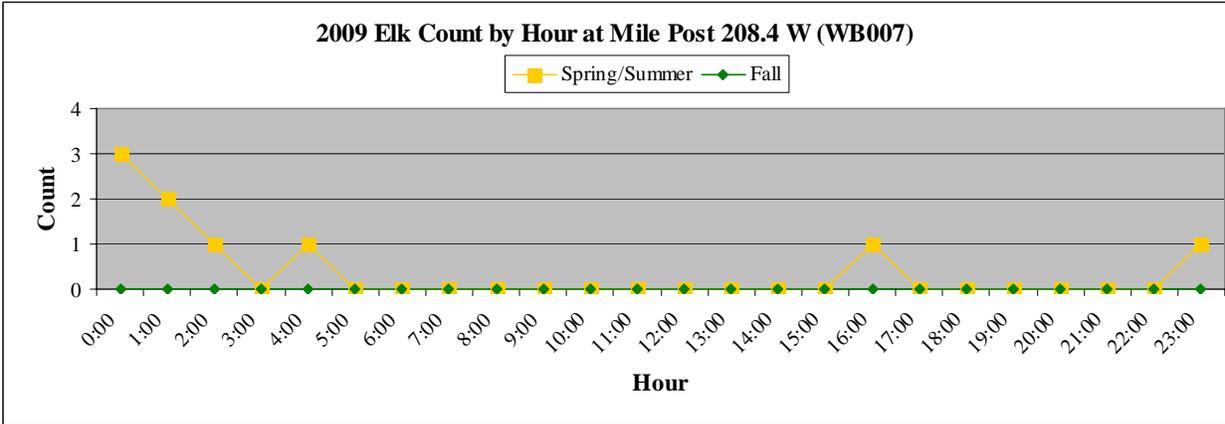


Figure 96 – Number of elk detected by hour at WB007, MP 208.4

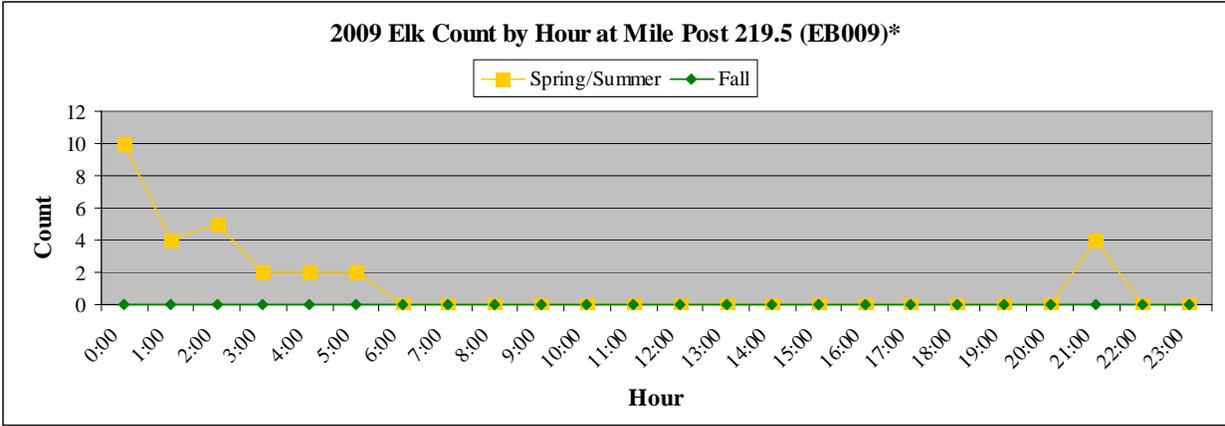


Figure 97 – Number of elk detected by hour at EB009, MP 219.5  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

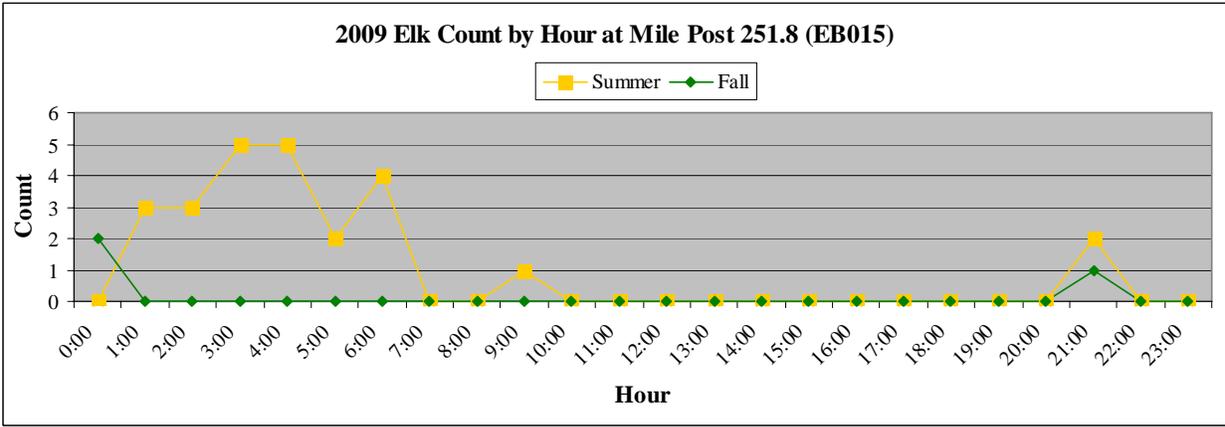


Figure 98 – Number of elk detected by hour at EB015, MP 251.8

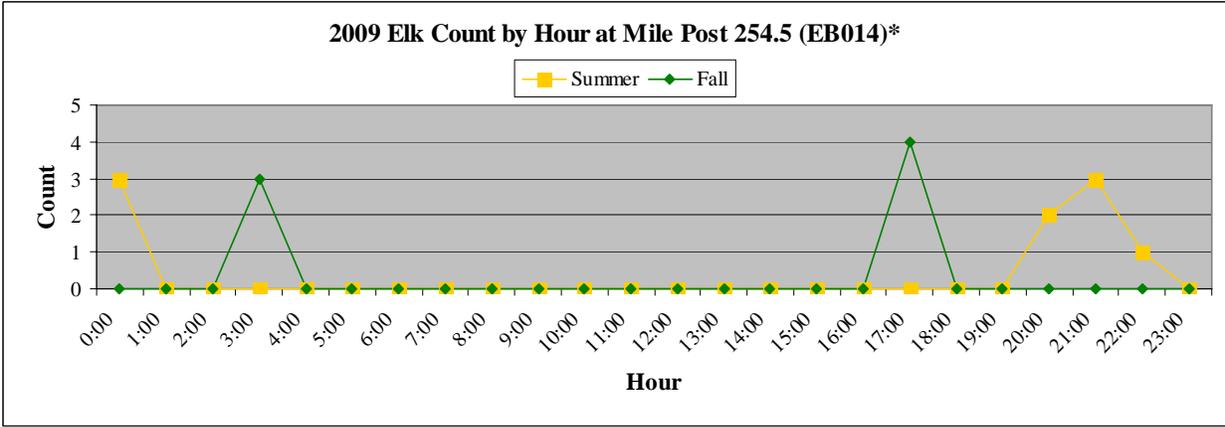


Figure 99 – Number of elk detected by hour at EB014, MP 254.5  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

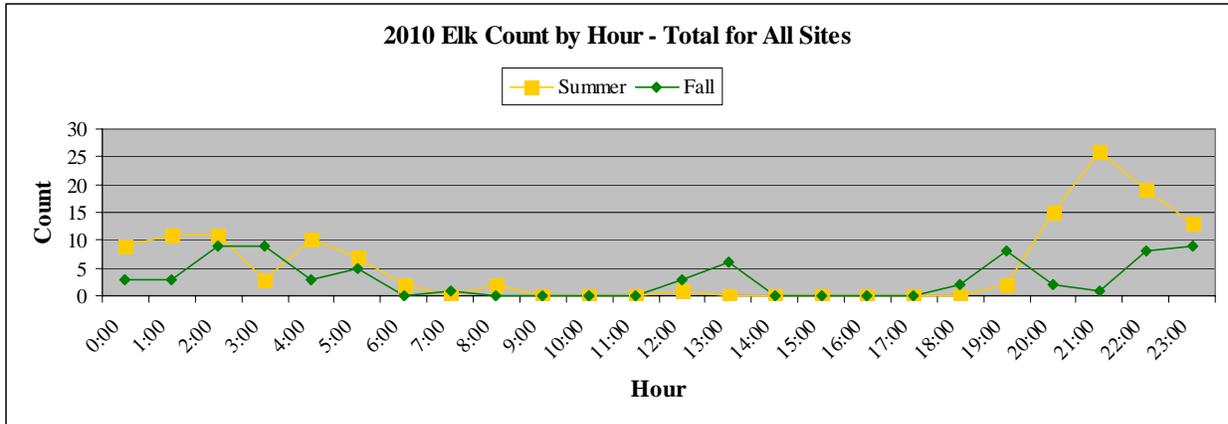


Figure 100 – Number of elk detected by hour at all sites in 2010

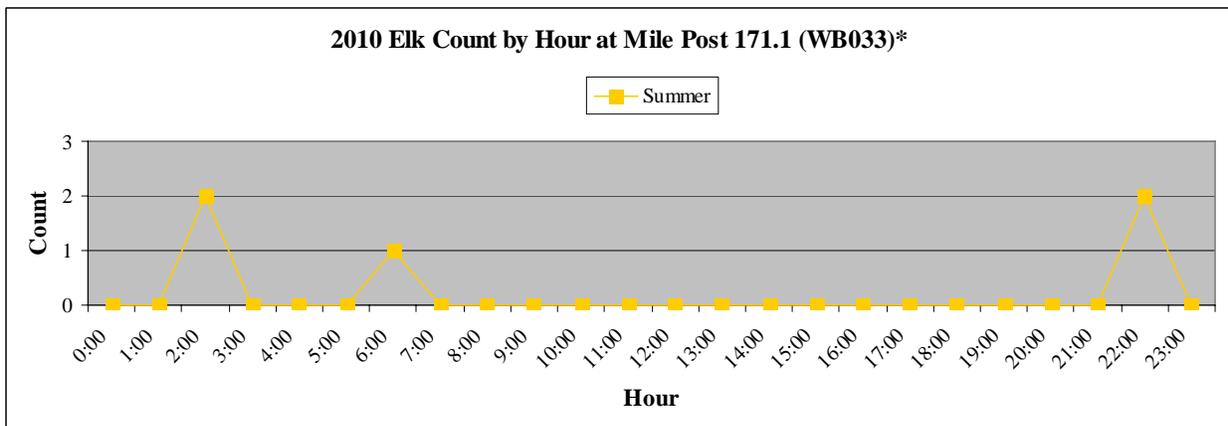


Figure 101 – Number of elk detected by hour at WB033, MP 171.1

\* The camera at this monitoring site was stolen sometime between 8/2/2010 – 9/16/2010.

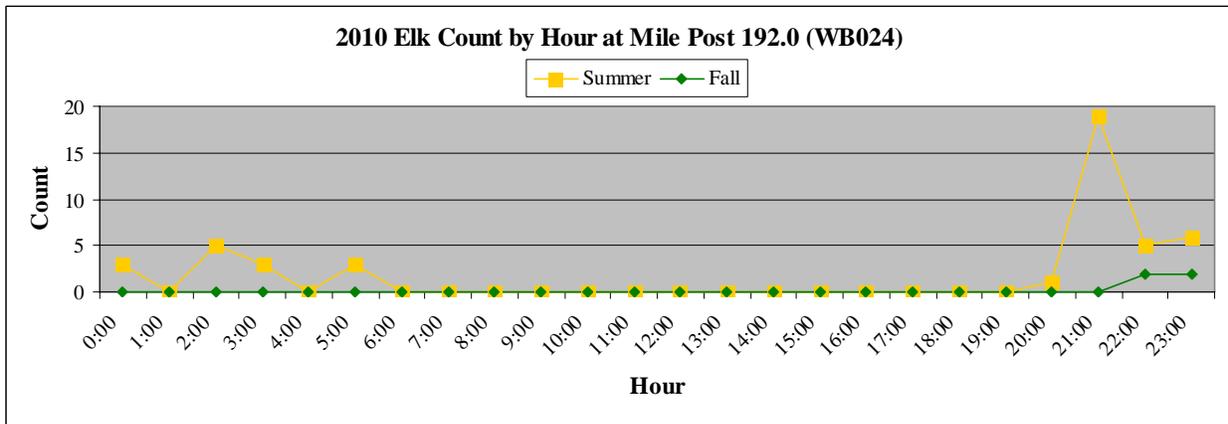


Figure 102 – Number of elk detected by hour at WB024, MP 192.0

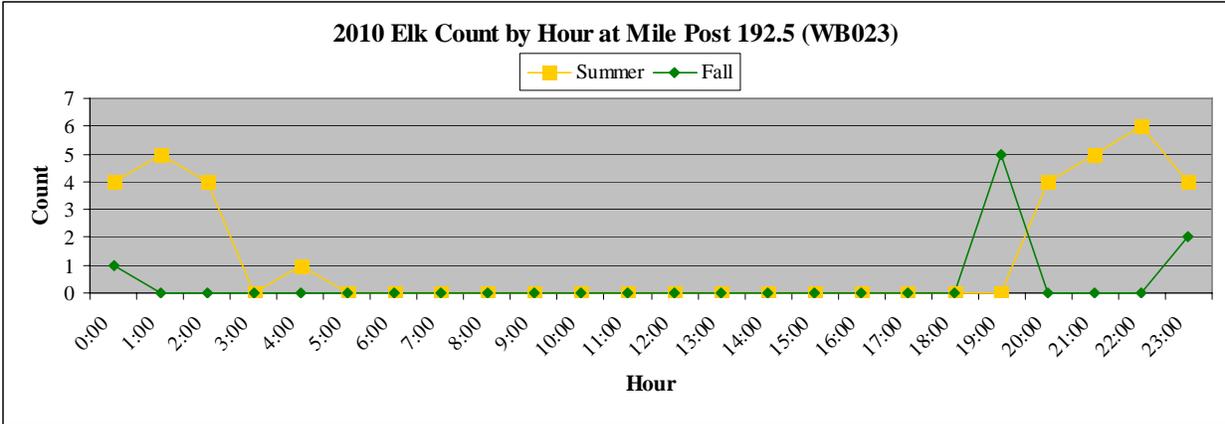


Figure 103 – Number of elk detected by hour at WB023, MP 192.5

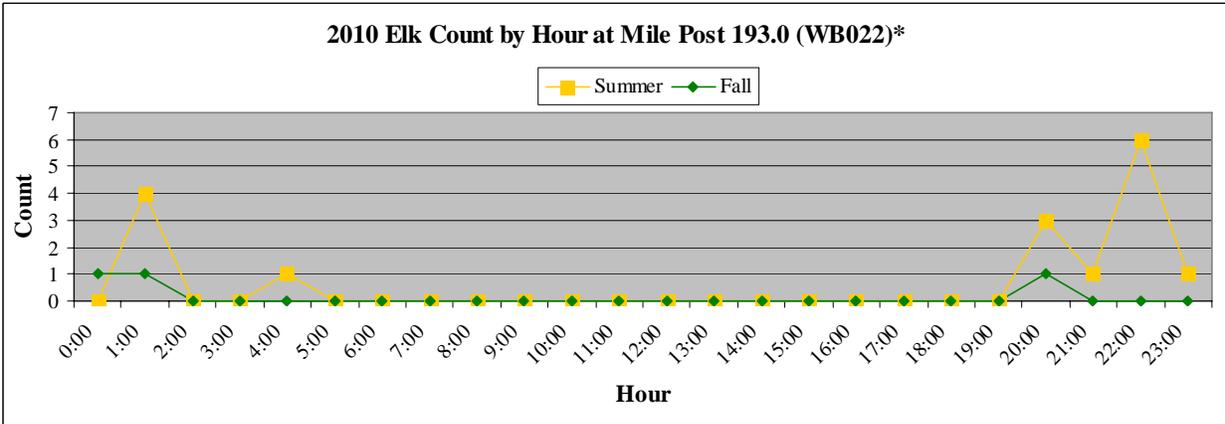


Figure 104 – Number of elk detected by hour at WB022, MP 193.0  
 \* The camera at this site was functioning for less than 50% of the time for 1 or more months in the study period.

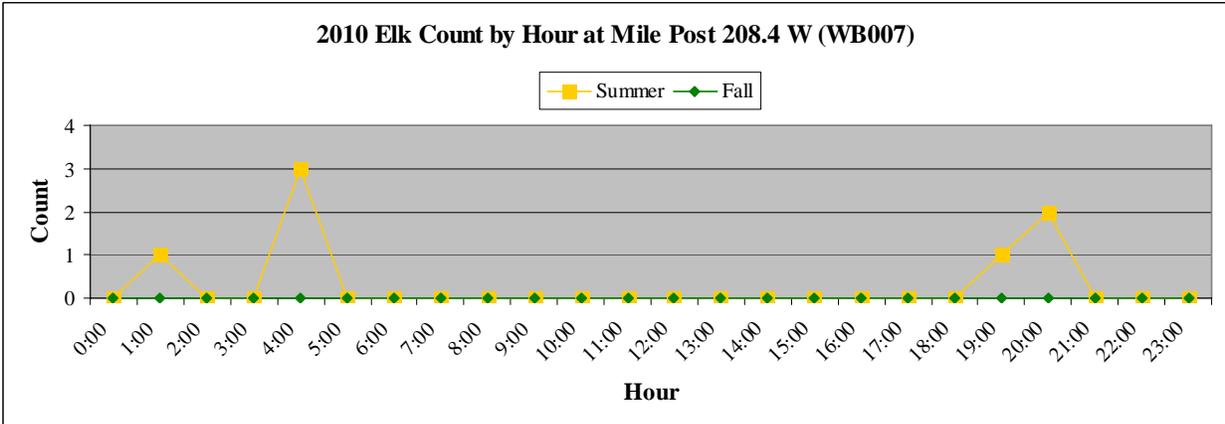


Figure 105 – Number of elk detected by hour at WB007, MP 208.4

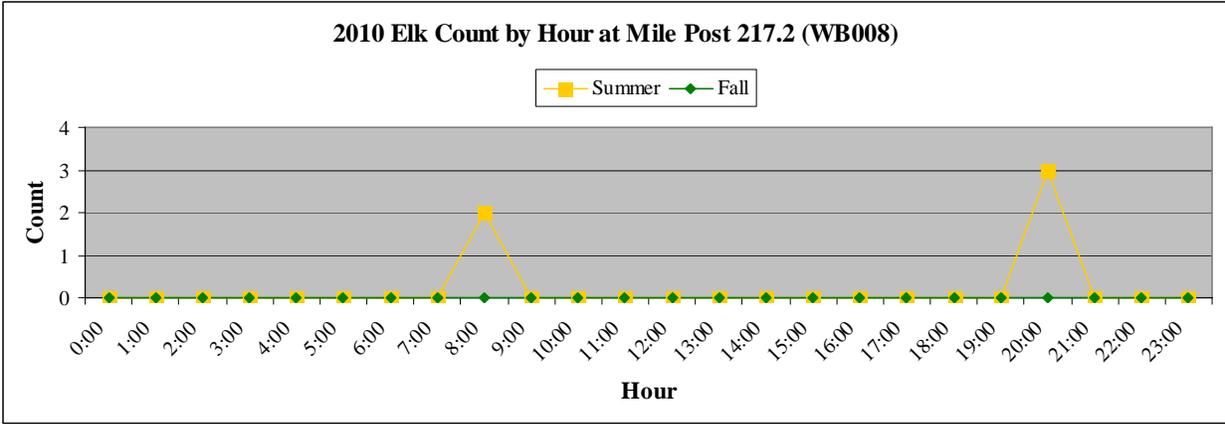


Figure 106 – Number of elk detected by hour at WB008, MP 217.2

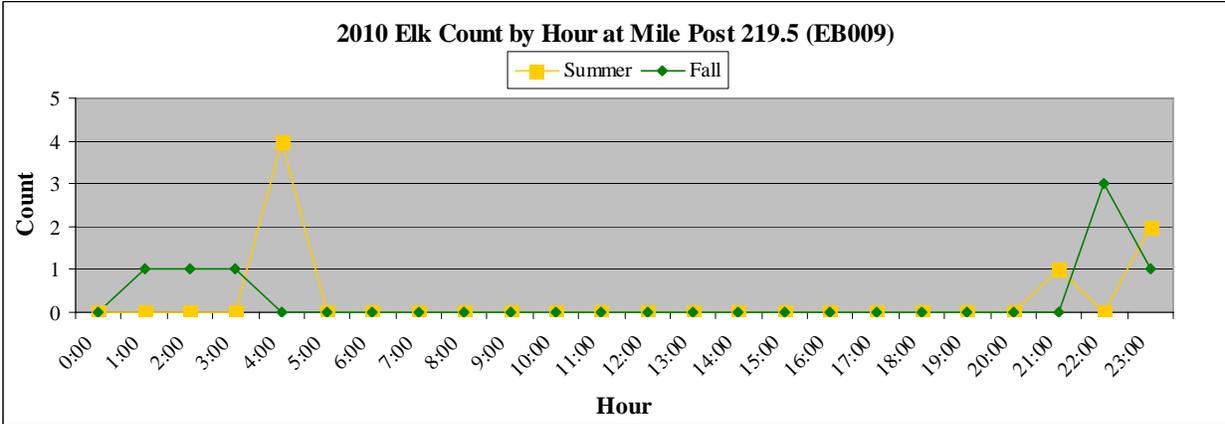


Figure 107 – Number of elk detected by hour at EB009, MP 219.5

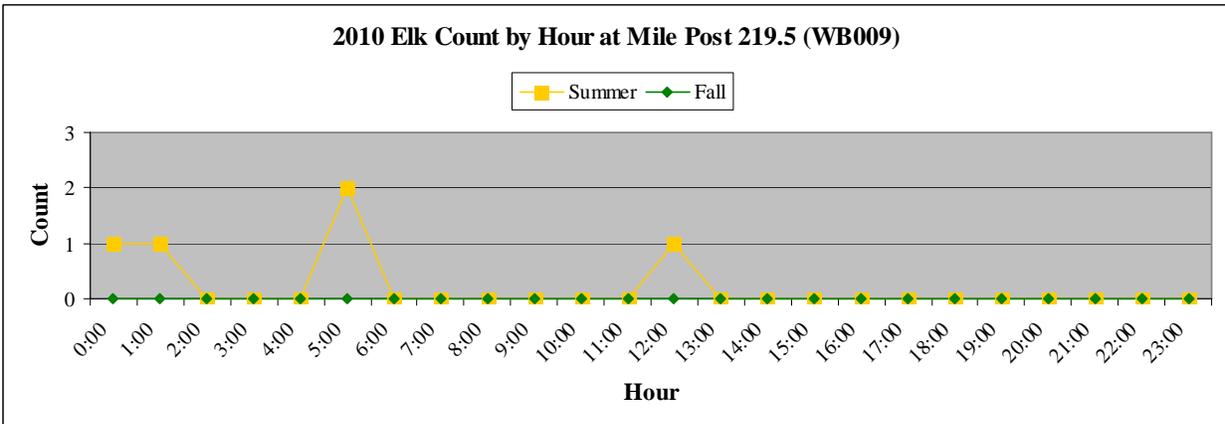


Figure 108 – Number of elk detected by hour at WB009, MP 219.5

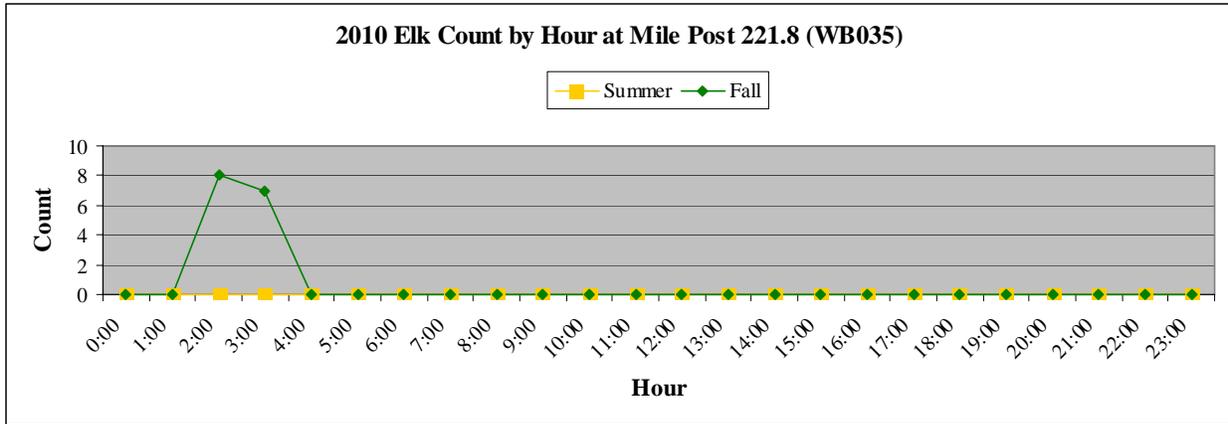


Figure 109 – Number of elk detected by hour at WB035, MP 221.8

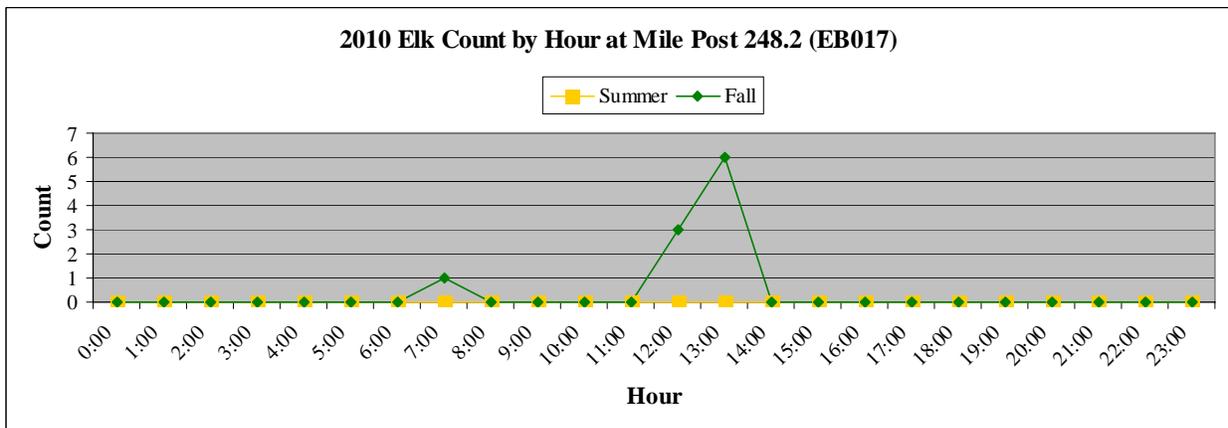


Figure 110 – Number of elk detected by hour at EB017, MP 248.2

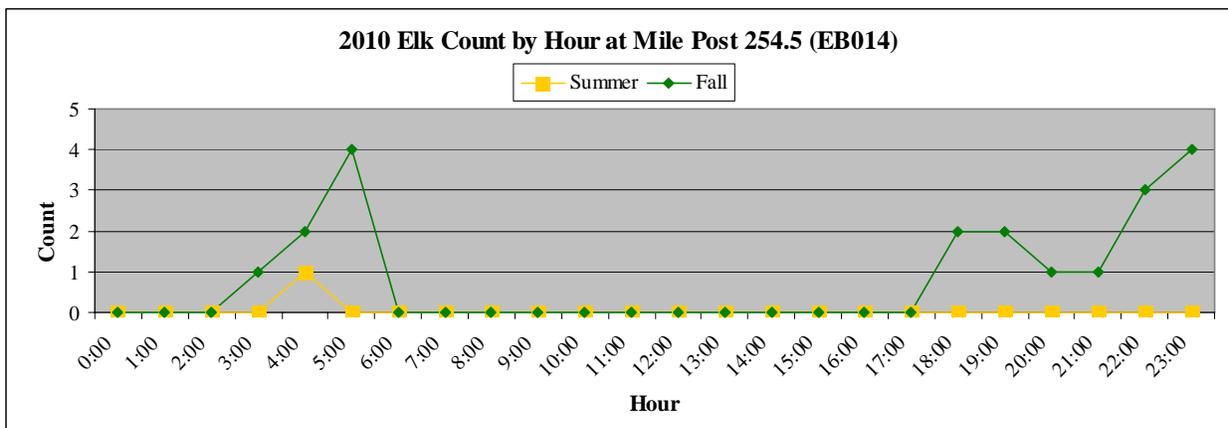


Figure 111 – Number of elk detected by hour at EB014, MP 254.5

*Domestic Animals*

At several monitoring stations, domesticated animals such as cattle, dogs, cats, goats, horses and sheep were documented. 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 (2009: Figures 112-118; 2010: Figures 119-131). These numbers have not been standardized by sampling night.

In general for both years, 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.

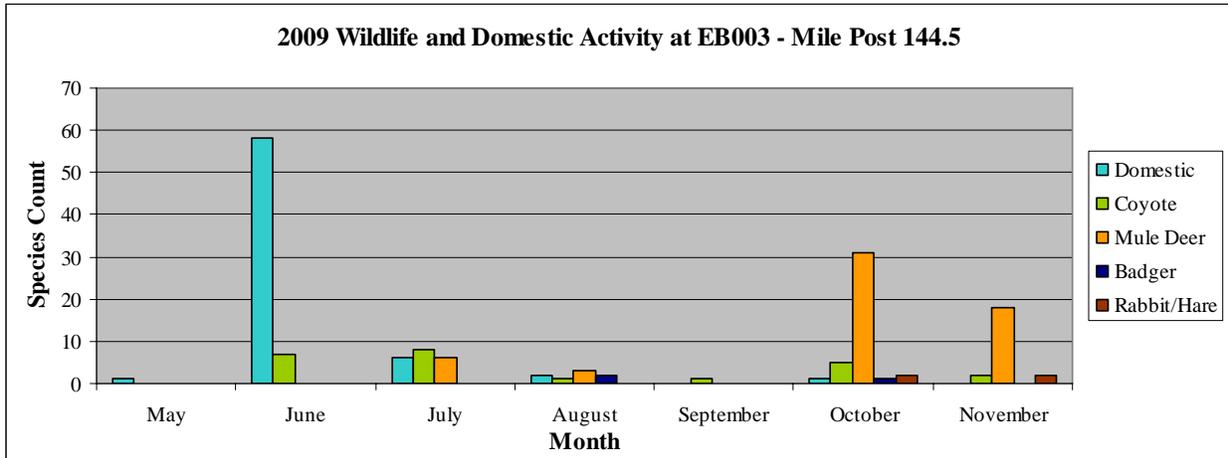


Figure 112 – Number of wildlife and domestic animals (incl. humans) detected at EB003, MP 144.5 west of Eagle in 2009

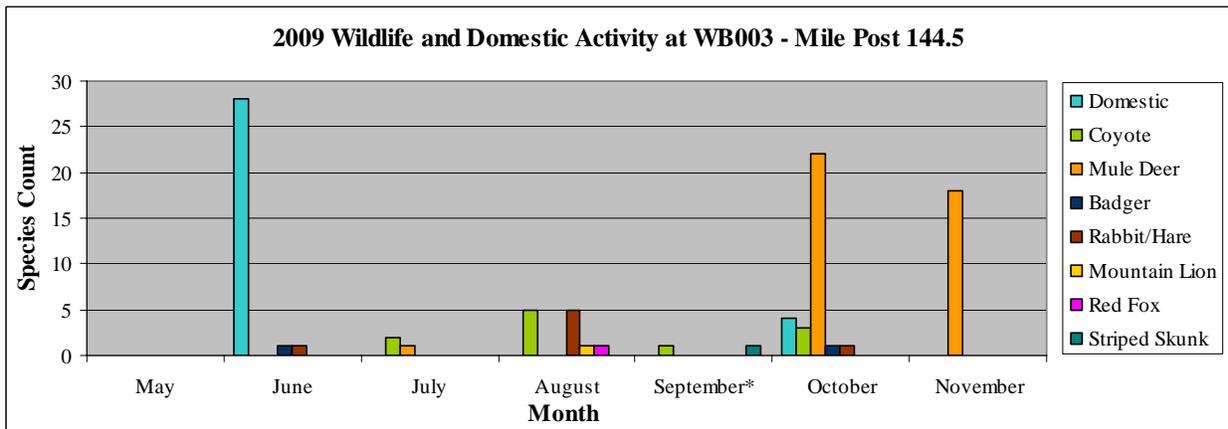


Figure 113 – Number of wildlife and domestic animals (incl. humans) detected at WB003, MP 144.5 west of Eagle in 2009

\* The camera at this site was functioning for less than 50% of the time during this month.

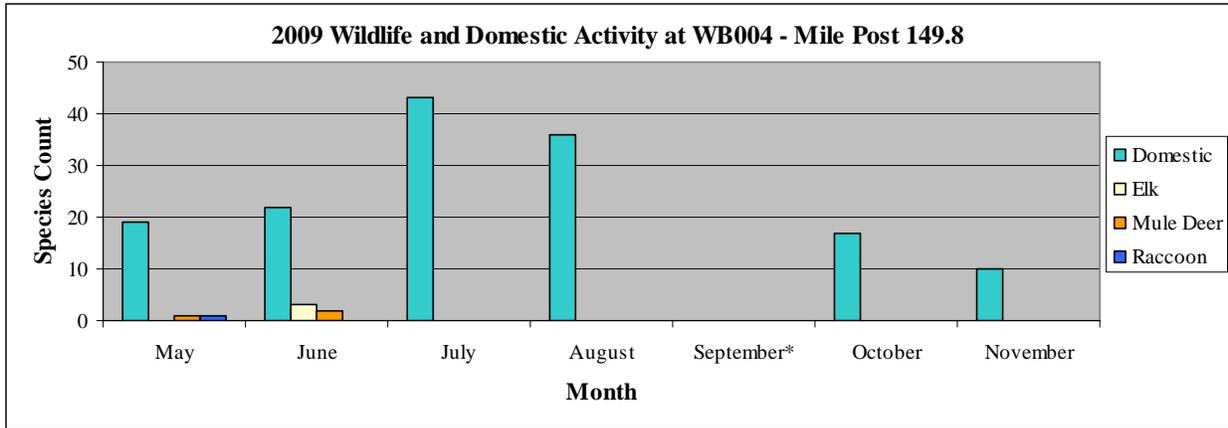


Figure 114 – Number of wildlife and domestic animals (incl. humans) detected at WB004, MP 149.8 east of Eagle in 2009

\* The camera at this site was functioning for less than 50% of the time during this month.

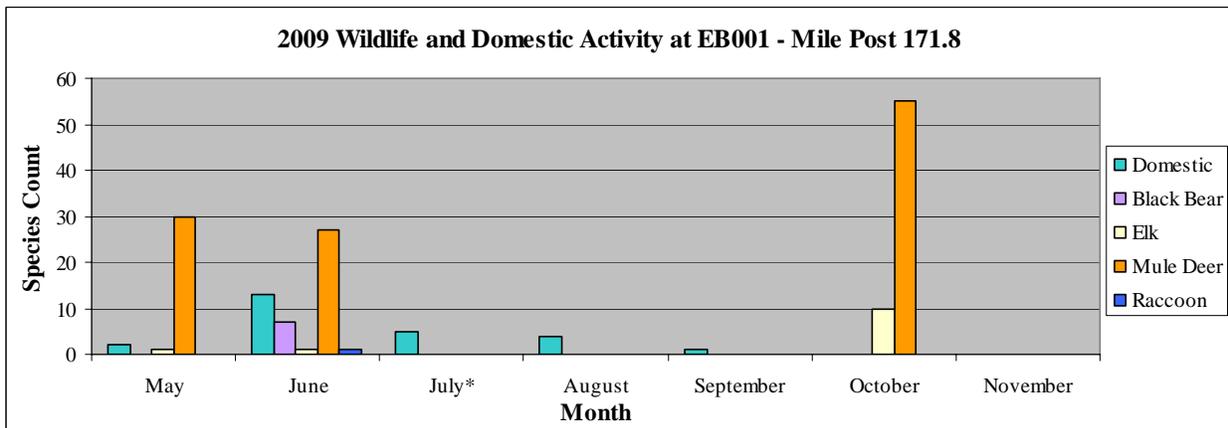


Figure 115 – Number of wildlife and domestic animals (incl. humans) detected at EB001, MP 171.8 between Minturn and Vail at Dowd’s Junction in 2009

\* The camera at this site was functioning for less than 50% of the time during this month.

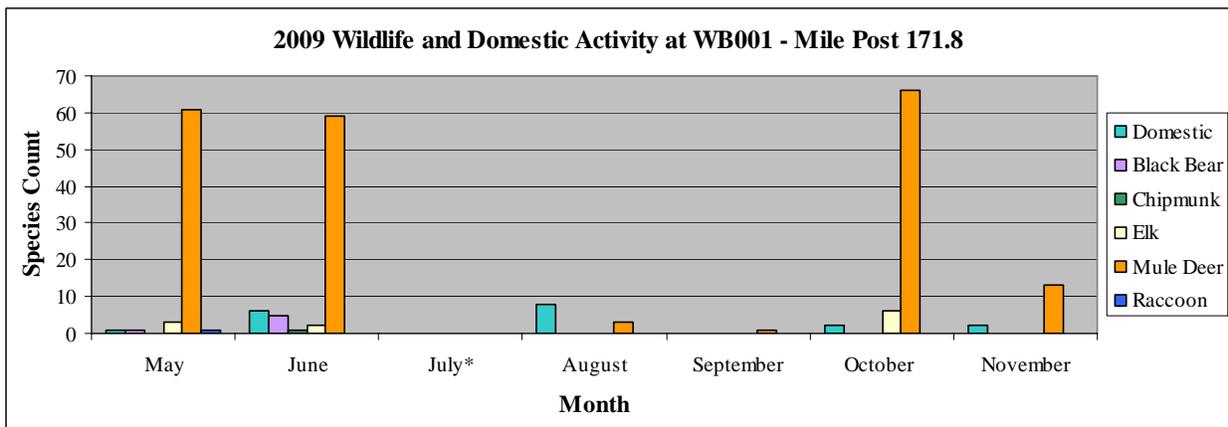


Figure 116 – Number of wildlife and domestic animals (incl. humans) detected at WB001, MP 171.8 between Minturn and Vail at Dowd’s Junction in 2009

\* The camera at this site was functioning for less than 50% of the time during this month.

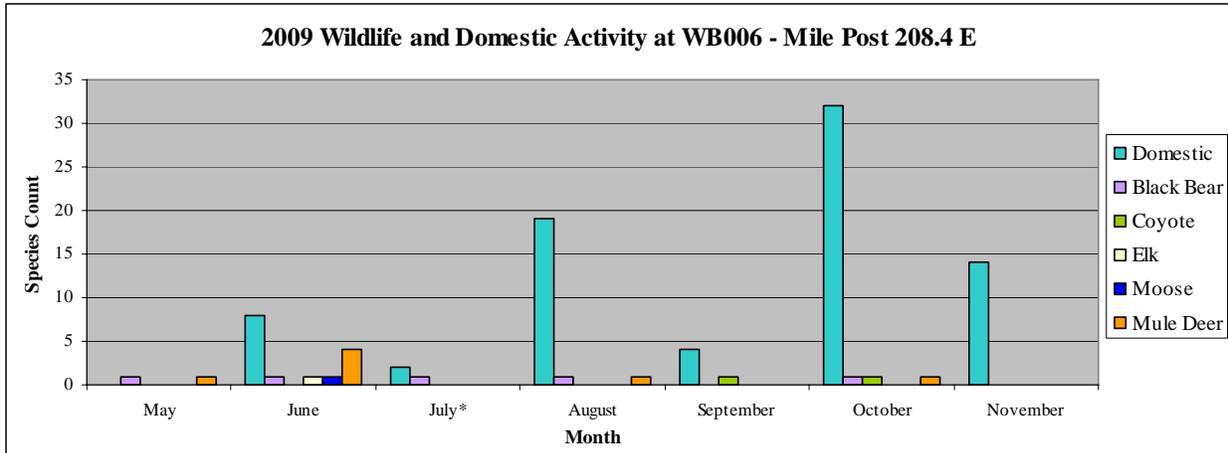


Figure 117 – Number of wildlife and domestic animals (incl. humans) detected at WB006, MP 208.4 east of Silverthorne at the Laskey Gulch drainage in 2009

\* The camera at this site was functioning for less than 50% of the time during this month.

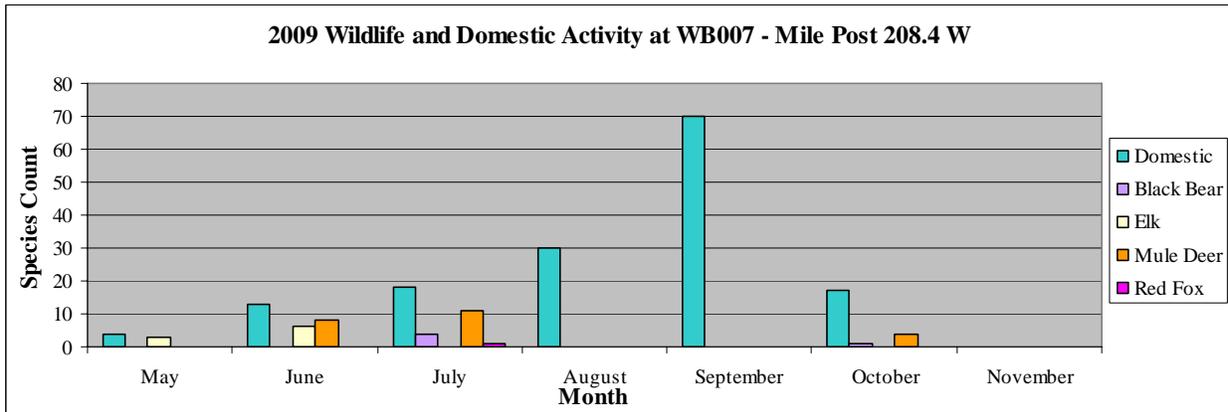


Figure 118 – Number of wildlife and domestic animals (incl. humans) detected at WB007, MP 208.4 east of Silverthorne at the Laskey Gulch drainage in 2009

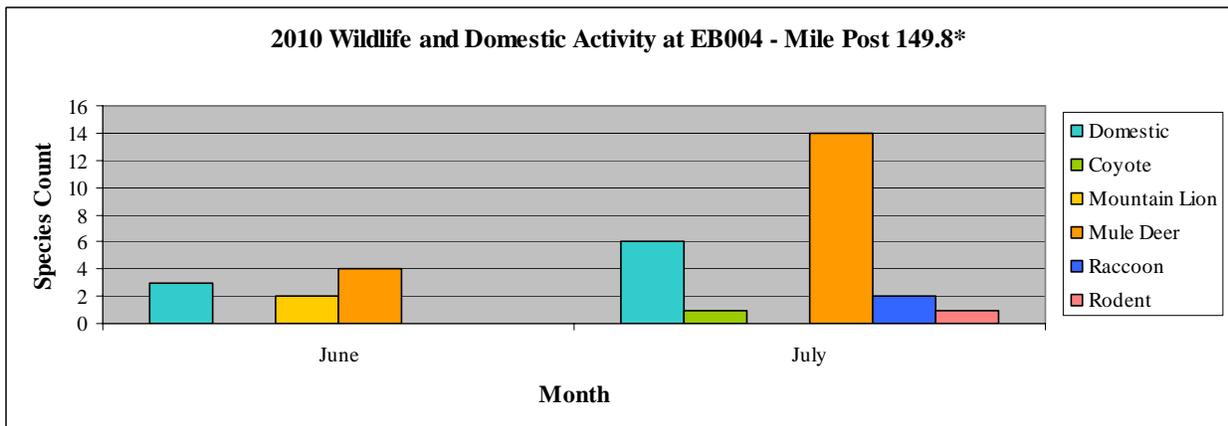


Figure 119 – Number of wildlife and domestic animals (incl. humans) detected at EB004, MP 149.8 east of Eagle in 2010

\* The camera at this monitoring site was stolen sometime between 8/2/2010 – 9/16/2010.

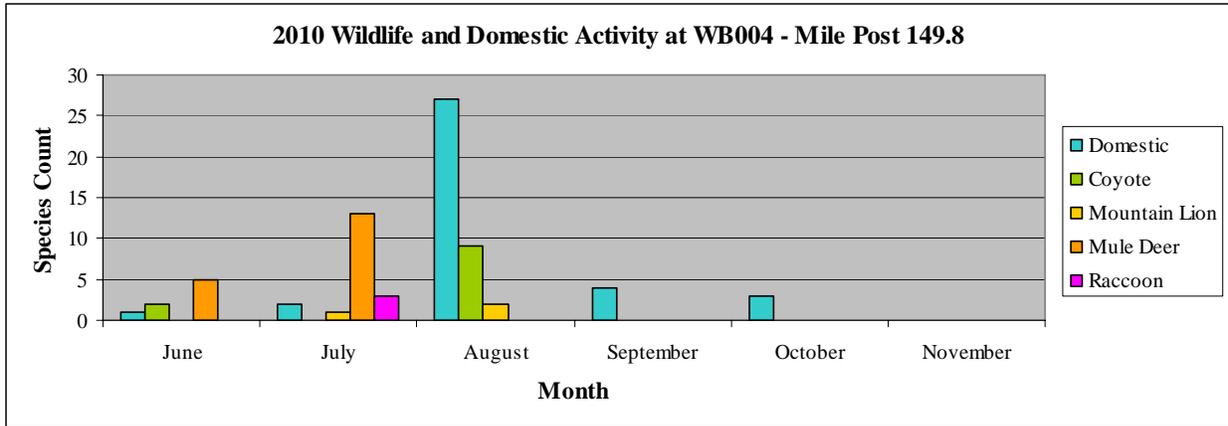


Figure 120 – Number of wildlife and domestic animals (incl. humans) detected at WB004, MP 149.8 east of Eagle in 2010

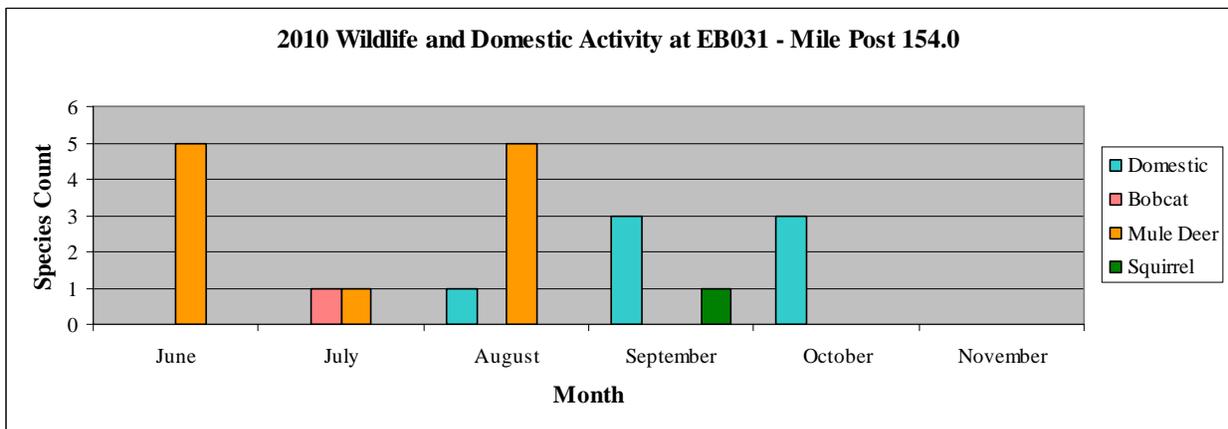


Figure 121 – Number of wildlife and domestic animals (incl. humans) detected at EB031, MP 154.0 west of Wolcott in 2010

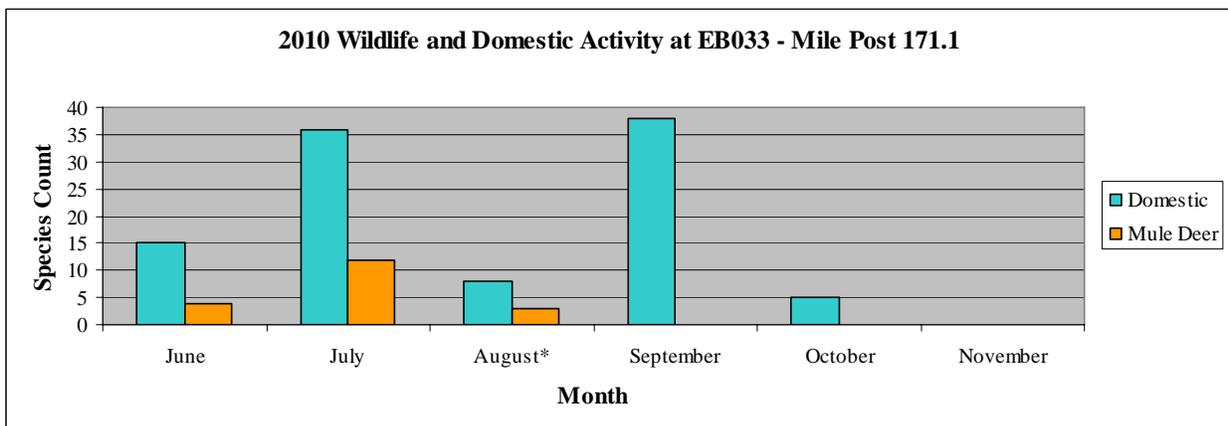


Figure 122 – Number of wildlife and domestic animals (incl. humans) detected at EB033, MP 171.1 near Minturn in 2010

\* The camera at this site was functioning for less than 50% of the time during this month.

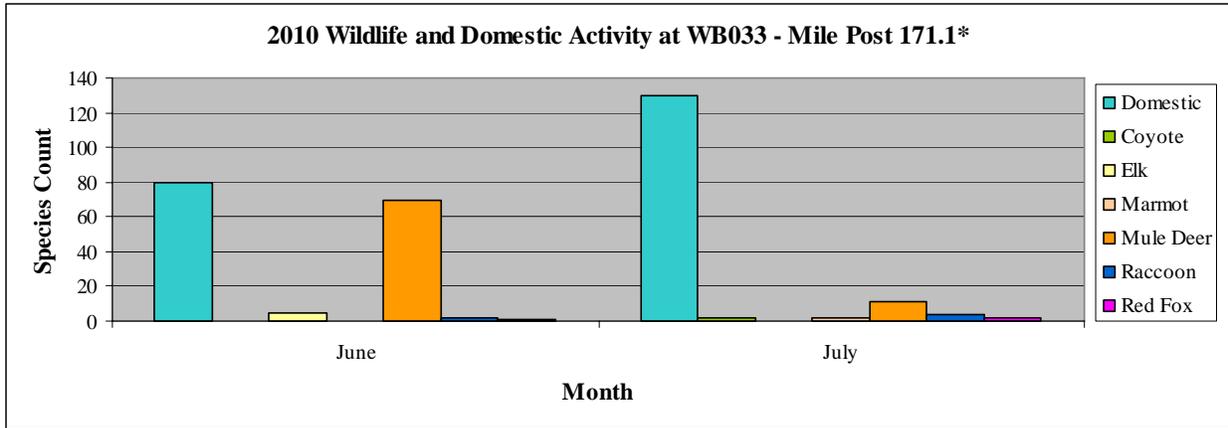


Figure 123 – Number of wildlife and domestic animals (incl. humans) detected at WB033, MP 171.1 near Minturn in 2010  
 \* The camera at this monitoring site was stolen sometime between 8/2/2010 – 9/16/2010.

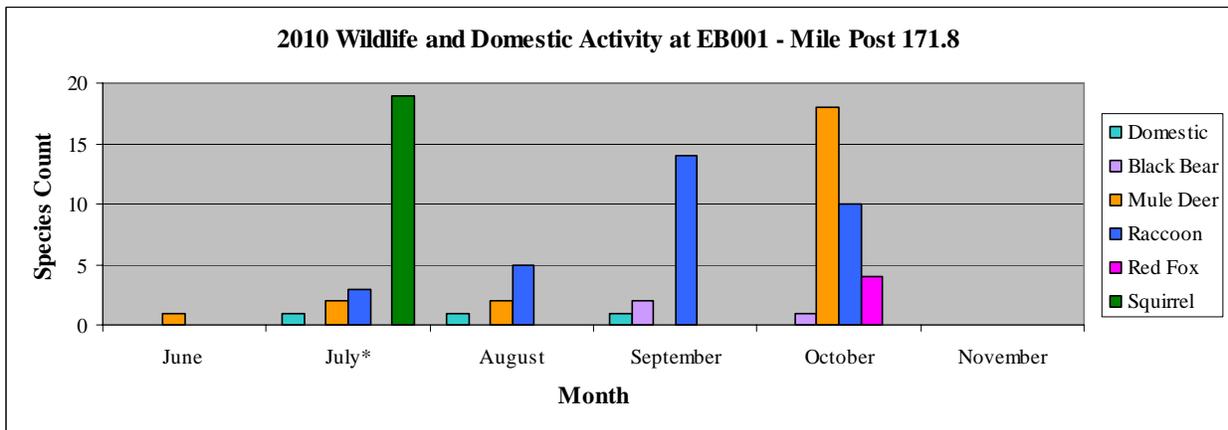


Figure 124 – Number of wildlife and domestic animals (incl. humans) detected at EB001, MP 171.8 between Minturn and Vail at Dowd’s Junction in 2010  
 \* The camera at this site was functioning for less than 50% of the time during this month.

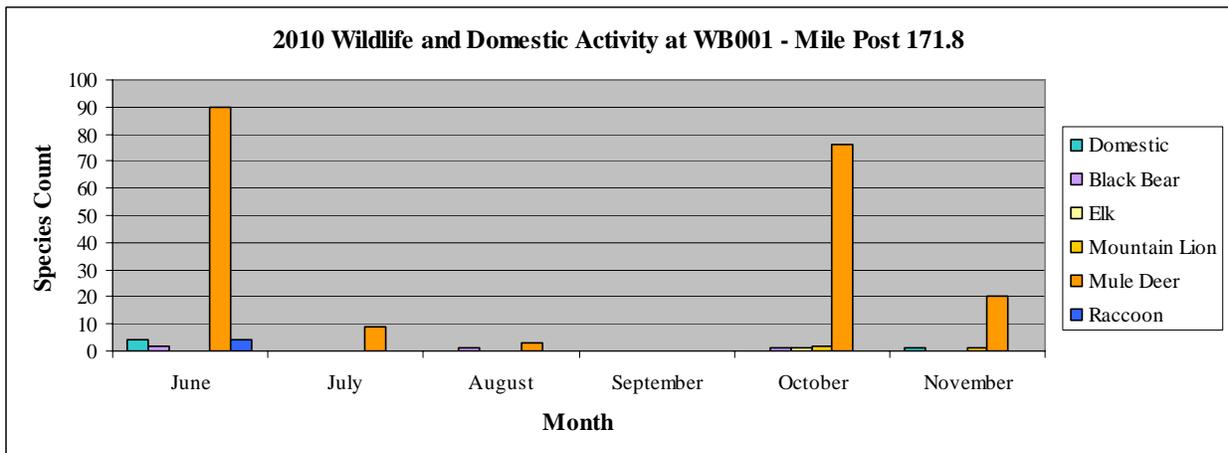


Figure 125 – Number of wildlife and domestic animals (incl. humans) detected at WB001, MP 171.8 between Minturn and Vail at Dowd’s Junction in 2010

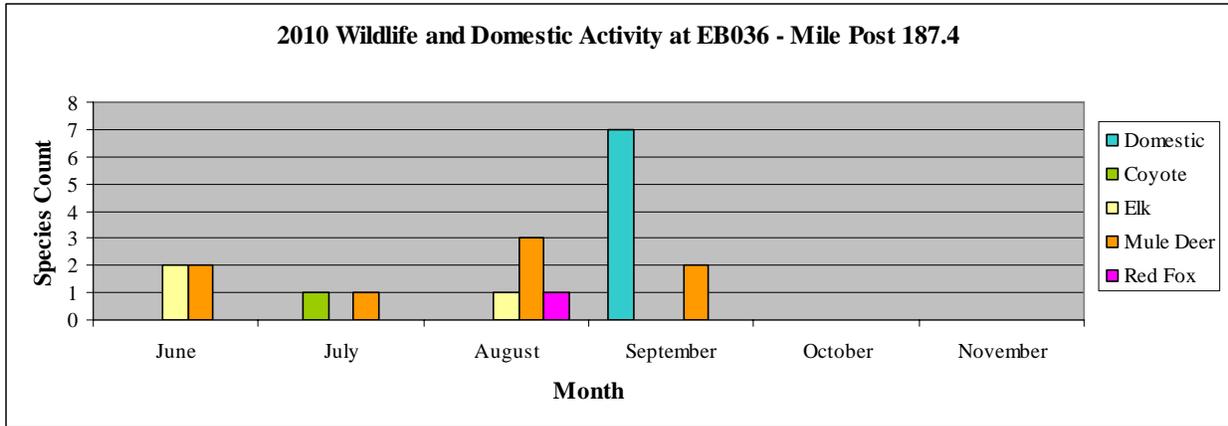


Figure 126 – Number of wildlife and domestic animals (incl. humans) detected at EB036, MP 187.4 east of Vail about 2.6 miles from the summit of Vail Pass in 2010

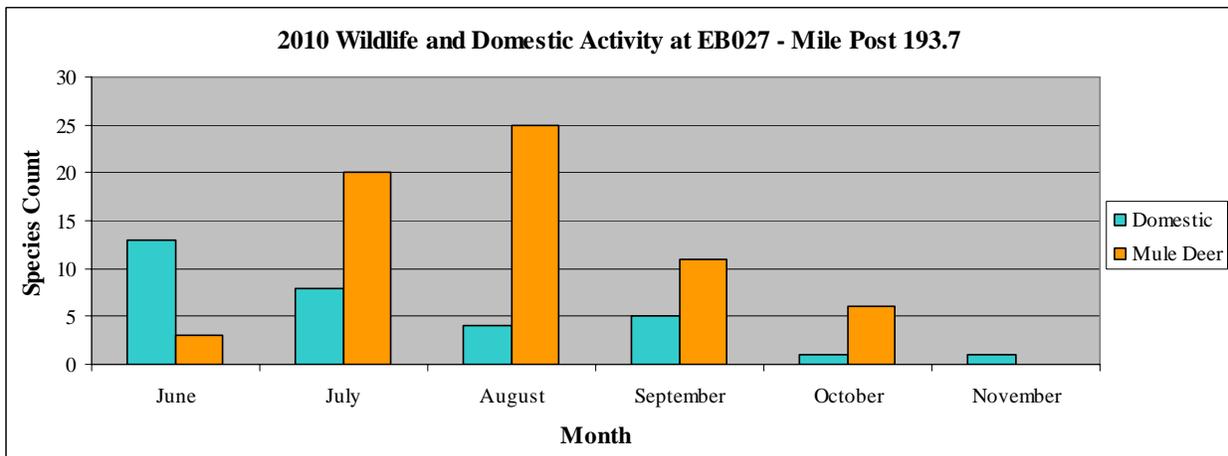


Figure 127 – Number of wildlife and domestic animals (incl. humans) detected at EB027, MP 193.7 west of Copper Mountain about 3.7 miles from the summit of Vail Pass in 2010

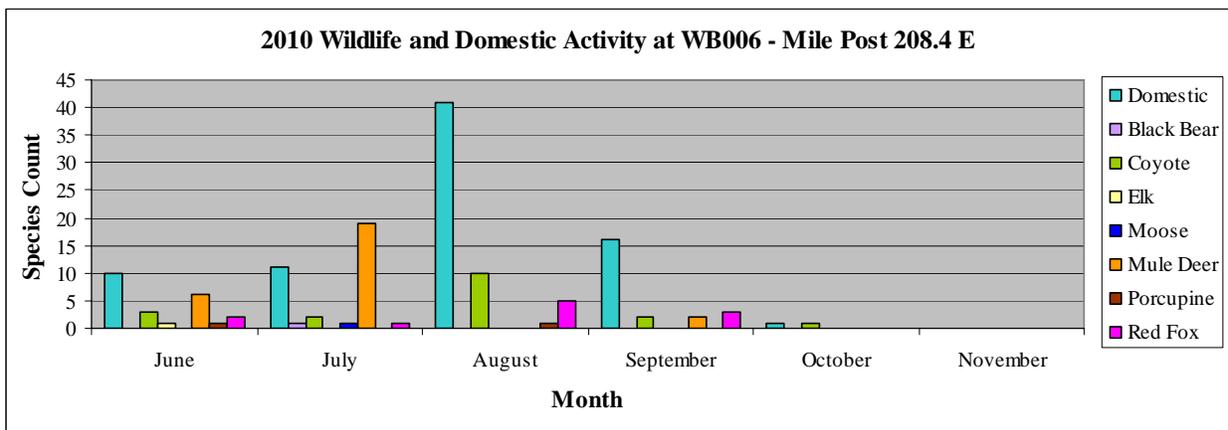


Figure 128 – Number of wildlife and domestic animals (incl. humans) detected at WB006, MP 208.4 east of Silverthorne at the Laskey Gulch drainage in 2010

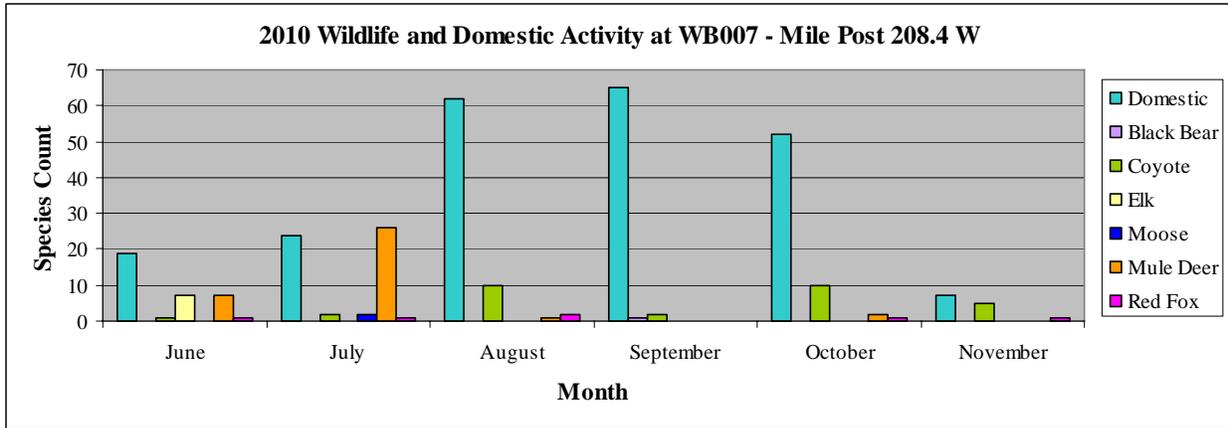


Figure 129 – Number of wildlife and domestic animals (incl. humans) detected at WB007, MP 208.4 east of Silverthorne at the Laskey Gulch drainage in 2009

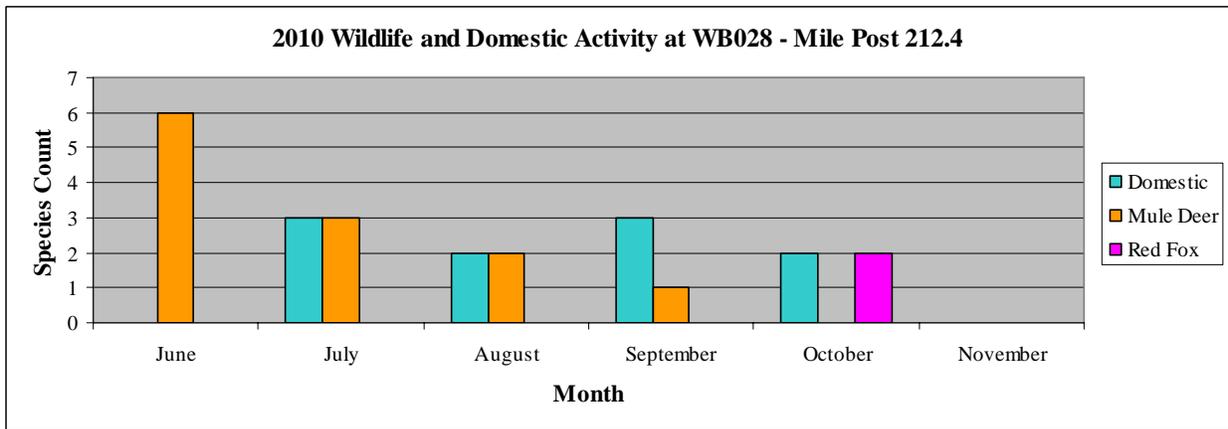


Figure 130 – Number of wildlife and domestic animals (incl. humans) detected at WB028, MP 212.4 east of Silverthorne and west of Eisenhower Tunnel in 2010

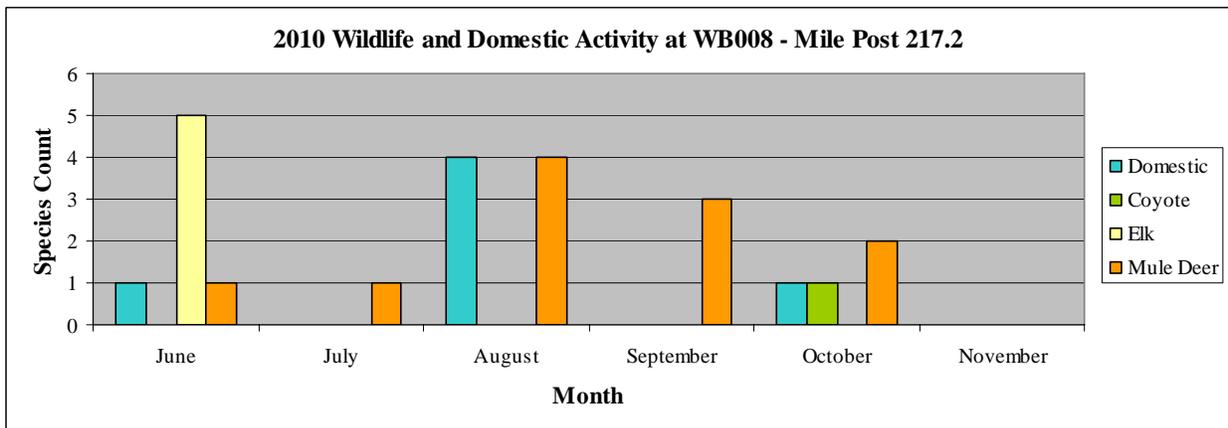


Figure 131 – Number of wildlife and domestic animals (incl. humans) detected at WB008, MP 217.2 east of Loveland Ski Resort and the junction with US Highway 6 at Dry Gulch in 2010

## **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 to monitor wildlife activity, several species are likely underrepresented (Bonaker 2008). Additionally, as the smallest time delay available on the model of cameras used is thirty seconds to one minute, it is difficult to infer behavior from the images or calculate passage and repel rates. However, further analysis of the data for through passage, though limited due to the constraints mentioned above, would give even greater insight into whether the existing structures along I-70 are adequate for wildlife movement.

## PART II: I-70 WILDLIFE WATCH REPORT

### Introduction

*I-70 Wildlife Watch* is a web-based wildlife observation data collection tool that allows motorists to report wildlife, both alive and dead, that they see along Colorado's Interstate 70 (I-70) between Golden and Glenwood Springs. The website, developed by Western Transportation Institute (WTI) at Montana State University (MSU), was modeled after similar websites in British Columbia, Canada, Ketchum, Idaho and Bozeman Pass, Montana. This on-line database was used as part of the greater I-70 Eco-Logical project to both educate drivers about wildlife crossing issues along I-70 as well as compile information on wildlife crossing hotspots that cannot otherwise be determined from road-kill counts or accident reports.

Currently, much of our knowledge about wildlife activity near the roadway is based on what can be gleaned from the animal-vehicle collision (AVC) data that is collected by Colorado State Patrol and Colorado Department of Transportation. This data consists mostly of collisions that were serious enough to report; therefore, AVCs are generally recognized as being severely underreported as well as unevenly reported over time and geographies. Romin and Bissonette (1996) recommend factoring in a 16-50 percent reporting rate when estimating AVC levels from accident reports. Similarly, Hess (2006) estimates that for every one AVC recorded, 3 are not. Thus, the information collected by the public through *I-70 Wildlife Watch* gives us a better idea where live animals are most active along the roadway as well as about otherwise under- or unreported road-killed animals.

### Methodology

#### *The website*

Motorists were asked to participate in *I-70 Wildlife Watch* by reporting wildlife observations, dead or alive, anywhere along I-70 between Glenwood Springs and Golden, Colorado. After making an observation, users first log into [www.I-70WildlifeWatch.org](http://www.I-70WildlifeWatch.org), the website's homepage created by Chad Bonaker and Rocky Mountain Wild. The homepage provides the user with general information about the website including why the website is important, how the data will be used, and where to get additional information.

On the homepage, there are two links directing users to the main wildlife report submission site, <http://wtiwwwapps.coe.montana.edu/WildlifeObservations/ColoradoI70/>, which is located on the WTI server. The homepage on WTI's server gives the user additional information about the website including information on participant's rights as human subjects and who to contact for technical support. From this page, users can click to enter the main website where they are prompted to identify the general location of their animal sighting on a Google map with a terrain background. Several green markers representing various landmarks are provided to help the user find the general location. After the general location is identified, the user zooms in on the map to select the specific sighting location down to a tenth of a mile (represented by red markers). Once the user selects the red marker that corresponds to the nearest tenth of a mile for their sighting, they are required to answer several questions about the observation including: was/were the animal(s) road-killed or alive, the location of the animal(s) in relation to the roadway, species, number of individuals sighted, date and hour of the day of the sighting, which exits the driver entered and exited the roadway on the trip when the sighting was made, and how many times the observer has driven the same section of highway prior to the observation date without making an observation. Users can also leave a comment or their contact information, but this information is optional. After submitting their observation, users have the option to input another observation or see what others have reported on the website (Figures 1-8).

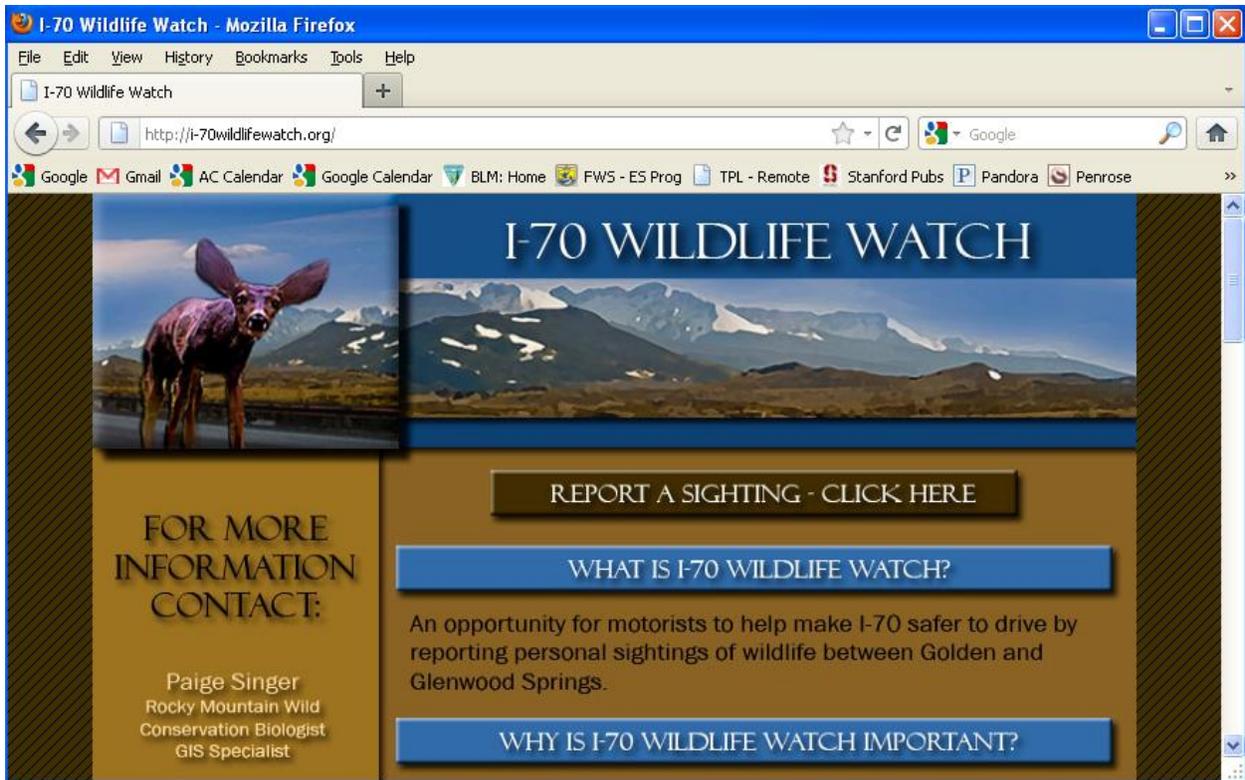


Figure 1: Screenshot of the *I-70 Wildlife Watch* homepage (top portion)

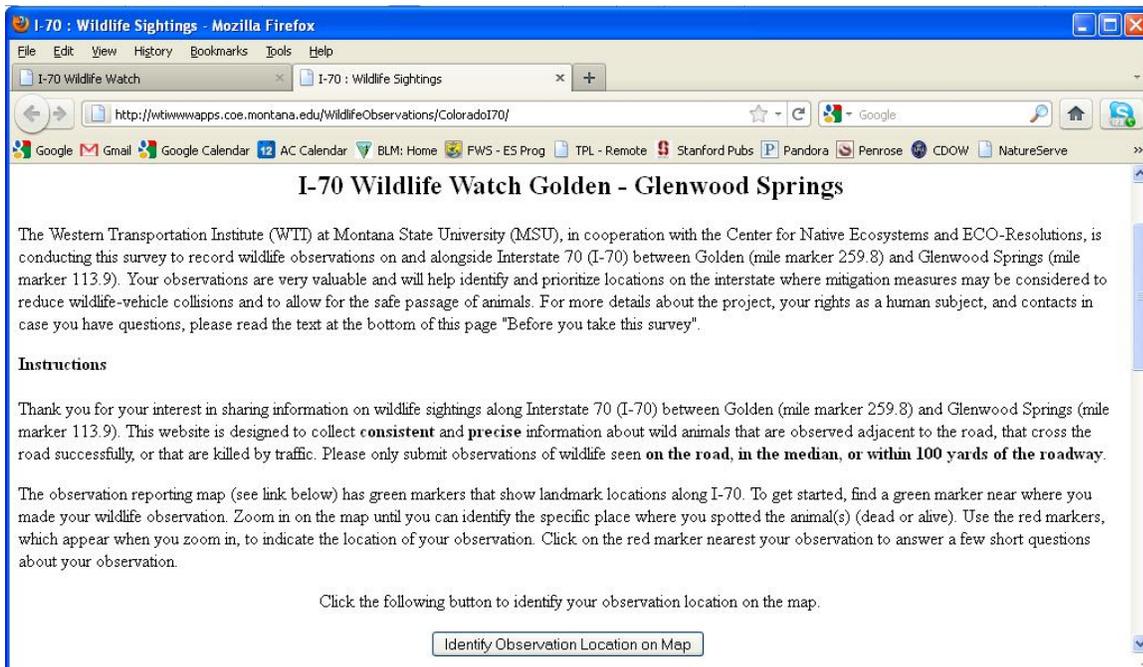


Figure 2: Screenshot of *I-70 Wildlife Watch* homepage hosted on WTI's server

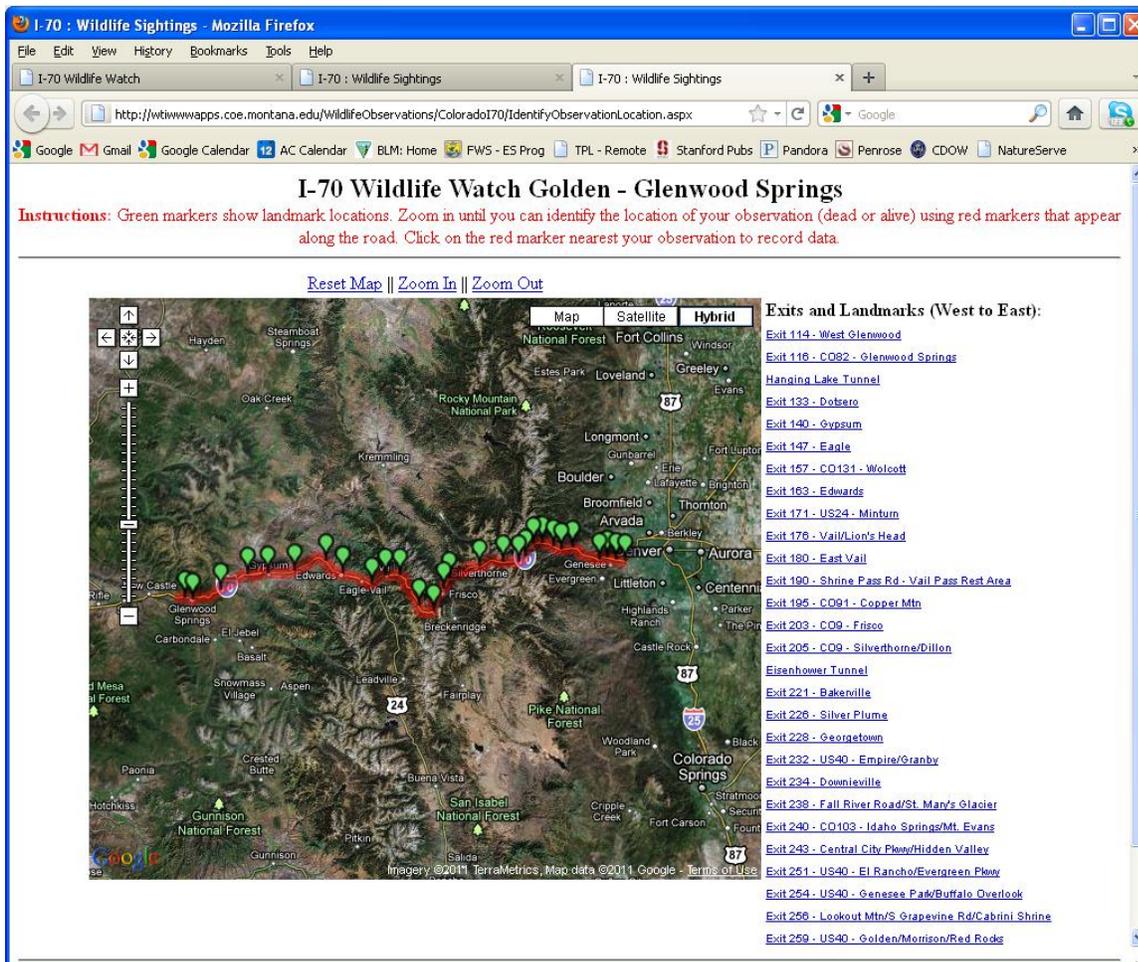


Figure 3: Screenshot of Google Earth map depicting landmarks in study area that allow users to identify the general location of their observation

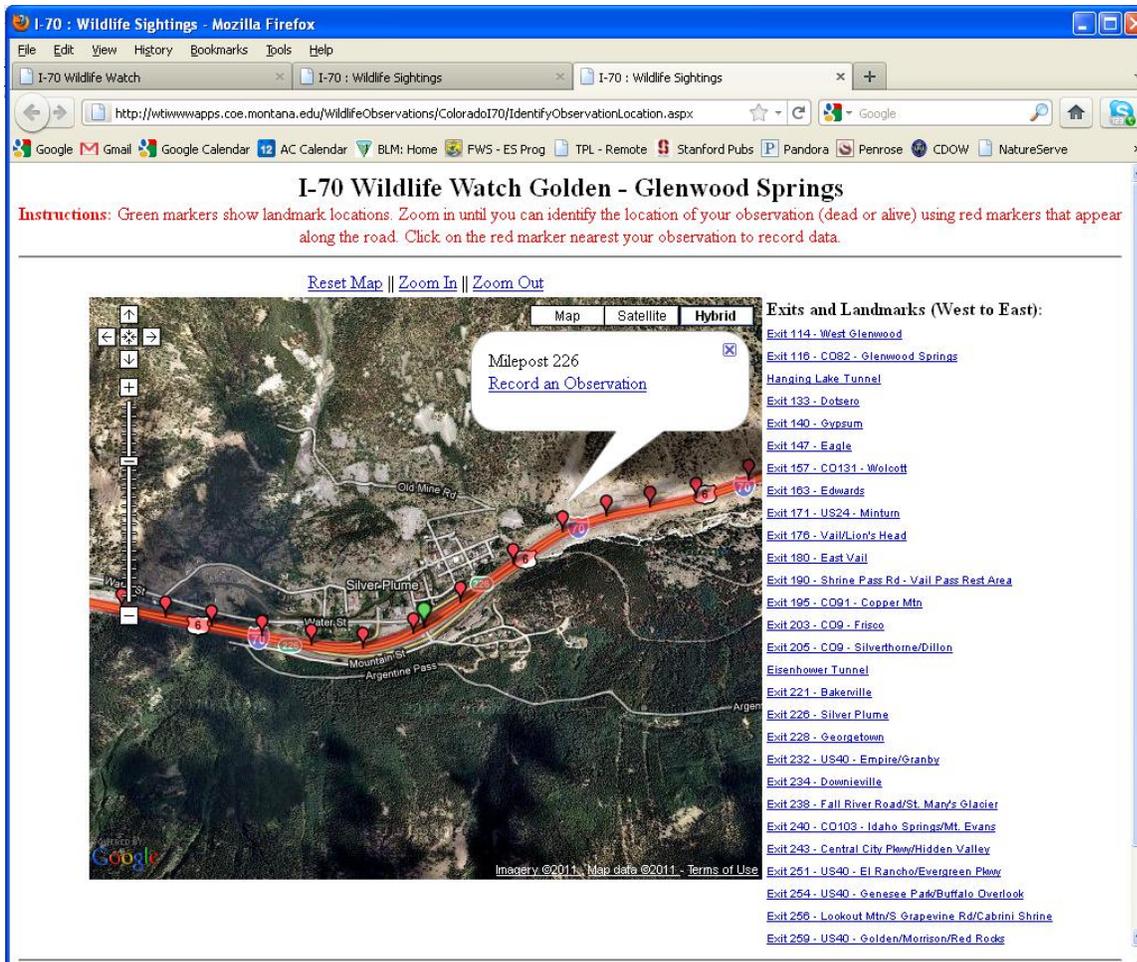


Figure 4: Screenshot of Google Earth map depicting landmarks in study area that allows users to identify the location of their observation down to the nearest tenth of a mile (red markers)

I-70 : Wildlife Sightings - Mozilla Firefox

File Edit View History Bookmarks Tools Help

I-70 Wildlife Watch I-70 : Wildlife Sightings I-70 : Wildlife Sightings

http://wtiwwapps.coe.montana.edu/WildlifeObservations/ColoradoI70/ObservationForm.aspx?mp=226&lat=39.69

Google Gmail Google Calendar AC Calendar BLM: Home FWS - ES Prog TPL - Remote Stanford Pubs Pandora Penrose CDOW NatureServe

## I-70 Wildlife Watch Golden - Glenwood Springs

- The questions below relate to the location you have just chosen.
- The questions below relate to one observation only. An observation is defined as: "animals that you saw at the same place, at the same time, that belonged to the same species, and that were all either dead or alive." If you saw animals at different locations, at different times, or if the animals belonged to different species, or if you saw both dead and alive animals, please treat them as separate observations and repeat the entire procedure.

**The 0.1 mi location closest to your observation. (Filled in automatically.)**

226

**Did you observe (choose 1):**

road-killed animal(s) (dead on road or alongside road)

live animal(s) (on road or within right-of-way)

**Did you observe the animal(s) (choose 1 location)**

(select)

**What species?**

(select)

[Click here for help identifying species.](#)

**How many individuals of that species did you see at that location? (Enter a number.)**

**On what date?**

May 2011						
Sum	Mon	Tue	Wed	Thu	Fri	Sat
24	25	26	27	28	29	30
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

**At what hour of the day?**

(select)

Figure 5: Screenshot of the top half of the data form for submitting a live or dead animal observation. Note: the tenth of a mile location obtained when clicking on a red marker on the previous page was automatically stored in the data form.

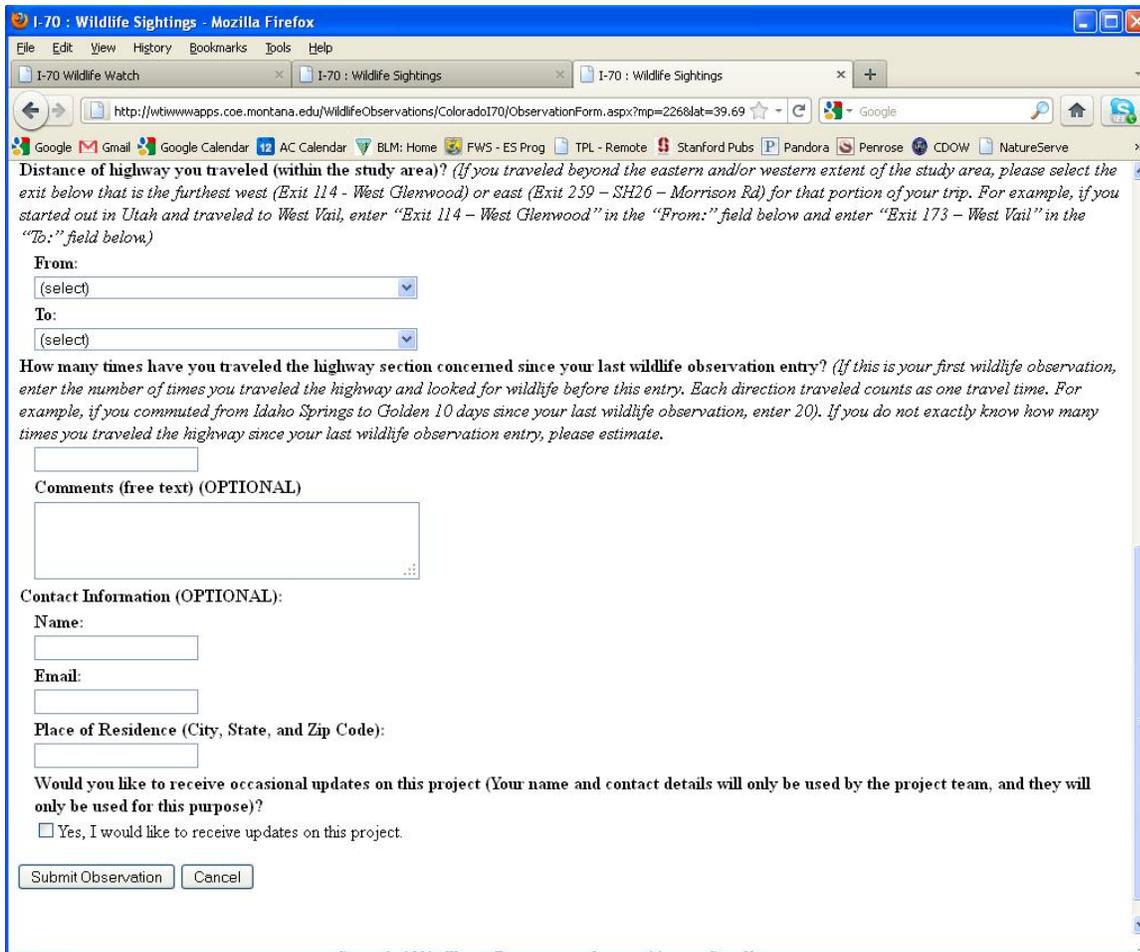


Figure 6: Screenshot of the bottom half of the data form for submitting a live or dead animal observation

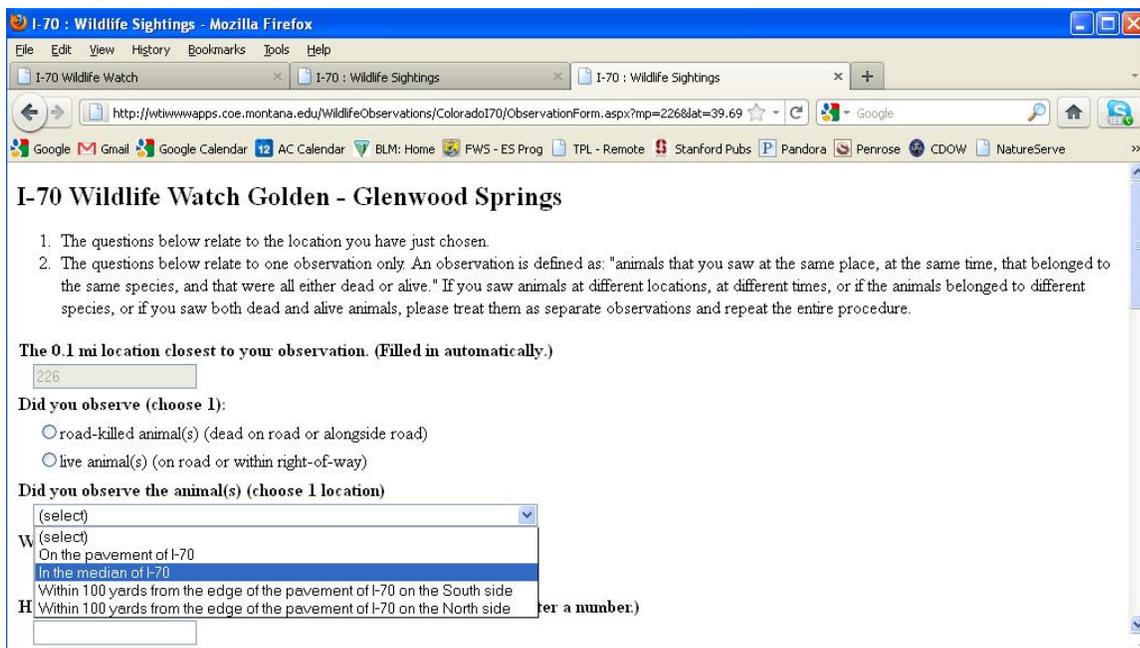


Figure 7: Screenshot illustrating easy-to-use drop down menus

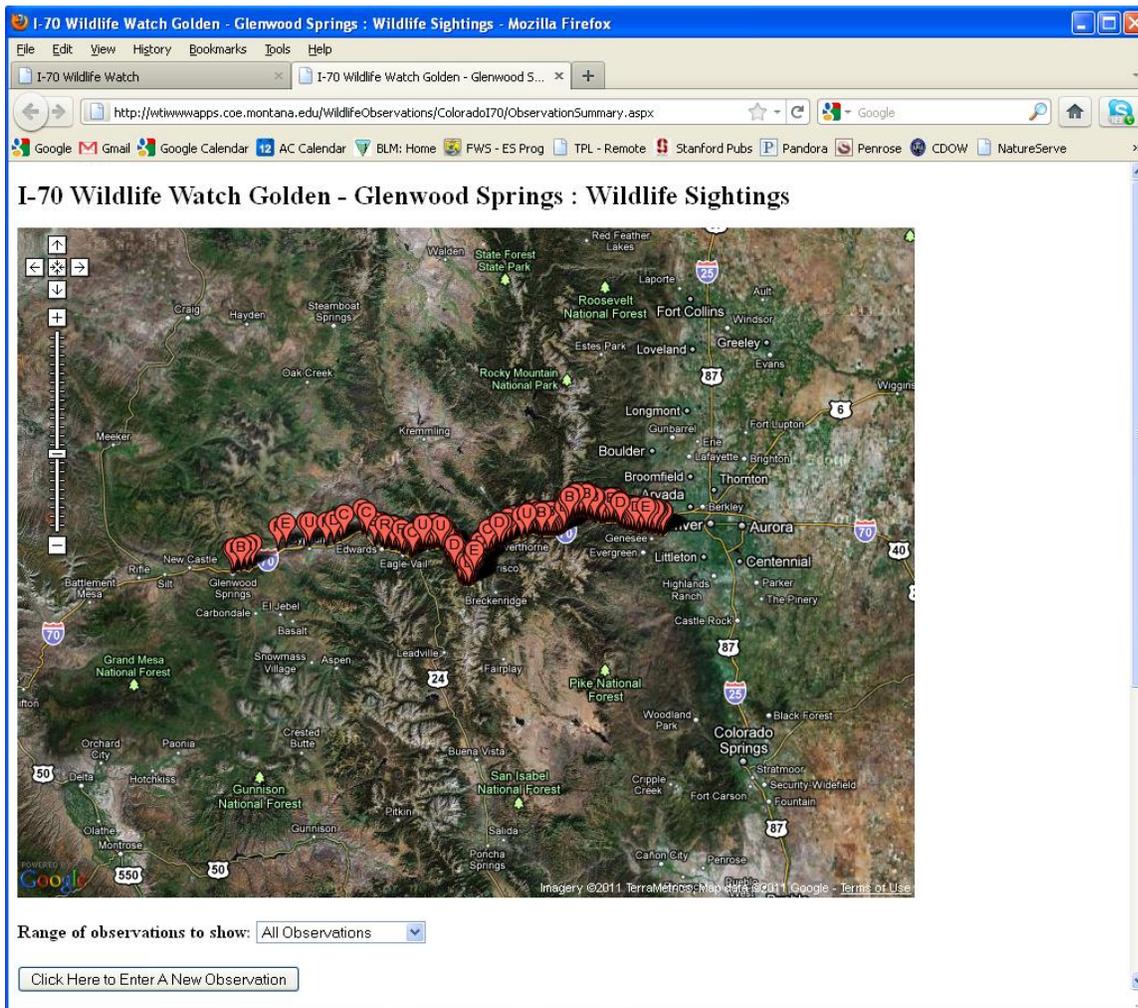


Figure 8: Screenshot of page that allows users to see what other people have reported on the website. They are also given the option to report another observation.

### *Study Area and Participation*

The public was asked to submit wildlife observations over a distance of about 145 miles - between exit 114 (West Glenwood Springs) and exit 259 (US40 - Red Rocks/Golden/Morrison). See Appendix 2 for a list of exits. Annual average daily traffic (AADT) over the 145 miles of the study area ranges between 15300 and 67200 (Figure 9). AADT is defined by Colorado Department of Transportation (CDOT) as “[t]he annual average daily traffic count for the highway segment, in both directions, representing an average 24-hour day in a year. (Total of all vehicles counted divided by 365.)” The AADT numbers used in this report are from 2009. When determining the AADT for each road segment, the AADT number representing the better part of the road section between two exits was used on the rare occasion that there is more than one AADT reported between exits. The lowest AADT of 15300 drivers occurs in Glenwood Canyon between exits 119 (No Name) and 133 (Dotsero). The highest AADT of 67200 drivers occurs at the easternmost portion of the study area between exits 256 (Lookout Mt) and 259 (US40 - Red Rocks/Golden/Morrison) (Figure 9).

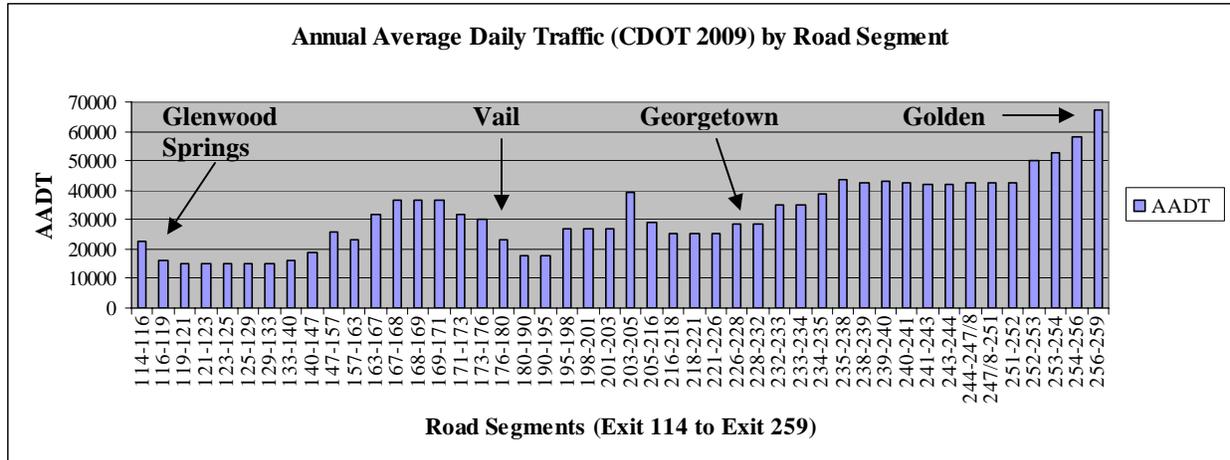


Figure 9: Annual Average Daily Traffic for each road segment, as defined by highway entrance/exit ramps (Exit 114 to Exit 259)

With each reported sighting, users were also required to note where they entered and exited the highway. Though not a complete picture, this exit range data from observers begins to give us a sense of the search and reporting effort that is likely to have occurred for the various road segments throughout the study area. It tells us where observers were when they made an observation as well as where they were, for that trip, when they did not see anything to report. However, this information is limited only to the trips where people made an observation at some point in their drive. In order to be completely accurate, we also need information about when observers drove the highway, were looking for animals, but did not see anything (and therefore did not submit an observation on the website). Unfortunately, this information is difficult to gather systematically and is therefore an acknowledged gap in our search and reporting effort analysis.

Total observers on each discrete road segment, or road segment between exits, in the study area ranged between 23 and 357 (Figure 10), out of a possible 430 observers<sup>2</sup>. The smallest number of people participating in the website of 23 observers occurred between exits 114 (West Glenwood Springs) and 116 (CO82 - Glenwood Springs). The largest number of people participating in the website of 357 observers occurred between exits 235 (Dumont) and 238 (Fall River Road) and exits 238 (Fall River Road) and 239 (Idaho Springs West). The percentage of the AADT that participated in *I-70 Wildlife Watch* ranges between 0.1 and 1.59% (Figure 11). The largest percentage of the AADT participating in the website occurred between exits 180 (East Vail) and 190 (Vail Pass/Shrine Pass Rd), the smallest between exits 114 (West Glenwood Springs) and 116 (CO82 - Glenwood Springs). Though small, these numbers give us a sense of where people are participating and where additional outreach is needed.

<sup>2</sup> After removing duplicates and other reports from the data, there were 430 unique reports submitted on the website. For the purposes of this report, we are assuming that each unique report equals one observer. Therefore, if all observers drove the same road segment, that road segment could have a total of 430 observers.

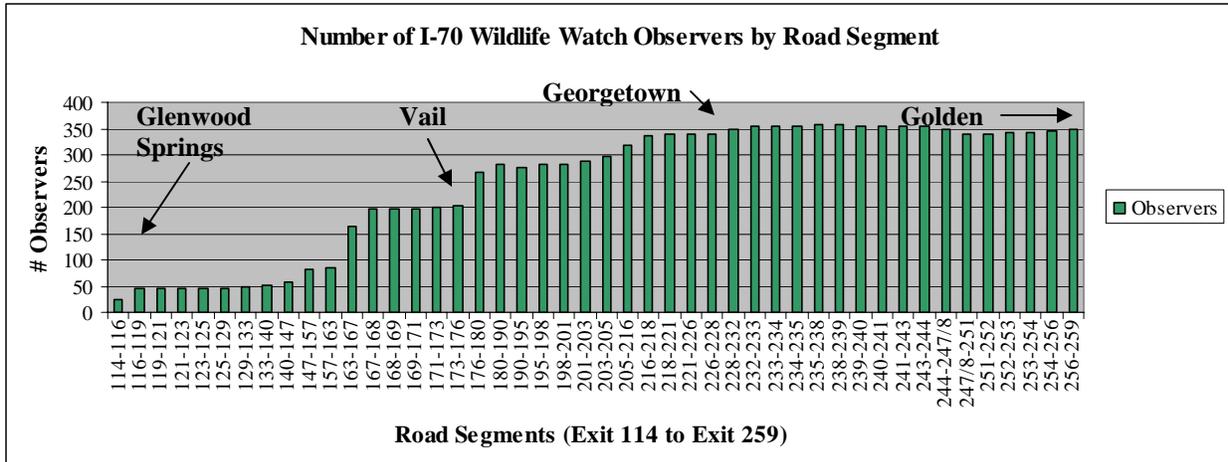


Figure 10: Total number of *I-70 Wildlife Watch* observers for each road segment (Exit 114 to Exit 259)

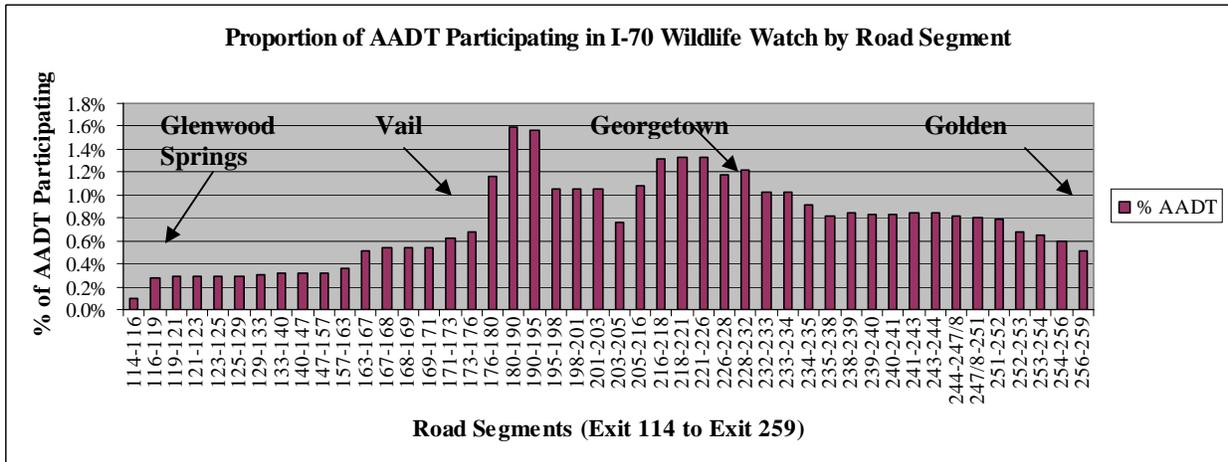


Figure 11: Proportion of AADT participating in *I-70 Wildlife Watch* for each road segment (Exit 114 to Exit 259)

### Public Notification

*I-70 Wildlife Watch* was launched on November 9, 2009 at a press event at the Colorado Division of Wildlife headquarters in Denver, Colorado. The launch was in coordination with the *Colorado Wildlife on the Move* coalition which includes Rocky Mountain Wild, ECO-Resolutions, LLC, Colorado Department of Transportation, Colorado State Highway Patrol, Colorado Division of Wildlife and Rocky Mountain Insurance Information Association. The launch date was specifically chosen to coincide with the fall migration; thus the launch was also used as a chance to remind motorists of the importance of safe driving on all of Colorado’s roadways. The press event included a press conference with speakers from all of the coalition groups, a website demonstration and a question and answer session. The press event received coverage from several web, radio and television media outlets including CBS4 News and 9News (Appendix 3). In addition, links to the website were placed on several key websites throughout the I-70 Mountain Corridor (Appendix 3).

The public was notified about the website in a variety of ways in addition to the press event announcing the launch (Appendix 3). Perhaps most notably, Waste Management generously donated the funds to design and place a billboard along the I-70 Mountain Corridor. The billboard was a major tool for increasing participation and developing a base of loyal citizen observers along the I-70 Mountain

Corridor. The billboard was deployed twice at strategic times during the study period. The first placement of the billboard was facing west (for eastbound traffic) on I-70 near Downieville, Colorado from March 30 through June 1, 2010, just in time for the spring migration and the start of summer travel in the Corridor. The billboard was moved once during this placement to another location in the same area (Figure 12). This location has a daily effective circulation of 31,490 people (B. Kelley, CBS Outdoor Denver, June 2011). A press release about the billboard was distributed just before Memorial Day Weekend and received attention from several news outlets throughout the study area, including a spot on ABC 7 News and Fox 31 (Appendix 3). The second placement of the billboard was facing east (for westbound traffic) on I-70 near the intersection with C-470, just west of Denver, from November 1-14, 2010. This placement was just in time for the fall migration and the start of the winter ski traffic on I-70 (Figure 12). This location has a daily effective circulation of 51,390 people (B. Kelley, CBS Outdoor Denver, June 2011). The associated press release did not receive much attention from the media.



Figure 12: Billboard placed on I-70 near Downieville, Colorado (left; © Russ Sands) and near C-470 intersection, just west of Denver (right; © RMW)

### *Data Analysis*

Several steps were taken to prepare the observation data from the website for analysis. First, the data was reviewed for quality assurance. After assessing all the comments, any reports that were deemed inaccurate, false (i.e. a Sasquatch sighting), or outside of the study area or time were removed. Because drivers reported where they got on and off the highway, any wildlife sightings that fell outside of the reported exit range were also removed (Table 1).

Each sighting that did not match up with the exit range reported was double checked using CDOT's interchange GIS data (with associated mile posts) and aerial photographs in case the milepost reported for the observation actually fit into the exit range even though it appeared not to based on the exit numbers themselves. If the observation was within .2 miles (but outside) of the exit an observer reported exiting at, the report was kept. Some of the reported exit ranges seemed unfeasible based on the date and time of day reported. However, all reports were assumed accurate unless deemed otherwise in the steps above, because even though we have access to IP addresses, there is no way to guarantee that a single person will always have the same IP address or that two different users always have the different IP addresses (D. Galarus, WTI, pers. comm., April 2011).

Fifteen records were removed from the analysis for various reasons. Five entries were made prior to the launch of the website. Three wildlife observations were either outside of the mile post range of the study area or farther than 100 yards from the roadside (as specified on the website). For four entries, the mile

post given for the observation was outside of the exit range reportedly driven by the observer. Three entries were deemed inaccurate or false based on comments given. After these records were removed, a total of 446 reports of wildlife observations remained (Table 1).

**Table 1. Break down of public reports received via I-70 Wildlife Watch**

Total public reports on website	461
Reports of observation prior to the study period	-5
Reports from outside of study area (either outside of the mile post range or farther than 100 yards from the roadside)	-3
Reports where mile post for observation did not match up to reported exit range.	-4
Reports where comments deemed them inaccurate or false	-3
Total live (n= 344 ) and dead (n=102) observation reports	446
Replicate reports of a single wildlife or carcass observation	-16
Total unique live (n=330) and dead (n=100) reports	430

Because duplicate reports could occur when different people report the same wildlife sighting, the following rule was applied: observations of live animals of the same species reported within 1 hour and .2 miles of each other were considered to be duplicate reports. In cases where the duplicate reports had differing animal counts, the largest number was chosen (Huijser et al. 2008). Based on this rule, 14 duplicate reports were removed (Tables 1 and 2).

**Table 2. Break down of duplicate reports**

Species	Alive	Dead
Black bear	0	0
Bighorn	6	0
Coyote	0	0
Mule deer	7	2
Elk	1	0
Lynx	0	0
Marmot	0	0
Marten	0	0
Porcupine	0	0
Raccoon	0	0
Red fox	0	0
Unknown	0	0
Unlisted	0	0
Total	14	2

Similarly, duplicate reports could occur when different people report the same carcass sighting; therefore, the following rule was applied: observations of dead animals of the same species reported within 2 days and .2 miles of each other were considered to be duplicate reports (Huijser et al. 2008; J. Peterson, CDOT, pers. comm., April 2011). In cases where the duplicate reports had differing animal counts, the largest number was chosen (Huijser et al. 2008). Based on this rule, 2 duplicate reports were removed (Tables 1 and 2).

The next step to prepare the data was to determine between which exits each observation fell. For most observations, this was a straightforward step. In some cases, however, a couple of additional rules were applied. First, if the reported milepost of an observation was less than .1 different from the CDOT exit GIS layer (i.e. in the middle of the exit), the observation was always placed into the segment to the east.

The exception to this was when an observer reported that they got off/on and saw something in the middle of the exit they exited/entered at, that observation was placed into the last/first segment driven. In addition, we recognize that exit ramps are not points and that some ramps have a larger footprint than others. We assumed that drivers are driving continuously along the reported stretch of highway, and therefore the reported observations were put between the two exits that made the most sense even if in some cases, a sighting would not have been possible if a person had gotten off at a particular exit. Finally, for the purposes of this report, exits 247 (eastbound exit) and 248 (westbound exit) were considered to be the same exit. This is because they have the same name and we could not assume that people knew the exact number (as was apparent by the exit range information given by some observers). The above ‘east’ rule was applied to any observations reported between the two exits. The same is true for the two Dotsero exits which have the same number but are separated geographically.

## Results

A total of 461 entries were made on *I-70 Wildlife Watch*, with the first observation reported on October 3, 2009 and the last on April 10, 2011. The website is still active, but this analysis only includes wildlife reports dating from the launch of the website on November 9, 2009 through April 19, 2011 which is the most recent date that data was requested from WTI (the data was requested on April 19, 2011 even though the last reported observation at that time was 9 days earlier on April 10). Thirty-one reports were removed from the data for various reasons for a final total of 430 unique observations (Tables 1-2).

### *Live Sightings*

Users submitted 330 unique wildlife reports of live animals (Tables 1-2). Some sightings were of more than one live animal; therefore, the total unique animal count for all species was much higher than 330. Total live animal counts include: 593 bighorn sheep, 1 black bear, 5 coyotes, 283 elk<sup>3</sup>, 1 lynx, 4 marmots, 1 marten, 1 mountain lion, 320 mule deer, 1 raccoon, 3 red foxes, 1 unknown species and 13 unlisted species (Figures 13 and 15). Twelve of the 13 animals reported as an unlisted species were described as mountain goats in the comments. No comment was left for the other unlisted animal. The largest proportion of live observations was attributed to bighorn sheep followed by mule deer and elk (Figure 17).

Users were required to note where they entered and exited the highway. This information allows us to begin to get a sense of the search and reporting effort that is likely to have occurred for each discrete road segment in the study area. In the graphs below, the total animal count (total animals seen alive) is first displayed using the raw data reported for each segment (Figures 13 and 15) followed by a second graph showing the raw numbers of the total animal count corrected for the number of observers reported to have driven the same segment as the observation (Figures 14 and 16). This was done by dividing the number of sightings reported for a particular segment by the number of observers for that same segment.

Most live bighorn sheep sightings occurred in the eastern portion of the study area with the greatest number of observations - 226 animals – occurring between exits 228 (Georgetown) and 232 (US40 - Empire Junction). Most elk observations were clustered in two areas, one on Vail Pass and the other at the eastern end of the study area. Mule deer observations, on the other hand, were spread throughout the study area. For both elk and mule deer, the highest number of live observations – 87 elk and 75 mule deer – occurred between exits 180 (East Vail) and 190 (Vail Pass/Shrine Pass Rd) (Figure 13). In general, correcting for observers did not have a major affect on the distributions for these three species. The greatest effect occurred in the westernmost portion of the study area where the numbers of sightings were accentuated (Figure 14).

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<sup>3</sup> The animal count for one record was reduced by 2 based on the comments given by the observer.

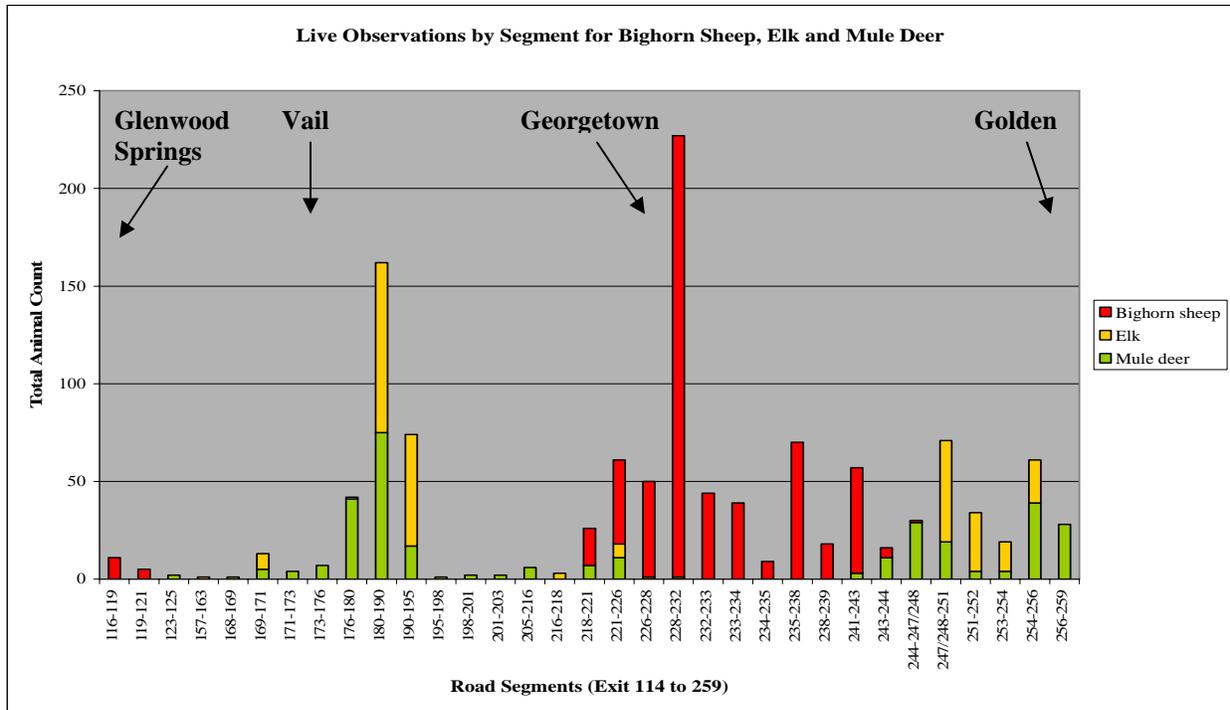


Figure 13: Total animal count by road segment for live observations of bighorn sheep, elk and mule deer. (Total n = 1196).

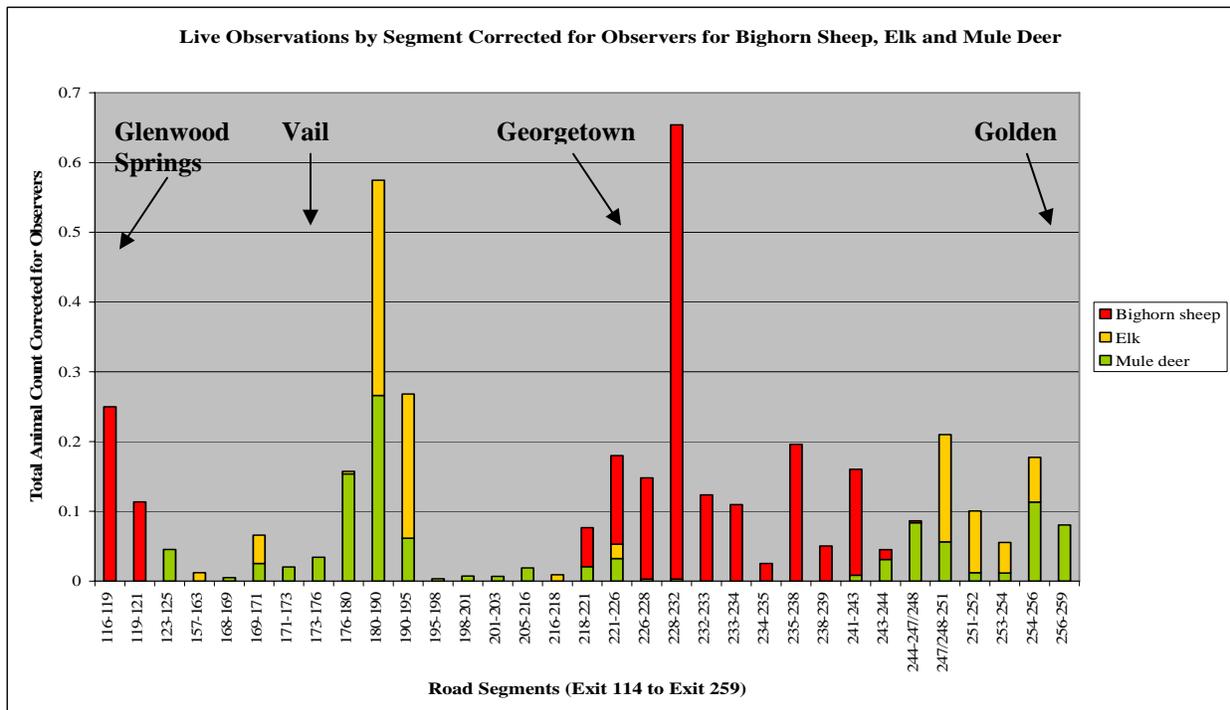


Figure 14: Total animal count by road segment corrected for observers for live observations of bighorn sheep, elk and mule deer

Live observations of black bear, coyote, lynx, marmot, marten, mountain lion, raccoon, red fox, and unknown and unlisted species were much fewer than the ungulate species presented above. Unlisted

species were the most reported species in this group, and as mentioned above, most of these animals were reported to be mountain goats in the comments. All of the mountain goat sightings were clustered between Copper Mountain and Silver Plume. The largest number of live sightings for mountain goat of 4 animals occurred in two locations, between exits 198 (Officers Gulch) and 201 (Frisco) and exits 205 (CO9/US6 - Dillon/Silverthorne) and 216 (US6 - Loveland Pass) (Figure 15). The other unlisted species sighting which occurred further west in the study area, and the species was not identified by the observer. Correcting for observers had a greater effect on the numbers for these species. In most cases, the numbers of sightings were accentuated in the western portion of the study area and minimized in the eastern portion of the study area (Figure 16).

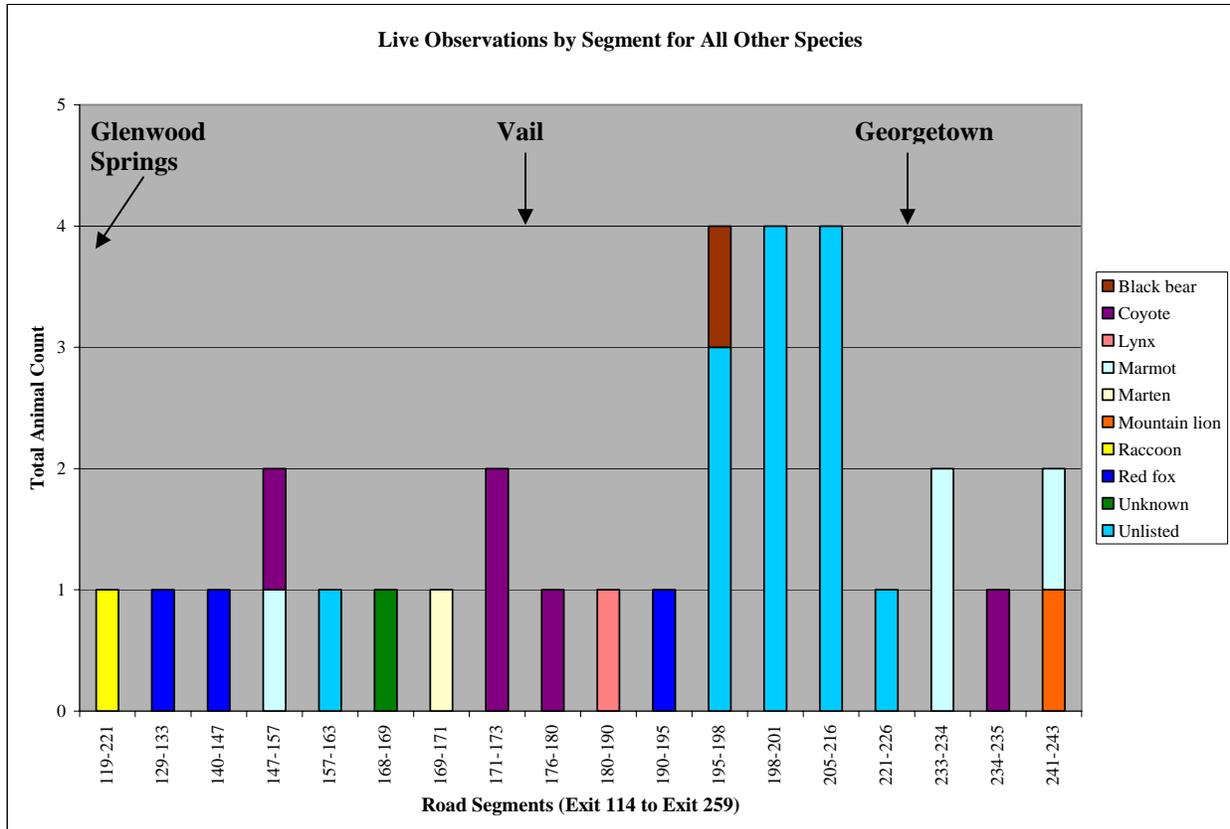


Figure 15: Total animal count by road segment for live observations of black bear, coyote, lynx, marmot, marten, mountain lion, raccoon, red fox, and unknown and unlisted species. (Total n = 31).

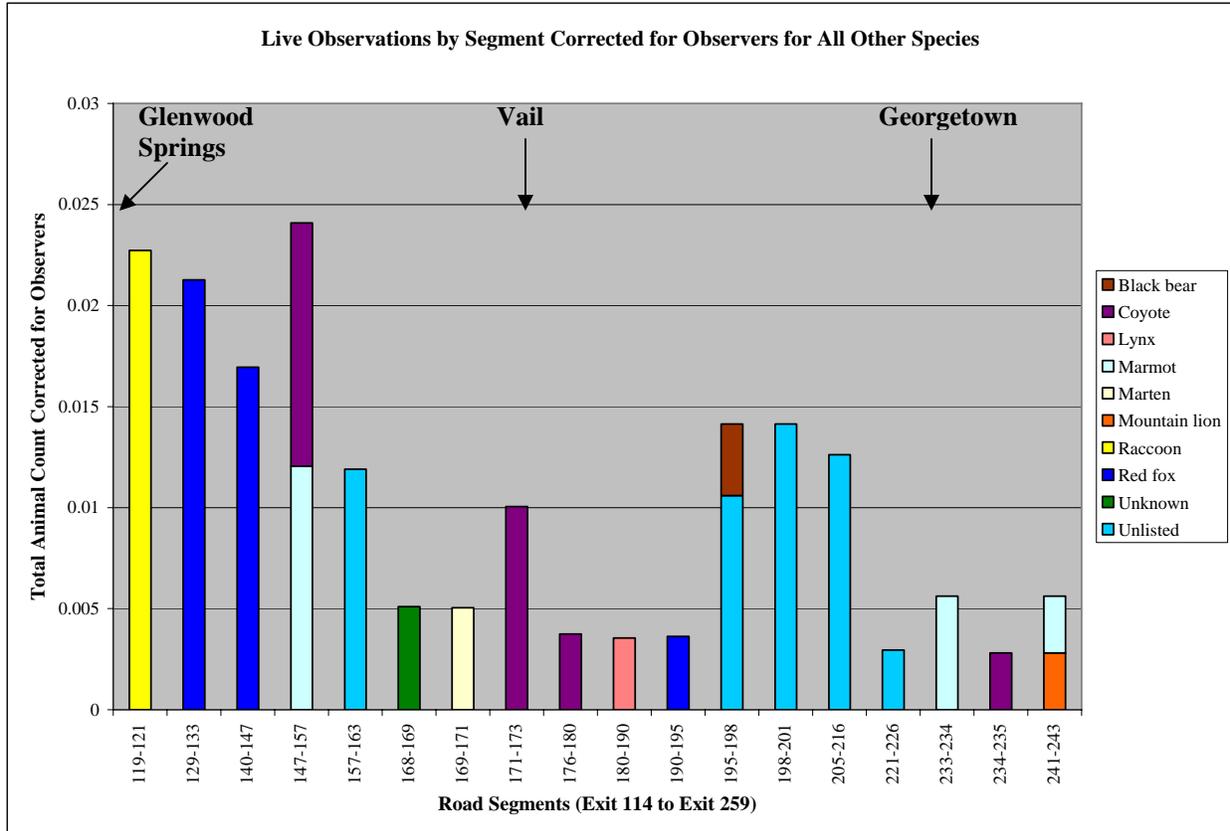


Figure 16: Total animal count by road segment corrected for observers for live observations of black bear, coyote, lynx, marmot, marten, mountain lion, raccoon, red fox, and unknown and unlisted species

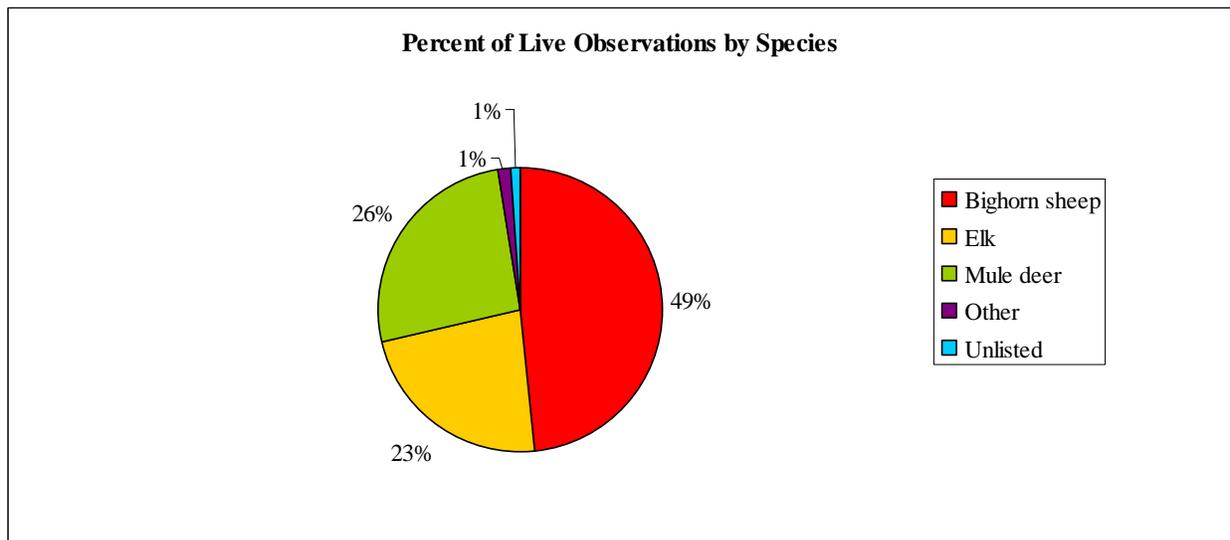


Figure 17: Percent of live observation reports on website by species. (Total n = 1227). “Other” category includes black bear, coyote, lynx, marmot, marten, mountain lion, raccoon, red fox, and unknown species.

## Carcass Sightings

After removing duplicate carcass sightings, users submitted 100 unique reports of dead animals. Though not likely to always be the case, no reports were of more than 1 carcass; therefore, the total unique carcass count for all species was 100. Total dead observations include 1 bighorn sheep, 1 black bear, 3 coyotes, 7 elk, 1 marmot, 1 marten, 40 mule deer, 2 porcupines, 6 raccoons, 18 red foxes, 19 unknown species and 1 unlisted species (Figure 18). The largest proportion of carcass observations was attributed to mule deer followed by unknown and red fox (Figure 20).

As mentioned previously, users were required to note where they entered and exited the highway. This information allows us to begin to get a sense of the search and reporting effort that is likely to have occurred for each discrete road segment in the study area. In the graphs below, the total carcass count is first displayed using the raw data reported for each segment (Figure 18) followed by a second graph showing the raw numbers of total carcass count corrected for the number of observers reported to have driven the same segment as the observation (Figure 19). This was done by dividing the number of sightings reported for a particular segment by the number of observers for that same segment.

Carcass observations of the most reported species – mule deer and red fox – were distributed across most of the study area. The largest number of carcass sightings for mule deer of 5 animals occurred between exits 180 (East Vail) and 190 (Vail Pass/Shrine Pass Rd) and exits 254 (US40 - Genesee) and 256 (Lookout Mt). For red fox, the greatest number of carcass sightings of 4 animals occurred between exits 163 (Edwards) and 167 (Avon) (Figure 18). Correcting for observers had the most effect in the westernmost portion of the study area where the numbers of sightings were accentuated (Figure 19).

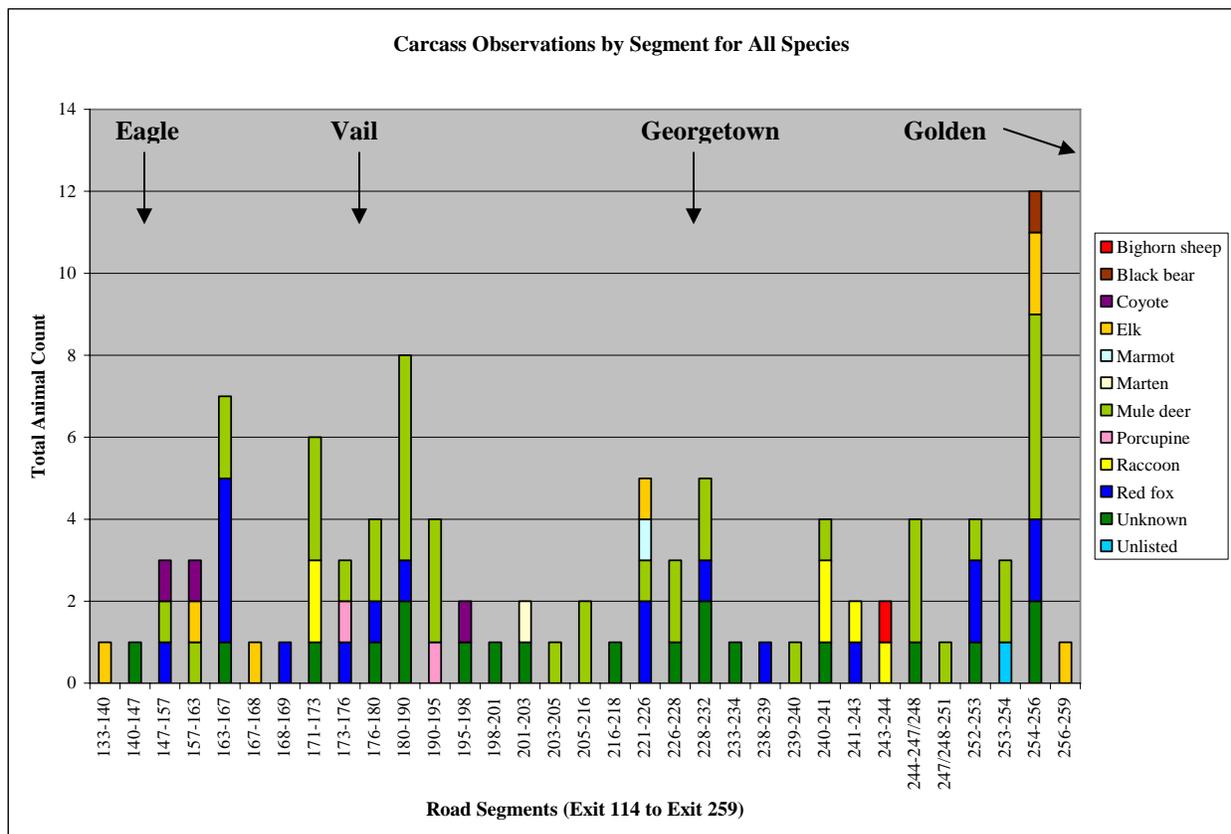


Figure 18: Total animal count by road segment for dead observations of bighorn sheep, black bear, coyote, elk, marmot, marten, mule deer, porcupine, raccoon, red fox, and unknown and unlisted species. (Total n=100).

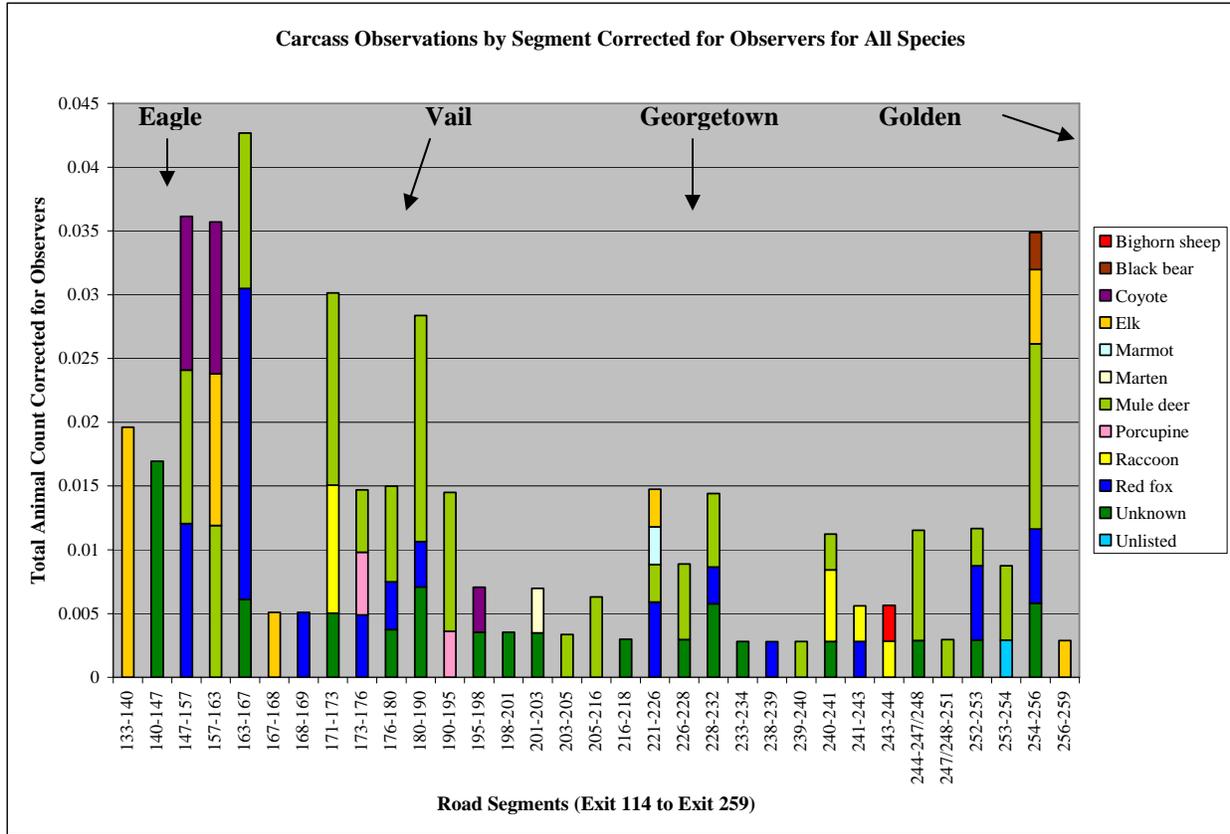


Figure 19: Total animal count by road segment corrected for observers for carcass observations of bighorn sheep, black bear, coyote, elk, marmot, marten, mule deer, porcupine, raccoon, red fox, and unknown and unlisted species

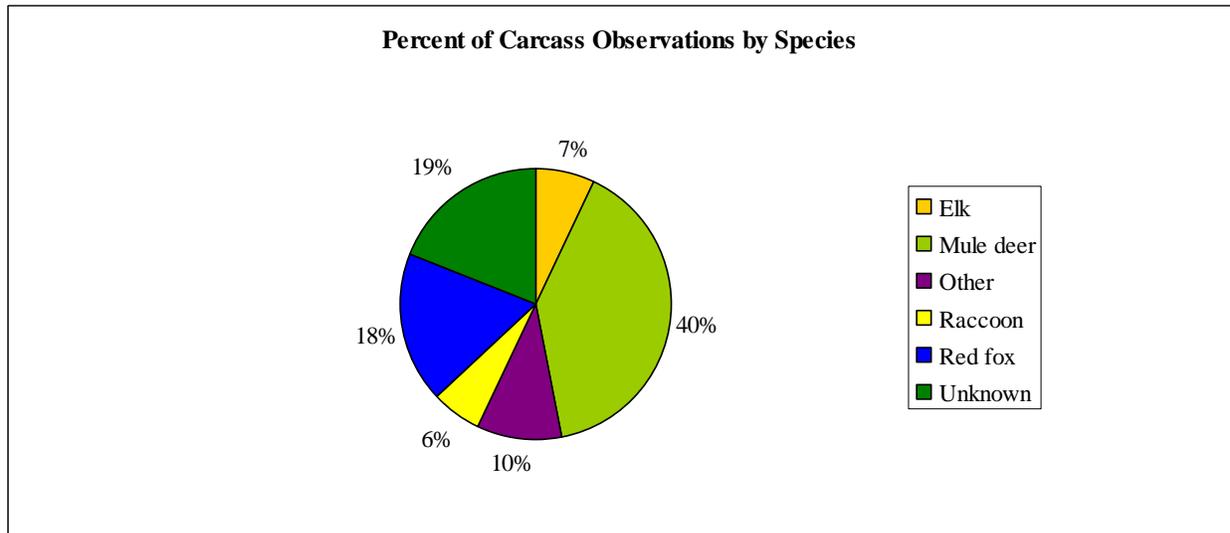


Figure 20: Percent of carcass observation reports on website by species. (Total n=100). “Other” category includes black bear, bighorn sheep, coyote, marmot, marten, porcupine and unlisted.

## Discussion

Requiring observers to log where they entered and exited the highway for each trip for which they submitted a sighting allowed us to take into account the search and reporting effort that is likely occurring on each highway segment within the study area. In general, correcting for observers seemed to accentuate the number of sightings in the western portion of the study area while it minimized the number of sightings in the eastern portion of the study area. This is due to the fact that there were fewer drivers participating in the website in the west compared to those participating in the east. As mentioned above, this information would be even more powerful if data was also collected on when observers drove the highway, were looking for animals, but did not see anything and therefore did not submit an observation on the website. Only then would we be able to completely take into account the search and reporting effort for each roadway segment.

Though the backbone of *I-70 Wildlife Watch* is sound, the impact of the website could be improved in a variety of ways. Because the website covered such a large study area – 145 miles – it was difficult to initiate and maintain a strategic and comprehensive outreach campaign. Most of the outreach done throughout the I-70 Mountain Corridor was done opportunistically. The billboard, press releases, and business cards were a good starting point, but they likely had the greatest impact in the eastern portion of the study area since that is where the organization promoting the website is located. This was reflected in the exit range data submitted by observers. A greater effort should be put into raising awareness for the website throughout the entire study area. In addition, in today's age of smart phones and PDAs, creating an app for the website might encourage more motorists to use it. We do not want to encourage people to use their cell phones while driving; however, an app may allow a passenger to more easily submit a sighting from the road instead of waiting until they arrive at their destination (where they may or may not have a computer).

Observations collected by the public on *I-70 Wildlife Watch* gives us a better idea of the animal activity along I-70 between Glenwood Springs and Golden, Colorado. In particular, the sightings reported by motorists in the I-70 Mountain Corridor greatly expanded our knowledge of where live animals are most frequently seen along the roadway as well as about otherwise under- or unreported road-killed animals (i.e. smaller animals such as red fox and raccoon). The large spikes in I-70 Wildlife Watch observations between exits 228 and 232 relates to an area around Georgetown where bighorn sheep are known to linger near the roadway; however, other clusters of live observations would remain otherwise undocumented, such as the spike between exits 180 and 190 around the summit of Vail Pass, which is primarily due to elk and mule deer observations. Figure 21 depicts recorded wildlife observations across all species, including live and carcass observations compared to AVC counts derived from Colorado State Patrol (CSP) accident reports. While the timeframe for the CSP data is markedly longer than that of the I-70 Wildlife Watch data, a comparison of these two datasets demonstrates different clusters in activity captured by each of these sources. Future comparisons should look at the data over common time periods. Overall, I-70 Wildlife Watch has proven to be a powerful wildlife data collection tool for the I-70 Mountain Corridor.

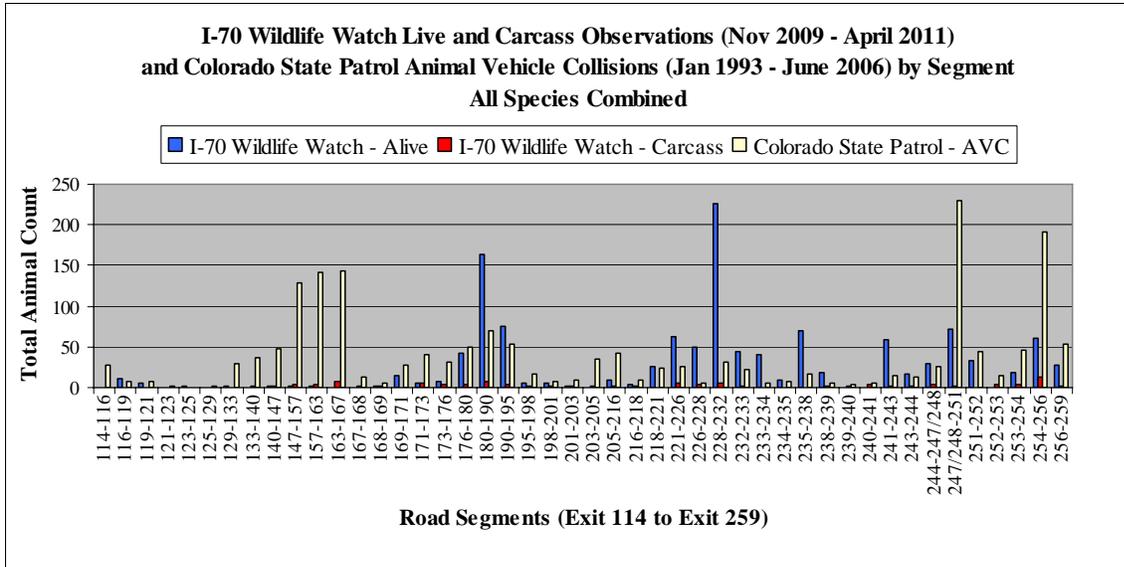


Figure 21: Comparison of I-70 Wildlife Watch observations (live animal and carcass) and AVC data from CSP per roadway segment. The CSP data covers 15 years, while the I-70 Wildlife Watch data captures only an 18 month period that does not overlap with any of the CSP data. Despite the different time frames, this graph demonstrates how these data sources capture different clusters of wildlife activity.

## Citations

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.

Hesse, S.G. 2006. Collisions with wildlife: An overview of major wildlife vehicle collision data collection systems in British Columbia and recommendations for the future. *Wildlife Afield* 3:1:3-7 (Supplement).

Huijser, M.P., A.V. Kociolek, L. Oechsli, and D.E. Galarus. 2008. Wildlife Data Collection and Potential Highway Mitigation along State Highway 75, Blaine County, Idaho. Report for Board of Blaine County Commissioners.

Romin, L.A. and J.A. Bissonnette. 1996. Deer-vehicle collisions: Status of state monitoring activities and mitigation efforts. *Wildlife Society Bulletin*, 24 (2):276-283.

**APPENDICES**

**Appendix 1 – Sample photographs from monitoring locations along the I-70 Mountain Corridor**

**MP 134.0, EB019, Concrete box culvert - Coyote**



**MP 143.0, EB002, Divided bridge – Mule Deer (left), Elk (right)**



**MP 144.5, WB003, Divided bridge – Mountain lion (left), Badger (right)**



**MP 149.8, WB004, Concrete box culvert – Elk (left), Mountain lion (right)**



**MP 152.6, EB032, Corrugated pipe culvert – Bushy-tailed woodrat (left), Bobcat (right)**



**MP 154.0, EB031, Divided bridge – Mule deer (left), Bobcat (right)**



**MP 170.0, EB018, Concrete box culvert – Mule deer (left), Red fox (right)**



**MP 171.1, WB033, Bridge – Raccoon (left), Elk (right)**



**MP 171.8, WB001, Concrete box culvert – Mountain lions (left), Black bear (right)**



**MP 183.0, EB005, Divided bridge – Coyote (left), Mule deer (right)**



**MP 185.5, EB025, Divided bridge – Black bear (left), Mule deer (right)**



**MP 187.4, WB036, At-grade – Coyote (left), Elk (right)**



MP 192.0, WB024, At-grade – Elk (left); EB024, Bridge – Mule deer (right)



MP 192.5, WB023, At-grade – Elk (left); EB023, Bridge – Porcupine (right)



MP 193.0, WB022, Fill slope – Mule deer (left), Elk (right)



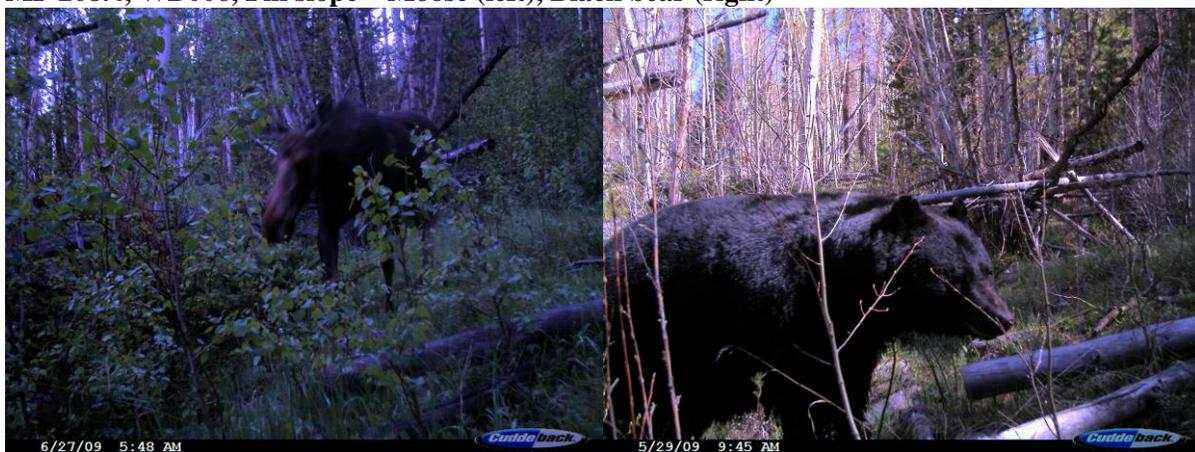
**MP 193.7, EB027, Bridge – Mule deer (left and right)**



**MP 204.5, EB034, At-grade – Coyote (left), Mule deer (right)**



**MP 208.4, WB006, Fill slope – Moose (left), Black bear (right)**



**MP 212.4, WB028, Fill slope – Red fox (left), Mule deer (right)**



**MP 217.2, WB008, At-grade – Elk (left), Coyote (right)**



**MP 219.5, EB009, At-grade - Mule deer (left), Bobcat (right)**



MP 221.8, WB035, Fill slope – Bighorn sheep (left), Elk (right)



MP 223.5, EB021, Bridge – Mule deer



MP 241.8, WB011, Bridge – Mule deer (left), Gray fox (right)



**MP 244.9, EB012, Fill slope – Elk (left), Mule deer (right)**



**MP 248.2, EB017, Fill slope, Pipe – Bobcat (left), Elk (right)**



**MP 250.2, EB016, Fill slope – Black bear (left), Elk (right)**



**MP 251.8, WB015, Fill slope – Bobcat (left), Mule deer (right)**



**MP 254.5, EB014, Fill slope – Coyotes (left), Elk (right)**



**MP 255.3, WB013, Fill slope – Elk (left), Mule deer (right)**



**Appendix 2 – Exits found in the I-70 Wildlife Watch study area**

<b>Exit Number</b>	<b>Exit Description</b>	<b>Exit Number</b>	<b>Exit Description</b>
<b>114</b>	West Glenwood Springs	<b>205</b>	CO9/US6 – Dillon/Silverthorne
<b>116</b>	CO82 - Glenwood Springs	<b>216</b>	US6 – Loveland Pass
<b>119</b>	No Name	<b>218</b>	Herman Gulch
<b>121</b>	Grizzly Creek	<b>221</b>	Bakerville
<b>123</b>	Shoshone	<b>226</b>	Silver Plume
<b>125</b>	Hanging Lake	<b>228</b>	Georgetown
<b>129</b>	Bair Ranch	<b>232</b>	US40 – Empire Junction
<b>133</b>	Dotsero	<b>233</b>	Lawson
<b>140</b>	US6 – Gypsum	<b>234</b>	Downieville
<b>147</b>	Eagle	<b>235</b>	Dumont
<b>157</b>	CO131 – Wolcott	<b>238</b>	Fall River Road
<b>163</b>	Edwards	<b>239</b>	Idaho Springs West
<b>167</b>	Avon	<b>240</b>	CO103 – Idaho Springs/Mt. Evans
<b>168</b>	East Avon	<b>241</b>	Idaho Springs East
<b>169</b>	US6 – Eagle-Vail	<b>243</b>	Hidden Valley/Central City
<b>171</b>	US24/US6 – Minturn/Leadville	<b>244</b>	US6 – Golden/Central City
<b>173</b>	West Vail	<b>247/248</b>	Beaver Brook/Floyd Hill
<b>176</b>	Vail	<b>251</b>	US40 – Evergreen/El Rancho
<b>180</b>	East Vail	<b>252</b>	CO74 – Evergreen Pkwy
<b>190</b>	Vail Pass/Shrine Pass Rd	<b>253</b>	Chief Hosa
<b>195</b>	CO91 – Copper Mountain/Leadville	<b>254</b>	US40 – Genesee
<b>198</b>	Officers Gulch	<b>256</b>	Lookout Mt
<b>201</b>	Frisco	<b>259</b>	US40 – Red Rocks/Golden/Morrison
<b>203</b>	CO9 – Frisco/Breckenridge		

### **Appendix 3 - Media and outreach activities to promote I-70 Wildlife Watch**

#### **Press coverage**

November 9, 2009 - Website launch press event and press release by *Colorado Wildlife on the Move* a coalition which includes Rocky Mountain Wild, ECO-Resolutions, LLC, Colorado Department of Transportation, Colorado State Highway Patrol, Colorado Division of Wildlife and Rocky Mountain Insurance Information Association. Press event took place at Colorado Division of Wildlife's headquarters in Denver, Colorado.

May 27, 2010 and November 8, 2010 - Press release by Center for Native Ecosystems and ECO-resolutions, LLC notified the public about the billboard placed along I-70 and reminded them about the website.

#### **Television coverage:**

CBS4, Denver (launch press event)  
9News, NBC, Denver (launch press event)  
ABC 7 News (billboard press release)  
Fox 31 (billboard press release)

#### **Web and print media coverage:**

"Motorists help make I-70 Safer to Drive with New Website", CSP News, November 9, 2009

"Motorists Help Make I-70 Safer to Drive with New Website", Colorado State Patrol News and Information, November 9, 2009

[http://coloradostatepatrol.blogspot.com/2009\\_11\\_08\\_archive.html](http://coloradostatepatrol.blogspot.com/2009_11_08_archive.html)

"New public-input web site for reporting I-70 wildlife sightings aims to improve highway safety", Kevin Flynn's Inside Lane, November 9, 2009

<http://www.inside-lane.com/2009/11/09/new-public-input-web-site-for-reporting-i-70-wildlife-sightings-aims-to-improve-highway-safety/>

"New site studies why (and where) wildlife cross the road", blog by Alan Prendergast on the Westword website, November 9, 2009

[http://blogs.westword.com/latestword/2009/11/new\\_site\\_studies\\_why\\_and\\_where.php](http://blogs.westword.com/latestword/2009/11/new_site_studies_why_and_where.php)

"New warning system prevents wrecks with wildlife", 9NEWS.com, November 9, 2009

<http://www.9news.com/news/story.aspx?storyid=126662&catid=339>

"Website Aims to Reduce Wildlife Accidents", KUNC, November 9, 2009

<http://www.publicbroadcasting.net/kunc/news.newsmain/article/1/0/1575962/Regional/Website.Aims.to.Reduce.Wildlife.Accidents>

"A new Web site to avoid wildlife collisions", grand-junction.us, November 10, 2009

<http://grand-junction.us/index.php?submit.x=0&submit.y=0&s=i-70+wildlife+watch>

"Coalition moves to reduce wildlife deaths on Colorado roads", Big Cat Observer Field Reports, November 10, 2009

<http://bigcatrescue.blogspot.com/2009/11/coalition-moves-to-reduce-wildlife.html>

“Coalition moves to reduce wildlife deaths on Colorado roads”, Denver Post, November 10, 2009  
[http://www.denverpost.com/news/ci\\_13751117](http://www.denverpost.com/news/ci_13751117)

“Groups create Web site so motorists can report wildlife along I-70, avoid accidents”, Fox 31 KDVR.com, November 10, 2009

“Groups join forces to battle wildlife-auto accidents”, Greeley Tribune, November 10, 2009  
<http://www.greeleytribune.com/article/20091110/NEWS/911109987/1037/NONE&parentprofile=1010>

“Motorists Make Highway Safer to Drive with New Website”, Park County Colorado Community Opinion Forum and Bulletin Board, November 10, 2009  
<http://www.parkbull.com/forum3/viewtopic.php?f=21&t=3316>

“Motorists help make I-70 safer with new Web site”, YourHub.com, November 10, 2009  
<http://denver.yourhub.com/Golden/Stories/News/Traffic/Story~684693.aspx>

“Safe highway travel: look out for Bambi!”, 11 News (Grand Junction, Colorado), November 10, 2009  
<http://www.nbc11news.com/localnews/headlines/69642152.html>

“Wildlife advocates, Colorado try to prevent roadkill”, The Aspen Times, November 10, 2009  
<http://www.aspentimes.com/article/20091110/NEWS/911109983>

“Wildlife advocates, state try to prevent roadkill”, Denver Post, November 10, 2009

“Wildlife advocates, state try to prevent roadkill”, Summit Daily News, November 10, 2009  
<http://www.summitdaily.com/article/20091110/NEWS/911109985/1078&ParentProfile=1055>

“Colorado Initiates System to Prevent Wildlife Crashes”, Insurance Journal, November 11, 2009  
<http://www.insurancejournal.com/news/west/2009/11/11/105247.htm>

“Colorado officials and advocates conserving wildlife by stopping roadkill”, Examiner.com, November 11, 2009  
<http://www.examiner.com/environmental-news-in-denver/colorado-officials-and-advocates-conserving-wildlife-by-stopping-roadkill>

“Crowdsourcing Where Animals Cross the Road”, a post by Adena Schutzberg on All Points Blog, Directions Magazine, November 11, 2009  
<http://apb.directionsmag.com/entry/crowdsourcing-where-animals-cross-the-road/161534>

“I-70 Wildlife Watch is Taking Off”, blog by Andrea West on Center for Native Ecosystems website, November 11, 2009  
<http://nativeecosystems.org/critterthink/i-70-wildlife-watch-is-taking-off>

“New Web site launched to track wildlife along Interstate 70”, Sky Hi Daily News, November 11, 2009  
<http://www.skyhidailynews.com/article/20091111/NEWS/911119998/1079&ParentProfile=1067>

“New Website Aims to Protect Wildlife and Improve Driver Safety Along CO I-70”, blog on TransWild Alliance Blog, November 12, 2009  
<http://www.transwildalliance.org/blog/?eid=51>

“Increase Driver Awareness – I-70 Wildlife Watch”, blog by Landon Balding on Grand Valley Insurance website, November 19, 2009

<http://www.grandvalleyinsurance.com/blog/?currentPage=2>

“Colorado initiates system to prevent wildlife crashes”, Lloyd Pro Group (Georgia), November 20, 2009

<http://www.lloydprogroup.com/news/colorado-initiates-system-to-prevent-wildlife-crashes/>

“Wildlife Advocates, State Try To Prevent Roadkill”, CBS4Denver.com (launch press event)

“A New Web Site To Avoid Wildlife Collisions”, CBS4Denver.com (launch press event)

“Groups create Web site so motorists can report wildlife along I-70, avoid accidents”, Channel 2 News (launch press event)

Farmington Daily Times (launch press event; told secondhand about report)

“I-70 Wildlife Watch Billboard is up at Downieville”, blog by Andrea West on Center for Native Ecosystems website, April 2, 2010

<http://nativeecosystems.org/critterthink/i-70-wildlife-watch-billboard-is-up-at-downieville>

“New Wildlife Tracking Billboard Along I-70”, ABC 7 News, May 28, 2010

<http://www.thedenverchannel.com/traffic/23708482/detail.html>

“New Wildlife Tracking Billboard Along I-70”, indiatimes, May 2010

<http://oneclick.indiatimes.com/article/04XkFB14hraSS?q=Colorado>

“Colorado drivers asked to help reduce wildlife-vehicle collisions”, Fox 31 KDVR (billboard press release)

#### **Radio coverage:**

Aspen Public Radio (launch press event)

Glenwood Springs radio station (launch press event; told secondhand about report)

Interviewed for but never heard story: KGNU, KOA (launch press event)

### **Billboard Deployment**

*March 30-June 1, 2010* – Billboard sponsored by Waste Management was placed facing west (for eastbound traffic) on I-70 near Downieville, Colorado. The billboard was moved once during this placement to another location in the same area.

*November 4 -15, 2010* – Billboard sponsored by Waste Management was placed facing east (for westbound traffic) on I-70 near the intersection with C-470, just west of Denver.

### **Promotions**

**Friends of I-70 Wildlife Watch:** Program which asked participating organizations to place a link to the [www.I-70WildlifeWatch.org](http://www.I-70WildlifeWatch.org) on the organizations website, encourage use of the website by employees, and increase public use of the website by handing out informational brochures. Additional organizations that contributed funding to I-70 Wildlife Watch were also included in the Friends program. Participating organizations include: Denver Zoo, Earth Friends Wildlife Foundation, TransWild Alliance, Xcel Energy,

and Waste Management.

**Fliers:** A limited number of fliers were given to *Colorado Wildlife on the Move* coalition member organizations.

**Business Cards:** Business cards advertising the website were available or handed out at several events throughout the Corridor including but not limited to: multiple *Rock the Earth* concert events; *Wolverine Night* in Edwards, Golden, Denver, and Boulder (Jan 26-29, 2011); and the I-70 Mountain Corridor ALIVE/SWEEP stakeholder meeting on May 4, 2011.

**Presentations:**

*I-70 Wildlife Watch* was discussed in a talk about habitat connectivity given on January 26, 2010 in Avon, Colorado. This talk was part of the *Adult Winter Speaker Series* put on by the Gore Range Natural Science School (now Walking Mountains) and the Eagle Valley Library District.

“Motorists as Citizen Scientists: The Benefits of a Wildlife Reporting Website”, a presentation and paper by Angela Kociolek et al. at the International Conference on Ecology and Transportation, 2009

**I-70 Wildlife Watch promoted in:**

*Rocky Mountain West* publication, Denver Zoo, last updated October 2010  
[http://www.denverzoo.org/downloads/dz\\_conservation\\_rockymtn.pdf](http://www.denverzoo.org/downloads/dz_conservation_rockymtn.pdf)

*Committee on Ecology and Transportation Newsletter*, Transportation Research Board Committee ADC30, Summer 2009  
<http://www.transwildalliance.org/resources/20091013154028.pdf>

**A link to the website was placed on the following websites:**

Colorado Department of Transportation  
<http://www.coloradodot.info/travel>  
Link found on their travel center page under the heading of Other Travel-related Links.

Colorado Department of Transportation’s traveler information website  
<http://cotrip.org>  
Link found under Traveler Information on the main page.

Colorado Department of Transportation’s I-70 Mountain Corridor CSS website  
<http://i70mtncorridorcss.com/corevalues/healthy-environment/wildlife>  
Link found on the page for wildlife under core values and healthy environment.

Colorado State Publications Library  
<http://cospl.blogspot.com/2010/01/i-70-wildlife-watch.html>

Denver Zoo  
<http://www.denverzoo.org/conservation/action.asp>  
Link found on their Conservation, Local Call to Action page.

ECO-resolutions, LLC  
<http://www.eco-resolutions.com/home.html>

I-70 Coalition

<http://www.i70solutions.org/news.html>

Link found on the page for the latest news for the I-70 Mountain Corridor.

Town of Carbondale, Colorado

[http://www.carbondalegov.org/index.asp?Type=B\\_BASIC&SEC={47D9DF08-3020-4ECA-B16E-8786C27C64A0}](http://www.carbondalegov.org/index.asp?Type=B_BASIC&SEC={47D9DF08-3020-4ECA-B16E-8786C27C64A0})

Link found on their Community Links webpage.

TransWild Alliance

<http://www.transwildalliance.org/resources/>

Link found on their Resource Library page

Witness for Wildlife, Freedom to Roam

[http://witnessforwildlife.org/eco\\_actions.php](http://witnessforwildlife.org/eco_actions.php)