

2006 Halfway-Sikanni Plains Bison Inventory



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Table of Contents

Introduction.....	2
Methods.....	4
Results.....	5
Discussion.....	9
Literature Cited.....	10
Appendix A – Population Estimates.....	11

List of Figures

Figure 1. Study area for the 2006 Halfway-Sikanni Plains Bison Inventory.....	3
Figure 2. Bison group locations during February 2006 inventory.....	6
Figure 3. Stratification of survey blocks during the 2006 Halfway-Sikanni Plains Bison Inventory.....	7
Figure 4. Blocks surveyed during the 2006 Halfway-Sikanni Plains Bison Inventory.....	7

List of Tables

Table 1. Summary results and population estimates for the February 2006 inventory of the Halfway-Sikanni plains bison population.....	6
Table 2. Observed and estimated population of plains bison within British Columbia from 1975 to 2006.....	8

Introduction

As a result of funding provided by the Ministry of Environment's 2005-2006 Wildlife Inventory Program, wildlife biologists in the Peace Region were able to carry out an aerial inventory of the Halfway-Sikanni plains bison (*Bison bison bison*) population in February of 2006. This population (also called the Pink Mountain plains bison population) is the world's largest free-ranging plains bison herd (COSEWIC, 2004). Historic evidence suggests that plains bison only occurred south of the Peace River in British Columbia prior to European colonization (van Zyll de Jong, 1986). Therefore, the Halfway-Sikanni plains bison herd exists outside of the sub-species historic range. Nonetheless, this herd plays an important role in the conservation of plains bison, a subspecies that is currently listed as "Threatened" (COSEWIC, 2004).

The herd was established in 1971 when 48 plains bison escaped from a ranch on the upper Halfway River. These bison were originally purchased at an Elk Island National Park, Alberta during a surplus bison sale. The court declared the free-ranging bison to be property of British Columbia after several years, and in 1982 they were listed as "big game" and "wildlife" under the British Columbia Wildlife Act. Since that time, the Ministry of Environment has managed the herd (COSEWIC, 2004).

Population inventories have been conducted on the herd periodically since its establishment. The last inventory, conducted in 2003, was a presumed total count with no sightability correction. The total population was estimated at 877 animals within a home range of approximately 1500km². At that time there were approximately 21.8, 15.8, and 43.1 calves, yearlings, and bulls per 100 cows respectively. The 2006 inventory was completed to determine current population size, density, composition, habitat utilization and range, and to compare these to 2003 values.

The study area included the entire known range of plains bison within British Columbia (Figure 1). Typical bison habitat occurs along the east-west oriented valleys of the Sikanni-Chief and Halfway Rivers as well as within meadow complexes throughout the range. Range expansions into Neves Creek to the north and Fiddes Creek to the south were two notable range expansions that had been reported since the last inventory.

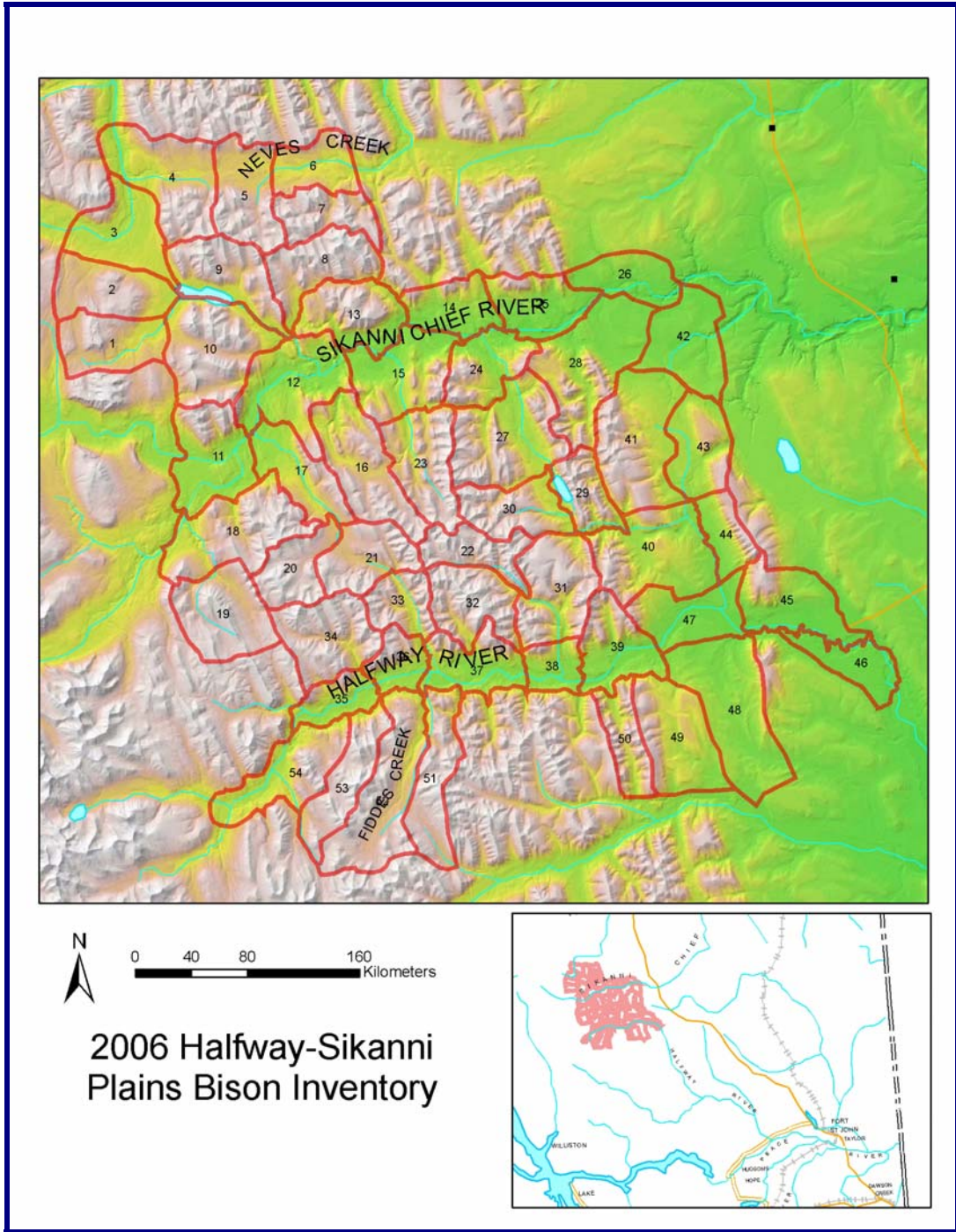


Figure 1. Study area for the 2006 Halfway-Sikanni Plains Bison Inventory.

Methods

An aerial inventory was completed between February 9th and 14th, 2006 within the range of plains bison in BC. Fifty-four survey blocks were delineated prior to the inventory using the survey blocks from the 1998 and 2003 inventories as a starting point. Blocks were added to accommodate known bison range expansions (most notably into Fiddes Creek and Neves Creek). Survey blocks were stratified prior to the count according to elevation, proximity to major valleys, and using expert local knowledge of bison distribution. It was recognized that the high stratum would be exceedingly variable due to the herding tendencies of this species, therefore a total count within this stratum would be required. A total count for the entire population is recommended by the BC Resource Inventory Committee (Terrestrial Information Branch, 2002), but financial constraints precluded this.

The methodology followed was a stratified random block count within the low stratum, and a total count within the high stratum. Blocks were surveyed using a Bell Model 206 Jet Ranger helicopter between February 9th and 14th, 2006. The survey crew consisted of the pilot and 3 observers. Transects were flown so as to approximate total visual coverage of selected survey blocks. All bison encountered were recorded according to geographic position (using a handheld Garmin GPS V receiver) and classified according to sex and age. Classification into age/sex classes was completed using horn morphology, body size, and secondary sexual characteristics. Cows were defined as female bison 2 years of age or older, bulls were defined as male bison aged between 2 and 6 years, and mature bulls were those judged to be 7 years or older.

Results

Stratification of the 54 delineated blocks resulted in 28 highs and 26 lows (Figure 3). The area of the high blocks totalled 1124.8 km², while low blocks totalled 1051.5 km². Twelve (46%) of the low blocks and 28 (100%) of the high blocks were inventoried (Figure 4). 1208 bison were observed in the high stratum, and 46 were observed in the low stratum in 72 separate groups (Figure 2). A population estimate for the total range was 1302.1 +/- 5.29% at the 90% confidence interval (90% confidence that the total population is between 1233.2 and 1370.9 individuals). The estimated number of cows, calves, yearlings, bulls and mature bulls is listed in Table 1.

The minimum convex polygon (MCP) area of occupancy during the inventory was 1513 km². The total study area was 2176.3 km². The current yearly area of occupancy likely falls somewhere between the February MCP and the entire area surveyed.

Table 1. Summary results and population estimates for the February 2006 inventory of the Halfway-Sikanni plains bison population.

Sex/Age Class	Estimate	% Width at 90% CI	Ratio per 100 cows	% Width at 90% CI
2+ Cows	679.80	6.03		
Calves	213.10	3.63	31.35	2.47
Yearlings	131.10	3.94	19.28	2.18
2+ Bulls	174.50	9.80	25.67	6.44
Mature Bulls	89.60	26.02	13.17	27.14
Total Bulls	264.10	9.84	38.84	8.99
Unknown	14.00	0.00	2.06	6.03

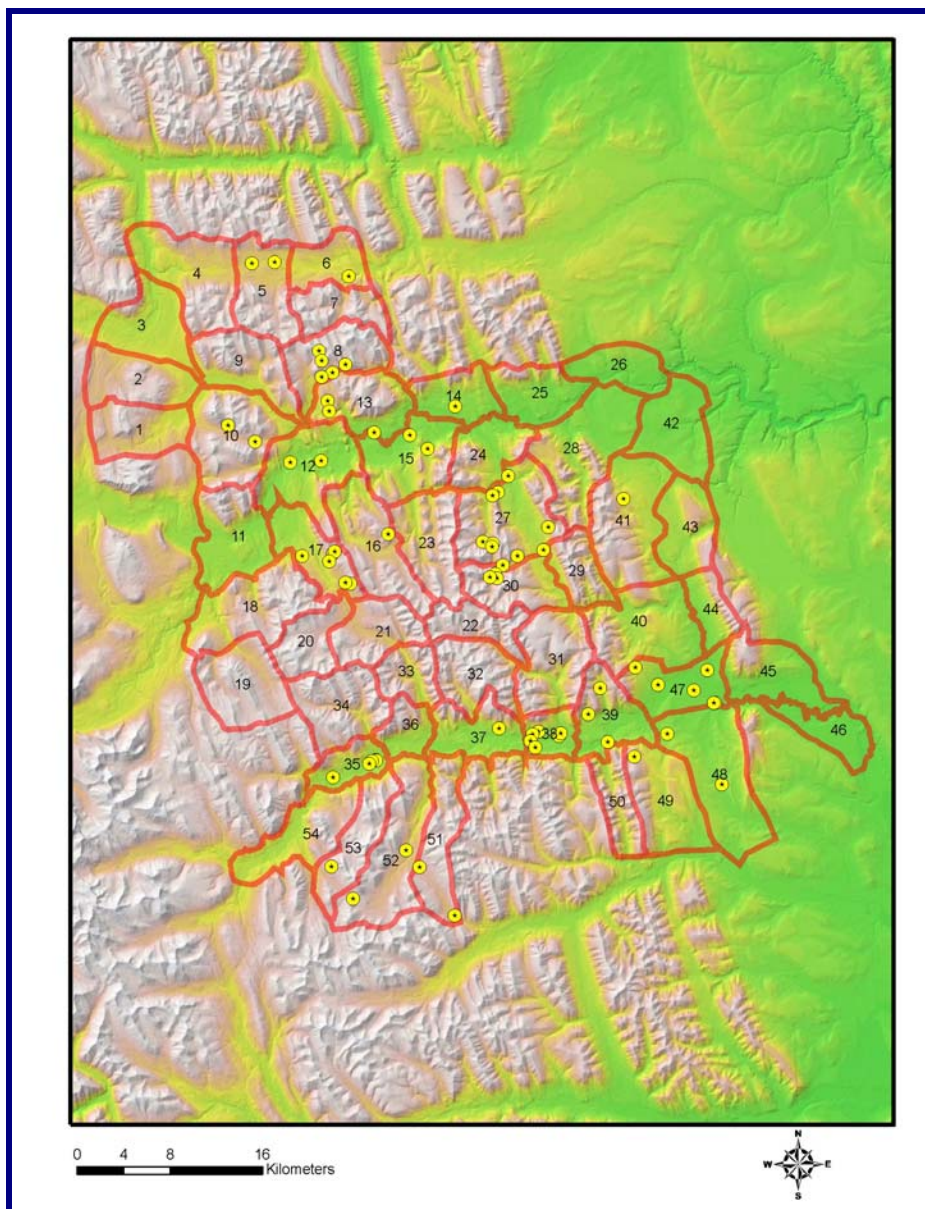


Figure 2. Bison group locations during February 2006 inventory.

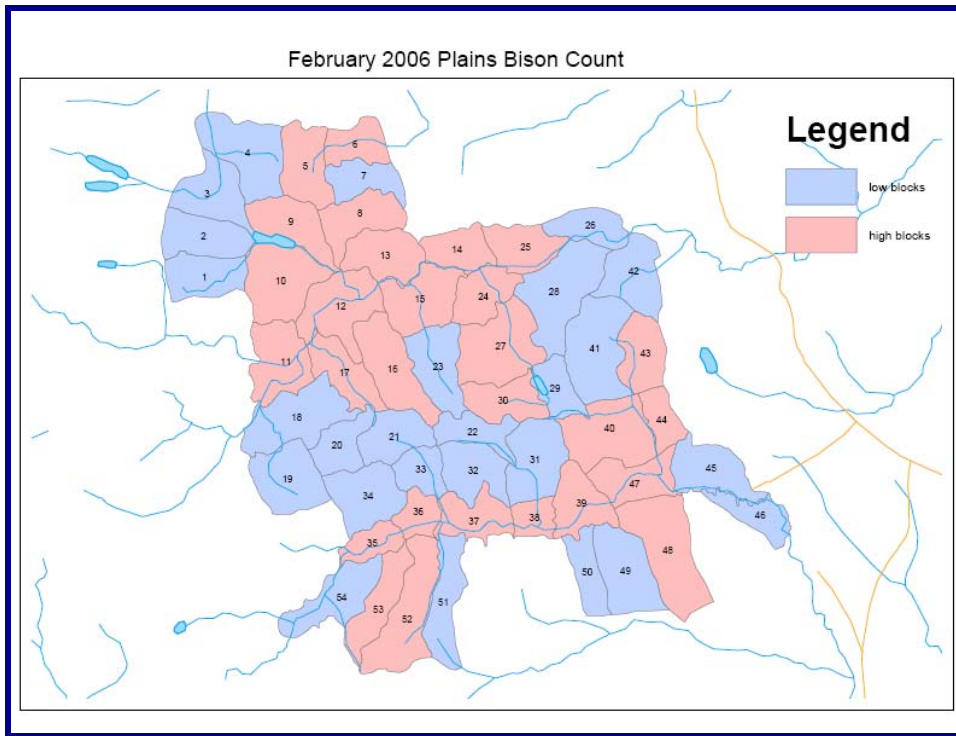


Figure 3. Stratification of survey blocks during the 2006 Halfway-Sikanni Plains Bison Inventory.

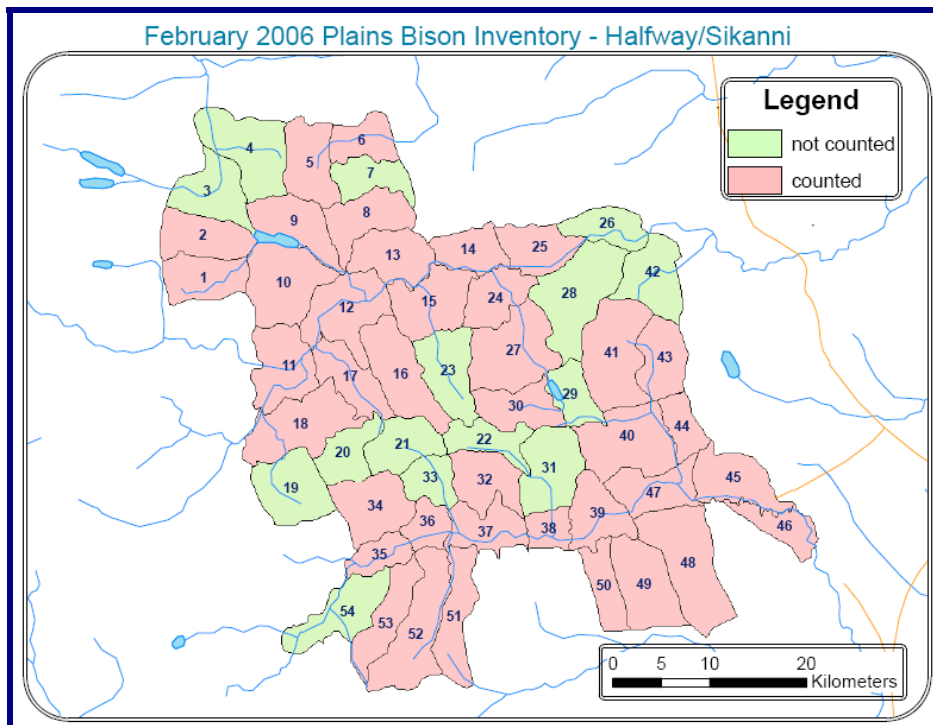


Figure 4. Blocks surveyed during the 2006 Halfway-Sikanni Plains Bison Inventory.

Table 2. Observed and estimated population of plains bison within British Columbia from 1975 to 2006 (modified from COSEWIC, 2004).

year	observed	modelled estimate	modelled % growth (λ)
1975	50	50.0	
1976	70	69.1	1.38
1977	95	95.6	1.38
1978	130	132.1	1.38
1979	175	182.7	1.38
1980		201.8	1.10
1981		222.9	1.10
1982		246.2	1.10
1983		272.0	1.10
1984		300.4	1.10
1985		331.9	1.10
1986		366.6	1.10
1987		404.0	1.10
1988		447.4	1.11
1989		494.2	1.10
1990		545.9	1.10
1991		603.0	1.10
1992	648	666.1	1.10
1993		692.9	1.04
1994		765.4	1.10
1995		845.4	1.10
1996		933.9	1.10
1997		928.7	0.99
1998		883.8	0.95
1999		795.3	0.90
2000		826.6	1.04
2001		839.1	1.02
2002		824.9	0.98
2003	876	874.2	1.06
2004		996.6	1.14
2005		1136.1	1.14
2006	1302	1295.2	1.14

Discussion

Although extreme winds prevented inventory flights during a portion of the project, population estimates were successfully produced. It appears that the Halfway-Sikanni plains bison population has expanded in both range and abundance since the last inventory was conducted. Population modelling suggests an average finite rate of growth of approximately 14% per year in the previous 3 years (Table 2).

Late winter calf recruitment (31.35 +/- 2.47% at 90% CI calves per 100 cows) is meeting management objectives. Sex and age ratios are comparable to the 2003 inventory. The estimated total population of 1302.1 +/- 5.29% at the 90% CI suggests the population was at an all-time high during the 2006 inventory. The ideal population size for this herd has been suggested to be between 1000 and 3000 individuals (COSEWIC, 2004), but additional work is needed in order to determine a more exact population target.

A major management goal is to minimize range expansion. The use of salt blocks placed throughout the present range has been used in an attempt to divert bison and limit range expansions. Fencing has been used between Pink Mountain and the Halfway River in order to limit bison movements into agricultural areas leading in the general direction of the Alaska Highway. Additional range expansions should be controlled through registered hunting and native sustenance harvesting. The limited entry hunting (LEH) authorizations awarded for this area will be reviewed based on this updated inventory information.

Literature Cited

- British Columbia Ministry of Sustainable Resource Management: Terrestrial Information Branch. 2002. Aerial-based Inventory Methods for Selected Ungulates: Bison, Mountain Goat, Mountain Sheep, Moose, Elk, Deer, and Caribou. Version 2.0. 91pp.
- COSEWIC. 2004. COSEWIC assessment and status report on the plains bison *Bison bison* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Vi + 71pp. (www.sararegistry.gc.ca/status/status_e.cfm).
- Van Zyll de Jong., C.G. 1986. A systematic study of recent bison, with particular consideration of the wood bison (*Bison bison athabasca* Rhoads 1898). National Museum of Natural Sciences, Publications in Natural Sciences 6:1-69. Ottawa, Ontario.

APPENDIX A:
ESTIMATED POPULATION SIZE
February 2006 Plains Bison Inventory - Sikanni/Halfway

Estimating Plains Bison Population Parameters from Aerial Surveys using the W.C. Gasaway, et al, 1986 method*

Where:

Stratum = high or low stratum Density = estimated bison/km²
N = number of survey blocks To = bison estimate
Tot Area = area in km² V() = sampling variance
n = survey blocks counted df = degrees of freedom
Area Sur = area surveyed in km² Te = total population estimate
seen = bison observed

Statistical outputs from the program Moosepop (Reed, 1989)

ESTIMATED TOTAL POPULATION:			
STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	1208	46	1254
Density	1.0739	0.0895	0.5983
To	1207.9	94.1	1302.1
V(To)	0.00	1469.54	1469.54
df	27	11	11
Te= 1302.1 V(Te)= 1469.54 df(Te)= 11			
80% CI around Te = (1249.8, 1354.3) is +/- 4.01%			
90% CI around Te = (1233.2, 1370.9) is +/- 5.29%			
95% CI around Te = (1217.7, 1386.4) is +/- 6.48%			

ESTIMATED TOTAL 2+ COWS:			
STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	643	18	661
Density	0.5716	0.0350	0.3124
W.n	643.0	36.8	679.8
V(W.n)	0.00	520.22	520.22
df	27	11	11
Wen= 679.8 V(Wen)= 520.22 df(Wen)= 11			
80% CI around Wen = (648.7, 710.9) is +/- 4.57%			
90% CI around Wen = (638.8, 720.8) is +/- 6.03%			
95% CI around Wen = (629.6, 730.0) is +/- 7.38%			

ESTIMATED TOTAL CALVES:

STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	207	3	210
Density	0.1840	0.0058	0.0979
W.n	207.0	6.1	213.1
V(W.n)	0.00	18.60	18.60
df	27	11	11

Wen= 213.1 V(Wen)= 18.60 df(Wen)= 11
80% CI around Wen = (207.3, 219.0) is +/- 2.76%
90% CI around Wen = (205.4, 220.9) is +/- 3.63%
95% CI around Wen = (203.6, 222.6) is +/- 4.45%

ESTIMATED TOTAL YEARLINGS (bulls and cows):

STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	127	2	129
Density	0.1129	0.0039	0.0602
W.n	127.0	4.1	131.1
V(W.n)	0.00	8.26	8.26
df	27	11	11

Wen= 131.1 V(Wen)= 8.26 df(Wen)= 11
80% CI around Wen = (127.2, 135.0) is +/- 2.99%
90% CI around Wen = (125.9, 136.2) is +/- 3.94%
95% CI around Wen = (124.8, 137.4) is +/- 4.83%

ESTIMATED TOTAL 2+ BULLS:

STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	152	11	163
Density	0.1351	0.0214	0.0802
W.n	152.0	22.5	174.5
V(W.n)	0.00	90.71	90.71
df	27	11	11

Wen= 174.5 V(Wen)= 90.71 df(Wen)= 11
80% CI around Wen = (161.5, 187.5) is +/- 7.44%
90% CI around Wen = (157.4, 191.6) is +/- 9.80%
95% CI around Wen = (153.5, 195.5) is +/- 12.01%

ESTIMATED MATURE MALES:

STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	65	12	77
Density	0.0578	0.0234	0.0411
W.n	65.0	24.6	89.6
V(W.n)	0.00	168.30	168.30
df	27	11	11

Wen= 89.6 V(Wen)= 168.30 df(Wen)= 11
80% CI around Wen = (71.9, 107.2) is +/- 19.75%
90% CI around Wen = (66.3, 112.9) is +/- 26.02%
95% CI around Wen = (61.0, 118.1) is +/- 31.88%

ESTIMATED TOTAL BULLS (2+ and Mature):

STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	217	23	240
Density	0.1929	0.0448	0.1213
W.n	217.0	47.1	264.1
V(W.n)	0.00	209.32	209.32
df	27	11	11

Wen= 264.1 V(Wen)= 209.32 df(Wen)= 11
80% CI around Wen = (244.3, 283.8) is +/- 7.47%
90% CI around Wen = (238.1, 290.0) is +/- 9.84%
95% CI around Wen = (232.2, 295.9) is +/- 12.06%

ESTIMATED TOTAL UNKNOWN:

STRATUM	high	low	TOTAL
N	28	26	54
Tot area	1124.80	1051.50	2176.30
n	28	12	40
Area sur	1124.86	513.85	1638.71
# seen	14	0	14
Density	0.0124	0.0000	0.0064
W.n	14.0	0.0	14.0
V(W.n)	0.00	0.00	0.00
df	27	11	99999

Wen= 14.0 V(Wen)= 0.00 df(Wen)= 9999
80% CI around Wen = (14.0, 14.0) is +/- 0.00%
90% CI around Wen = (14.0, 14.0) is +/- 0.00%
95% CI around Wen = (14.0, 14.0) is +/- 0.00%

RATIOS

RATIO OF TOTAL CALVES TO COWS:

p= 0.3135 V(p)= 0.00001860 df(p)= 11

80% CI around p = (0.3076, 0.3194) is +/- 1.87%

90% CI around p = (0.3058, 0.3213) is +/- 2.47%

95% CI around p = (0.3040, 0.3230) is +/- 3.03%

RATIO OF TOTAL BULLS (2+ and Mature) TO COWS:

p= 0.3884 V(p)= 0.00037827 df(p)= 11

80% CI around p = (0.3619, 0.4149) is +/- 6.82%

90% CI around p = (0.3535, 0.4234) is +/- 8.99%

95% CI around p = (0.3456, 0.4312) is +/- 11.02%

RATIO OF 2+ BULLS TO COWS:

p= 0.2567 V(p)= 0.00008468 df(p)= 11

80% CI around p = (0.2442, 0.2692) is +/- 4.89%

90% CI around p = (0.2402, 0.2732) is +/- 6.44%

95% CI around p = (0.2364, 0.2769) is +/- 7.89%

RATIO OF MATURE BULLS TO COWS:

p= 0.1317 V(p)= 0.00039613 df(p)= 11

80% CI around p = (0.1046, 0.1589) is +/- 20.59%

90% CI around p = (0.0960, 0.1675) is +/- 27.14%

95% CI around p = (0.0879, 0.1755) is +/- 33.25%

RATIO OF TOTAL YEARLINGS TO COWS:

p= 0.1928 V(p)= 0.00000550 df(p)= 11

80% CI around p = (0.1896, 0.1960) is +/- 1.66%

90% CI around p = (0.1886, 0.1970) is +/- 2.18%

95% CI around p = (0.1877, 0.1980) is +/- 2.68%

RATIO OF TOTAL UNKNOWNNS TO COWS:

p= 0.0206 V(p)= 0.00000048 df(p)= 11

80% CI around p = (0.0197, 0.0215) is +/- 4.57%

90% CI around p = (0.0194, 0.0218) is +/- 6.03%

95% CI around p = (0.0191, 0.0221) is +/- 7.38%

*Gasaway, W.C., S.D. Dubois, D.J. Reed, and S.J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biological Papers of the University of Alaska; no.22. 108pp.

Reed, D.J. 1989. Draft. Moosepop: program documentation and instructions. Alaska Department of Fish and Game. Fairbanks, AK. 15pp.