WMU 258 Aerial Ungulate Survey (2016)

Background

An aerial ungulate survey was conducted in WMU 258 from January 10th-13th, 2016, using a combination of strip and distance sampling techniques to compare the two approaches. Distance surveys are seeing increasing use in boreal WMUs, but have not been used extensively in parkland areas to date. The focal species of the survey were moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), and elk (*Cervus canadensis*). The most recent population estimates for this WMU were obtained using a Gasaway survey in 2005, which estimated populations of 226 moose ($0.085/km^2$; 90% CI = 39.5%), 5656 white-tailed deer ($2.123/km^2$; 90% CI = 13.9%), and 588 mule deer ($0.221/km^2$; 90% CI = 42.0%).

As of 2015, white-tailed deer were hunted under a general season in WMU 258, whereas other big game species are allocated under special licences. Elk tags are allocated to the St. Paul Superunit (WMUs 252, 254, 256, and 258). Both elk and mule deer were also included in a general archery season, and there were no supplemental tags available for any ungulates. Hunter harvest data for special licences indicate three year average success of: antlered moose 60%, antlerless moose 66%, antlered mule deer 33%, antlerless mule deer 45% and for elk in the WMU252/254/258/260 superunit: antlered elk 44%, and antlerless elk 46%.

A combined strip/distance sampling survey focusing on moose, white-tailed deer, and mule deer was undertaken with the intent of meeting the following objectives: 1) estimate total population sizes and densities of moose, white-tailed deer, and mule deer; 2) compare results of strip surveying to distance sampling, including consistency and precision of population and density estimates; and 3) conduct a minimum total count of elk.

Methods

A total of 53 parallel north-south transect lines (survey effort = 2443.28 km; interval = 1.09 km) were flown over a three-day period. Upon detection, GPS coordinates were immediately taken on the transect line (line waypoint). Another set of coordinates were then taken overhead of the point where the group was first observed (group waypoint). Ungulates were classified by age class (adult or juvenile), sex, and antler class whenever possible.

Line and group waypoints were used to calculate perpendicular distances from the transect line for each group. Using these distances, an 'informed' strip analysis was performed using only groups that were observed within 200 m of the transect line (400 m strip width). Transect lengths varied, and thus densities were calculated by dividing the total number of animals observed by the total search area. For each species, the density was then multiplied by the total area of the WMU to obtain a population estimate (excluding elk). Confidence intervals (90%) and coefficients of variation were calculated according to the method laid out by Krebs (2014).

Focal species data were also analyzed using Distance 6.0 (Release 2; Thomas et al., 2010). Distance fits a detection function to a distribution of observed perpendicular distances of groups from transect lines flown during a given survey (separately for each species). The detection function is then used to estimate density and abundance. Distance also calculates 90% confidence intervals and coefficients of variation. The analysis for Distance includes determining if data should be limited or grouped to improve

the fit of the detection function and then test the survey data against candidate models to determine which model is most appropriate. Following model selection, additional combinations of candidate models/data filters were explored to improve model fit and/or precision before final models and data filters were selected.

Table 1. Final models used in distance analyses for focal ungulate species (Chi-sq GOF = Chi-square goodness-of-fit test p-value; K-S GOF = Kolmogorov-Smirnov goodness-of-fit test p-value).

Species	Key Function	Series Expansion	Truncation	Bin Interval	Chi-sq GOF	K-S GOF
Moose	Uniform	Cosine	None	None	0.531	0.624
White-tailed Deer	Uniform	Cosine	500 m	100 m	0.370	-
Mule Deer	Uniform	Cosine	550 m	50 m	0.148	-

Results

A total of 287 moose were observed in 170 groups. Of these, 61 (21.2%) were bulls, 138 (48.1%) were cows, and 88 (30.7%) were calves (bull:cow = 0.44; calf:cow = 0.64). A total of 1653 white-tailed deer were observed in 531 groups. Of these, 1280 animals were classified, including 232 (18.1%) bucks, 639 (49.9%) does, and 409 (32.0%) fawns (buck:doe = 0.36; fawn:doe = 0.64). A total of 873 mule deer were observed in 174 groups. Of these, 585 animals were classified, including 158 (27.0%) bucks, 294 (50.3%) does, and 133 (22.7%) fawns (buck:doe = 0.54, fawn:doe = 0.45). A total of 26 elk were observed in 5 groups, including 2 bulls, 18 cows, and 6 calves. Results from the strip and distance analyses are summarized in Tables 2 and 3, respectively.

Table 2. Historical abundance estimates (N) estimates and age-sex composition ratios for WMU 258.

Year	Type	Moose			White-tailed Deer			Mule Deer		
		N (90% CI)	Bull:Cow	Calf:Cow	N (90% CI)	Buck:Doe[1]	Fawn:Doe	N (90% CI)	Buck:Doe[1]	Fawn:Doe
1999	Class	-	0.88	1.13	-	0.37	0.56	-	0.33	0.33
2002	Class	-	0.25	0.75	-	0.34	0.27	-	0.67	0.00
2003	Strip	372	-	-	3604	-	-	-	-	-
2005	Gasaway	226 (137-315)	-	-	5656 (4871-6441)	0.37	0.63	588 (323-793)	-	-
2008	Class	-	0.29	0.59	-	0.27	0.53	-	0.22	0.63

[1] Buck:doe ratios are likely underestimates because unclassified portion is typically male-skewed.

Table 3. Strip analysis results for the 2016 aerial ungulate survey in WMU 258 (n = # of individuals; R = est. # individuals/km^2; SE = standard error; CV = coefficient of variation; N = total est. abundance).

Species	n	R (90% CI)	SE_R	CV_R	N (90% CI)	SE_N	CV_N
Moose	152	0.156 (0.132 − 0.179)	0.014	0.092	414 (351 − 478)	38.08	0.092
White-tailed Deer	1149	1.176 (0.991 − 1.360)	0.110	0.094	3132 (2639 − 3625)	294.20	0.094
Mule Deer	434	0.444 (0.364 − 0.525)	0.048	0.108	1183 (969 − 1398)	128.09	0.108

Table 4. Distance analysis results for the 2016 aerial ungulate survey in WMU 258 (n = # of groups; R = est. # individuals/km^2; SE = standard error; CV = coefficient of variation; N = total est. abundance).

Species	n	Encounter Rate (groups/km)	Mean Cluster Size	R (90% CI)	SE$_R$	CV$_R$	N (90% CI)	SE$_N$	CV$_N$
Moose	170	0.07	1.69	0.165 (0.140 – 0.193)	0.016	0.095	438 (374 – 513)	41.61	0.095
White-tailed Deer	525	0.21	3.10	1.330 (1.075 – 1.645)	0.172	0.129	3544 (2865 – 4384)	457.18	0.129
Mule Deer	167	0.07	4.97	0.462 (0.369 – 0.578)	0.063	0.136	1230 (983 – 1540)	167.28	0.136

Literature

Krebs, C.J. 2014. Ecological Methodology, 3rd Edition. Chapter 4, Estimating Abundance: Quadrat Counts [online] http://www.zoology.ubc.ca/~krebs/downloads/krebs_chapter_04_2013.pdf .

Thomas, L., Buckland, S. T., Rexstad, E. A., Laake, J. L., Strindberg, S., Hedley, S. L., Bishop, J.R.B., Marques, T.A., and Burnham, K. P. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. *The Journal of Applied Ecology*, *47*(1), 5–14.