Princeton Mule Deer Composition Surveys:
December 2012

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Executive Summary

Two survey days, December 7th and 8th, were completed to assess composition ratios for mule deer in MUs 8-04, 8-05 and 8-06 in 2012. Winter ranges surveyed included Allenby, Jura, Hembrie Mtn, Lorne Lk, Mount Miner, Whipsaw Ck and Willis Ck.

A total sample size of 693 mule deer was counted and classified during the survey. The total survey time was approximately 12.7 hrs. I calculated the total buck to doe ratio for all MUs at 12 bucks: 100 does ([CI 90%] 9-16), 9 < 4pt bucks: 100 does (CI 7-12) and 2 > 4pt bucks: 100 does (CI 0-4). I calculated 49 fawns: 100 does (CI 46-52). For observations where bucks were recorded there was at least one doe in the group 78% of the time.

Mule deer ranged between 640 m and 1600 m elevation during the surveys. Bucks, > 4pt and < 4pt, were observed throughout this elevation range. There was no significant difference in elevation between buck and doe observations during the survey (P=0.3).

In addition to mule deer, a total of 336 elk were classified in MU 8-04, 8-05 and 8-06 including 254 cows, 54 calves, 12 spike bulls, 5 raghorn bulls, 9 5pt bulls, 1 6pt and 1 unclassified. Sufficient sample sizes were collected to run sightability models for elk. The survey coverage for elk was not complete but the sample size (n=336) was sufficient to analyse bull, calf, and 6pt ratios using an incomplete sightability model.

The primary target for this survey was mule deer. Therefore, we did not have complete survey coverage of the study area for elk. Sightability corrected bull ratios were 11 bulls: 100 cows (CI 10-12) and estimated calf ratios were 21 calves: 100 cows (CI 20-22). We observed mature bulls away from cow calf groups during the time of survey. As well, several large elk groups were observed at the end of the survey when the light was poor. Classification in the air and from photos was not ideal. For these reasons, we need to use caution when interpreting the bull and calf ratios for this survey.

This survey suggests that mule deer buck ratios are lower than Ministry targets across all three MUs. Therefore, buck ratio should be re-sampled in 2013. It is recommended to survey in mid-November, during peak rut, regardless of snow level to maximize sightability of bucks.
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**Introduction**

In 2010, Region 8 applied the new Southern Interior Mule Deer Harvest Strategy (MOE Mule Deer Harvest Strategy, 2010) to: align hunting seasons with adjacent Regions, simplify hunting regulations, and increase mule deer hunting opportunity in the Okanagan Region. The most significant change of the new harvest strategy was an increase to the “any buck” season through the entire month of October across all Management Units (MU). This change increased the “any buck” season by 10 days from previous years.

Mule deer populations in the Southern Interior peaked in the mid 1950s and we have not seen populations as high since (Hatter et al. 1998). The latest peak in mule deer numbers in the Okanagan occurred in the early 1990s but by 1998 mule deer numbers had declined by as much as 50% since the peak in 1992 (Harper 1998). Harvest statistics suggest that mule deer are recovering from the population declines of the mid 1990s; however, this recovery has not been uniform across the Region.

Currently, information on sex ratios of mule deer populations is limited and managers are uncertain how current hunting season changes will affect population composition and population growth, as well as hunter success and satisfaction. Maintaining ratios of 20 bucks: 100 does is the management objective set by the Mule Deer Harvest Strategy (2010). (MOE Mule Deer Harvest Strategy, 2010). Recent changes in mule deer seasons will require reliable composition data to assess the effects of the hunting regimes on mule deer demographics.

**Study Area**

We focused our surveys on winter ranges near Princeton (Figure 1). The study area winter ranges occur primarily in dry climatic zones but parts extend into moist climatic regions at higher elevation. Lower elevations, between 650 and 900m, are in the Ponderosa Pine (PPxh1) biogeoclimatic zone (BEC) Okanagan Very Dry Hot subzone/variant. The PPxh1 is characterised by grassland and open forest conditions with climax stands of ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*), and a dominant understory of bluebunch wheatgrass (*Agropyron spicatum*).

Mid-slope winter range, between 900-1400m occurred in the Interior Douglas-fir (IDF) zone, Okanagan Very Dry Hot (xh1), Thompson Dry Cool (dk1) and Cascade Dry Cool (dk2) subzones/variants. The IDF is characterised by warm, dry climate, long growing seasons, and common moisture deficits. The IDF zone is distinguished by its climax stands of Douglas-fir and pinegrass (*Calamagrostis rubescens*) understory. The xh1 is the most common subzone/variant in the study area with open forest stands of Douglas-fir and Pondersa Pine.
Shrub layer is sparse consisting mainly of birch-leaved spirea (*Spirea betulifolia*), Saskatoon (*Amelanchier alnifolia*), and snowberry (*Symphoricarpos albus*).

At higher elevations, 1450-1650 m, the study area reaches into the Montane Spruce (MSxk) zone/subzone. These forests experience cold winters and fairly short, dry summers. Historically wildfires were common, limiting the occurrence of subalpine fir (*Abies lasiocarpa*) and hybrid white spruce (*Picea engelmannii x glauca*) as climax species. Instead mature seral logdepole pine (*Pinus contorta*) stands are the dominant overstory.

![Figure 1: Map showing study area surveyed for mule deer composition in December, 2012](image-url)
Methods

Survey Area Selection
Survey units or “blocks” were determined from analysis of provincial mule deer winter range mapping, previous winter mule deer aerial survey observations, and interviews with local hunters and guide outfitters.

Survey Procedures
General survey standards were adopted from aerial-based inventory techniques for selected ungulates (RISC, 2002). Surveys were conducted with a Bell 206 Jet Ranger equipped with rear bubble observation windows. Encounter transects were used to locate mule deer with transects spaced at approximately 400 m in open habitats and 300 m in more closed forested habitats. Transects typically followed contours from either low elevation to high or vice versa. Speeds of 50-80 km/hour were targeted while maintaining a distance of 20-100 m above the tree tops.

We used three people on survey at all time: one navigator in the front seat and two observers in the rear. The navigator used the track log function and real time navigation feature on a Garmin 60Cx handheld GPS to maintain transect width, monitor survey coverage, and mark waypoints of animal locations. The navigator took pictures of larger doe/fawn groups and mature bucks whenever possible and recorded data. The observer’s main tasks were to spot and classify animals. Generally, once groups of animals were observed the animals would be put on the navigator’s side of the helicopter to be counted, classified, and photographed. Each group of animals was circled and in areas with high crown closure, deer were sometimes herded into openings until classification was possible. In cases where mule deer were lost in forests with high crown closure, they were recorded as “unclassified”. We surveyed to the height of land in each block or to the elevation where deer tracks were no longer present in the snow.

Classification
In 2010, Regions decided to standardize mule deer classification methods by collecting buck data in two categories: < 4pt and > 4pt buck. The 4pt buck definition reads: any buck having at least 4 tines, excluding brow tine, on one antler. Antlerless deer were classified as adult female (less than 1.5 years old) and fawns (young of the year). We completed the survey in early December to maximize sightability of bucks (Reid 2010; 2011) and to ensure bucks were classified before antler drop. We used a digital SLR camera with a 70-300 mm anti-vibration zoom lens to photograph buck observations.
Data Analysis

Mule Deer
An incomplete sightability model was not used in this analysis. We calculated buck ratio confidence intervals (90%) using the binomial variance estimator in the programs distributed with Ecological Methodology (Krebs 1999).

Elk
A sightability model was used to correct elk observations for incomplete sightability in program Aerial Survey (Unsworth et al. 1999). I used the Hiller 12-e elk model to correct elk observations for incomplete sightability. The Hiller 12-e model was developed in Idaho and has been used extensively for elk surveys in the Kootenay Region.

Results

Composition
Two survey days, December 7th and 8th, were completed in MUs 8-04, 8-05 and 8-06 in 2012. Winter ranges surveyed included Allenby, Jura, Hembrie Mtn, Lorne Lk, Mount Miner, Whipsaw Ck and Willis Ck. Automated Snow Pillow data from Blackwell Peak (1900 m), suggest high elevation snowpack was at the 45 year average during the time of survey.

All MUs (8-04, 8-05, 8-06)
A total sample size of 693 mule deer was counted and classified during the survey (Figure 2, Table 1). The total survey time was approximately 12.7 hrs. I calculated the total buck to doe ratio for all MUs at 12 bucks: 100 does ([CI 90%] 9-16), 9 < 4pt bucks: 100 does (CI 7-12) and 2 > 4pt bucks: 100 does (CI 0-4). I calculated 49 fawns: 100 does (CI 46-52). For observations where bucks were recorded there was at least one doe in the group 78% of the time.

8-04
In MU 8-04 a sample size of 340 mule deer was counted and classified during the survey (Figure 2, Table 1). I calculated the buck to doe ratio at 14 bucks: 100 does (9-18), 10 < 4pt bucks: 100 does (CI 6-15) and 2 > 4pt bucks: 100 does (CI 1-5). The fawn ratio was calculated at 46 fawns: 100 does (CI 39-51) in MU 8-04.

8-05
In MU 8-05 a sample size of 120 mule deer was counted and classified during the survey (Figure 2, Table 1) I calculated the buck to doe ratio at 11 bucks: 100 does (5-20), 8 < 4pt bucks: 100 does (CI 3-16) and 3 > 4pt bucks: 100 does (CI 0-9). The calculated fawn ratio was 47 fawns: 100 does (CI 36-59) in MU 8-05.
In MU 8-06 a sample size of 233 mule deer was counted and classified during the survey (Figure 2, Table 1) I calculated the buck to doe ratio at 12 bucks: 100 does (7-18), 9 < 4pt bucks: 100 does (CI 5-15) and 1 > 4pt bucks: 100 does (CI 0-5). I calculated 56 fawns: 100 does (CI 51-61) in MU 8-06.

Table 1: Classification of mule deer observed during composition surveys in MU 8-04, 8-05, 8-06 on December 7th and 8th, 2012.

<table>
<thead>
<tr>
<th>Management Unit</th>
<th>Fawns</th>
<th>Does</th>
<th>&lt;4pt Bucks</th>
<th>&gt;4pt Bucks</th>
<th>Unclass. Buck</th>
<th>All Bucks</th>
<th>Unclass</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-04</td>
<td>91</td>
<td>200</td>
<td>20</td>
<td>4</td>
<td>3</td>
<td>27</td>
<td>22</td>
<td>340</td>
</tr>
<tr>
<td>8-05</td>
<td>36</td>
<td>76</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>8-06</td>
<td>78</td>
<td>139</td>
<td>12</td>
<td>2</td>
<td>2</td>
<td>16</td>
<td>0</td>
<td>233</td>
</tr>
<tr>
<td>Total</td>
<td>205</td>
<td>415</td>
<td>38</td>
<td>8</td>
<td>5</td>
<td>51</td>
<td>22</td>
<td>693</td>
</tr>
</tbody>
</table>
Figure 2: Map showing ungulate observations scaled to group size and flight path during the composition surveys in MU 8-04, 8-05 and 8-06 on December 7th and 8th, 2012.
Elevation
Mule deer ranged between 640 m and 1600 m elevation during the surveys. Bucks, > 4pt and < 4pt, were observed throughout this elevation range (Figure 3). There was no significant difference in elevation between buck and doe observations during the survey (P=0.3).

![Graph showing distribution of mule deer does and bucks by elevation](image)

**Figure 3**: Distribution of mule deer does and bucks observations by elevation during the December 7th and 8th survey in MU 8-04, 8-05 and 8-06.

Other Species
We encountered multiple species during surveys in both MUs including elk, moose and white-tailed deer (Table 2). Sufficient sample sizes were collected to run sightability models for elk. The survey coverage for elk was not complete but the sample size (n=336) was sufficient to analyze bull, calf, and 6pt ratios using an incomplete sightability model.

**Table 2**: Other species observed during mule deer surveys in MU 8-04, 8-05 and 8-06 on December 7th and 8th, 2012.

<table>
<thead>
<tr>
<th>Species</th>
<th>MU</th>
<th>Unclass.</th>
<th>Juvenile</th>
<th>Adult Female</th>
<th>Adult Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elk</td>
<td>8-04</td>
<td>1</td>
<td>19</td>
<td>161</td>
<td>7</td>
<td>188</td>
</tr>
<tr>
<td></td>
<td>8-05</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>8-06</td>
<td>0</td>
<td>35</td>
<td>94</td>
<td>13</td>
<td>142</td>
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<td>Moose</td>
<td>8-04</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>8-05</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>8-06</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>White-tailed Deer</td>
<td>8-04</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>8-05</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>8-06</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
Elk
A total of 336 elk were classified in MU 8-04, 8-05 and 8-06 including 254 cows, 54 calves, 12 spike bulls, 5 raghorn bulls, 9 5pt bulls, 1 6pt and 1 unclassified. Sightability corrected bull ratios were 11 bulls: 100 cows (CI 10-12) and estimated calf ratios were 21 calves:100 cows (CI 20-22).

Discussion

Sightability
Differential sightability of bucks and does has been an important topic of discussion amongst southern interior mule deer managers since 2010 and the introduction of ratio targets. To maximize the sightability of bucks it is felt that surveys should be complete before bucks form bachelor groups and segregate away from does. We summarized data from the Okanagan, Boundary and Kootenay regions over the past 3 years and looked at the percent of bucks observed with at least one doe during composition surveys (Reid 2011, Stent 2010; Table 3). The data suggests that number of bucks observed with does begins to drop after November and that mule deer composition surveys should be completed before December 7th, preferably in mid November.

For this survey we delayed our survey till December 7th and 8th because of a lack of snow at high and low elevations. We desired more snow to drive the mule deer to lower elevation as well as increase sightability of mule deer on the ground. We received snow in the days prior to the survey creating ideal conditions for spotting mule deer. However, our final buck ratios are below the southern interior mule deer strategy target of 20 bucks: 100 does across the study area. We now need to determine if we are indeed hunting too many bucks or if the low buck ratio is a result of survey timing.

Hunting can influence mule deer population parameters, including sex ratios, age structure, and abundance (Erickson et al. 2003). Research, however, has shown that pregnancy and fawn recruitment are not related to the number of bucks per 100 does (Erickson et al. 2003) and buck harvest has little effect on overall population trend (Bowden et al. 2000, Gaillard et al. 2000). Small changes in doe survival can have a significant influence on the population trend (Bowden et al. 2000, Gaillard et al. 2000). The regional doe harvest has been small with an estimated harvest of 335 female deer between 2000 and 2010 from all of MU’s 8-04, 8-05 and 8-06. Currently there are only 65 antlerless deer tags issued annually among all MU’s 8-04, 8-05 and 8-06. Nutritional condition is likely the ultimate cause of mortality for adult females and fawns in this study area which currently lacks wolves. Nutrition appears to set the population equilibrium for similar mule deer populations (Forrester and Wittmer 2013) and enhanced nutrition of deer has been shown to reduce coyote (Canis latrans) and mountain lion (Puma concolor) predation rates of 6-month-old fawns and adult females (Bishop et al. 2009).
Table 3: The percent of bucks observed with at least one doe during composition surveys across the Okanagan and Kootenay Regions in 2010, 2011 and 2012.

<table>
<thead>
<tr>
<th>MU</th>
<th>Survey Year</th>
<th>Survey Dates</th>
<th>% of bucks with does</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-02, 4-03 4-21 and 4-22</td>
<td>2011</td>
<td>Nov. 19th and 20th</td>
<td>92</td>
<td>784</td>
</tr>
<tr>
<td>4-02, 4-21 and 4-22</td>
<td>2010</td>
<td>Nov. 22nd and 23rd</td>
<td>92</td>
<td>596</td>
</tr>
<tr>
<td>8-15</td>
<td>2011</td>
<td>Nov. 25th and 26th</td>
<td>87</td>
<td>147</td>
</tr>
<tr>
<td>8-23</td>
<td>2011</td>
<td>Nov. 30th and Dec. 1st</td>
<td>78</td>
<td>318</td>
</tr>
<tr>
<td>8-23</td>
<td>2010</td>
<td>Dec. 2nd and 3rd</td>
<td>79</td>
<td>384</td>
</tr>
<tr>
<td>4-06 and 4-07</td>
<td>2011</td>
<td>Dec. 5th and 7th</td>
<td>82</td>
<td>335</td>
</tr>
<tr>
<td>815</td>
<td>2011</td>
<td>Dec. 6th</td>
<td>70</td>
<td>64</td>
</tr>
<tr>
<td>8-04, 8-05, 8-06</td>
<td>2012</td>
<td>Dec. 7th and 8th</td>
<td>78</td>
<td>693</td>
</tr>
<tr>
<td>4-03, 4-06 and 4-07</td>
<td>2010</td>
<td>Dec. 15th and 22nd</td>
<td>52</td>
<td>246</td>
</tr>
<tr>
<td>8-12, 8-14 and 8-15</td>
<td>2010</td>
<td>Dec. 10th, 11th and 15th</td>
<td>40</td>
<td>390</td>
</tr>
<tr>
<td>4-26</td>
<td>2011</td>
<td>Dec. 13th</td>
<td>75</td>
<td>72</td>
</tr>
<tr>
<td>4-06 and 4-07</td>
<td>2009</td>
<td>Dec. 31st</td>
<td>91</td>
<td>146</td>
</tr>
<tr>
<td>8-23</td>
<td>2010</td>
<td>Jan. 6th</td>
<td>35</td>
<td>233</td>
</tr>
<tr>
<td>4-02, 4-21 and 4-22</td>
<td>2009</td>
<td>Jan. 6th and 7th</td>
<td>68</td>
<td>864</td>
</tr>
</tbody>
</table>

**Composition**

According to this survey results, early winter fawn ratios look healthy with results ranging from 46 - 56 fawns: 100 does. Therefore, the does are being breed by the remaining bucks. A late winter ground count could confirm carry over ratios for this population. This survey suggests that buck ratios are lower than Ministry targets across all three MUs surveyed.

**Management Recommendation**

Buck ratio should be re-sampled from the ground in spring 2013 in an attempt to verify low buck ratios as well as by further aerial surveys in winter 2013. It is recommended to survey in mid-November, during peak rut, regardless of snow level to maximize sightability of bucks.

**Elk**

The primary target for this survey was mule deer. Therefore, we did not have complete survey coverage of the study area for elk. We observed mature bulls away from cow calf groups during the time of survey. In addition, several large elk groups were observed at the end of the survey.
when the light was poor. Classification in the air and from photos was not ideal. For these reasons, we need to use caution when interpreting the bull and calf ratios for this survey.

Gyug (2008) surveyed MU 8-04, 8-05 and 8-06 for elk and covered much of the same area as this survey. In 2008, 375 elk were counted and classified. Ratios were down from the 2008 survey, which documented 15.3 bulls: 100 cows and 27.9 calves: 100 cows. Gyug (2008) suggested populations were up from survey in 1999 where only 119 elk were observed. However, survey intensity and coverage from the 1999 survey are unknown, so direct comparison is not possible.
Literature Cited


