CRATERS OF THE MOON NATIONAL MONUMENT
MULE DEER SURVEY
2000

Prepared by:
Michael Munts
Biological Technician
Resource Management Division
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Executive Summary

Mule deer surveys were performed during the spring and fall of 2000. These included unstructured spring surveys as well as the systematic fall surveys in the north end of the monument. Systematic road surveys were continued on the loop road in addition to the usual informal count during May and June.

The number of does and yearlings observed in the spring counts were at similar numbers as in 1999. Although down from the record year of 1998, the number of both does and yearlings observed were near the 15 year average. Over winter survival of fawns at 55% was also at a near average value for the 16 years of monitoring.

The fall survey recorded numbers for all age classes, except yearling males, that were down from previous years. The fawn to adult ratio for the first time showed a major decline indicating either a change in previously stable birth rates or a decline in early fawn survival. The total population estimate also showed a significant decrease from the three and 15 year averages. This is likely a result of near drought conditions for the previous 15 months.

When the data was averaged into three year intervals the deer population shows a general pattern of decline since the mid 1980s. The numbers of all age/sex classes showed at least small increases in 1996-1998 over the previous three year period and showed very little change in 1999. Then fall 2000 numbers showed a significant decline.

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Introduction

Monitoring of the mule deer population began in 1980 when Griffith (Griffith, B. 1983. Ecological characteristics of mule deer: Craters of the Moon National Monument, Idaho. Report B-83 2. Coop. Park Studies Unit. Univ. of Idaho, Moscow 109 pp.) initiated a study on the population dynamics and habitat use of the monument's deer herd. As a result of this study Griffith developed site specific Standard Operating Procedures (SOP) for the continued monitoring of the deer population using an annual spring and late summer deer survey. These surveys were first performed in 1984 and have been conducted every year since.

Methods

In accordance with the monument's Standard Operating Procedures (SOP) informal spring surveys were conducted from late April until 30 June. During this period monument staff are requested to record any mule deer sighted. Most of these observations were made while in the field conducting other duties such as ranger patrols or other wildlife monitoring. Deer sighted were classified as adult males, adult females, yearlings and unknown. Starting in the spring of 1998 systematic road surveys were conducted in addition to the usual informal survey. The spring road surveys were conducted on the loop road starting at the Visitor Center and ending at the end of the one way section of the loop road. The route used included the spur road to the tree molds parking area but did not include the road to Devil's Orchard trailhead. Ten surveys were run on this route from 10 May to 29 June 2000.

From 14 August to 13 September, there were eight early morning surveys conducted from a vehicle along the 3.9 mile section of secondary road that runs from the North End gate off Highway 26 to the old Martin Mine site in the north end of the monument (appendix 2). Observations began 10 minutes after sunrise and were made in one direction only. Survey days were spread out evenly over the four week period, avoiding mornings with rain or winds greater than 10 mph. As with the spring surveys, all sightings were classified according to sex and age (adult, yearling, fawn). Surrounding hillsides, lava flows, and valleys along the route were carefully observed with the use of binoculars and a spotting scope. All surveys took approximately two hours to complete.

Over-winter survival rates were determined using the spring and previous year's late summer survey data. In order to get more normally distributed data for analysis the highest and lowest counts were dropped leaving the 6 middle surveys for statistical analysis. Population means, ratios and percent change estimates

were calculated for all age/sex classes. Population estimates and 95% confidence intervals were established using data from the six late summer surveys. Standard error estimates for each age and sex class in the late summer survey were calculated and 95% confidence intervals established using the student t-test.

Results

SPRING SURVEY

The number of adult does observed in the spring surveys was 87 (table 1). These included 61 in the usual informal survey and 26 in the structured road survey. The number of yearlings was 36. Overwinter fawn survival was 55%. This was only a little below the 15 year average of 62.5%. The yearling to doe ratio was similar at 51 compared to the 15 year average of 60. The percentage of does that were adults was 80 compared to the 15 year average of 73.

FALL SURVEY

The mean number of deer in most sex/age classes showed varying degrees of declines over 1999 counts (Table 1). The only exception was yearling males which had a mean count of 0.5 in 2000 which was identical to last year. Adult females at a mean of 13.8 decreased slightly from 15 in 1999. Fawns showed a decrease of 6 from 14 in 1999 to 8 in 2000. The total number of deer observed showed a substantial decline (23.5 from 33.8 in 1999) which was statistically significant at $p = 0.04$. The fawn to doe ratio at 59 was an even greater decline from the last year's ratio of 92. Fawn to adult doe ratios showed an even greater rate of decline falling from 132 in 1999 to 72 in 2000.

Conclusions

The 2000 fall deer counts showed decreases in all age classes except yearling males. Yearling males, which usually have low counts, remained the same as 1999 with a mean count of only 0.5. Most age classes declined in the fall and were at similar numbers in the spring survey compared to 1999. Declines in the fall counts were statistically significant ($P<0.05$) for the fawn counts and for the total numbers (Table 2). The mean counts were down 41% for fawns and 31% for the total counts. This pattern may be related to weather conditions that predominated in the two years. The winter of 1998-99 produced a snow pack 150% of the 40 year average. This was followed by an unusually dry summer and fall during 1999. With the good snowpack and spring rains, 1999 experienced decent growing and forage conditions at least into midsummer. By contrast the dry conditions of fall continued

through the winter of 1999-2000 and into spring and summer. Through the end of September the year 2000 has experienced only one month of average precipitation (February) and recorded the 2nd highest average temperature yet recorded at the monument (National Weather Service, Western Region Climate Center 2000). Incidental observations indicate poor growth and early drying of vegetation. The only surface water in the area is Little Cottonwood and Leech Creeks which dried up much earlier than normal and much higher up the stream channels than has been recorded in several years. This lack of water and forage has likely had a negative influence on fawn survival. Dry conditions will also cause deer to spread out over much larger areas in search suitable browse as well as open water. The search for water is also a likely factor in the increase in vehicle killed deer recorded on the highway. Deer will cross the highway to reach watered lawns in the main compound. In a dry year like 2000 the availability of water may force deer to take the risk of crossing the highway. The average number of roadkill deer is 13 but 20 were found this year. This was the highest number recorded since 1996 (table 1).

Over-winter fawn survival was 55% in 2000 compared with 43% in 1999. This was midrange value and only a little lower than the 15 average of 63%. The number of yearlings per 100 does showed the same pattern. This ratio was about 15% below the 15 year average but was the median value for the last five years.

Table 3 shows survey and population statistics in 3 year intervals since surveys began in 1984. Several trends are observable in this data. One is declining numbers of does and fawns in the fall survey since the mid 1980s. These data show that recent counts of these two age classes are about half of what they were in the mid 1980s. The most recent period (1999 and 2000) showed the lowest average count of fawns and the 2nd lowest for adult females. These declines are likely a result of climate and other factors already discussed. This year's data accounts for most of the drop with 1999 counts being near the 1996-98 levels.

Another trend is the declining overwinter survival of fawns. Fawn survival has declined nearly 30 percentage points since the early 1990s. This trend is noticeable for all periods since 1992. Fawn survival was down in 1999. But, even with a modest rebound in 2000 the most recent period is the lowest of any period to date.

Unlike females and fawns, male deer (both adults and yearlings) have always had comparatively low counts and they have not showed any consistent trends in their year to year numbers. This lack of trends is true both for spring and fall counts. This accounts for large percentage fluctuations not having much significance. A

decrease of 47% from 1998 to 1999 was less than a whole animal per survey.

One population statistic, which has remained relatively constant, has been the birth rate as measured by the ratio of fawns to adult does in the fall survey. This number has generally remained between 100 and 130 since 1988, except for unusually high years in 1990 and 91. Thus, population fluctuations during the last ten years are likely the result of survival rates rather than birth rates. The major exception to this was 2000. This year the fawn to adult doe ratio fell to an all time low of 74. This is 44% drop from the previous year and the 15 year average.

The total population estimates follow similar trends as the doe counts. That is declining numbers throughout the 1980s and mid 1990s with stabilizing numbers in the late 1990s and a crash this year. This trend was likely influenced by the occurrence of frequent drought years from the mid 1980s through the early 1990s. Throughout shrub lands of southern Idaho many stand replacing fires occurred during this time period. This included the 1992 Little Prairie Fire in the monument. These environmental conditions produced poor forage conditions compared with the first few years of deer monitoring in the monument. In the years since the drought, vegetation has begun to recover. Which may explain the stabilizing numbers in the last 4 years. Late summer 1999 through September of 2000 had similar drought like conditions and the resulting poor forage. Time will tell whether the drought and resulting population declines will follow.

Recommendations

Spring surveys have always been informal with monument staff recording deer sightings as they have occurred. The problem with this approach is there is no way to measure the sampling effort in any year or combination of years. Known sampling effort is necessary to compare results between years. The current standard operating procedure makes any comparison of numbers very difficult and highly questionable. The current methods can only provide a very general look at broad scale trends in the population. In order to get more comparable numbers from year to year in the spring survey, structured surveys begun in 1998 should be continued. The standard operating procedures will be revised to include these surveys. To further quantify spring use of the monument by mule deer it may be useful to expand the survey area to include walking surveys on the wilderness trail or other areas of deer use.

Annual weather patterns are also a factor in the movement of deer in the region. In years like 1998, which produce excellent forage conditions, deer may be more spread out rather than actually experiencing an apparent decline. In other years like 1999, which

are unusually dry in spring and summer, deer may be more concentrated in areas of better forage or available water. In even more dry years like 2000 when water sources dry up the deer likely suffer higher mortality, lower reproduction, and spread out even more in search of water. These factors will be difficult to determine without much more widespread surveys and great caution when looking at single year data. Data under these conditions is best looked at over periods of several years and for analysis of long term trends rather than year to year fluctuations.

Table I. Summaries for 1996-2000 Craters of the Moon National Monument Mule Deer Survey.

SPRING	1996	1997	1998	1999	2000	15 year Average
Adult Doe	50	42	120	95	87	64
Yearlings	25	21	68	38	45	39
Yearling:100 Doe	50	47	57	40	51	60
Over-winter Survival	51.8%	47%	70%	43%	55%	63%
Total Does	63	52	154	114	110	99
Adult Doe Ratio	0.8	0.81	.78	83	80	73
FALL						
Mean # Adult Males	4.2	3.5	3.7	3.8	1.0	3.6
Percent change	-6.7%	-16.7%	5.7%	2.7%	-73%	
Mean # Yearling Male	3.67	1.5	1.2	0.5	0.5	3.4
Percent change	118%	-59.1%	-20%	-46.7%	0.0	
Mean # Adult Females	18.3	17.0	13.5	15	13.8	21.8
Percent change	44.0%	-7.1%	-20.6%	18.8%	-7.8%	
Mean # Fawns	18.5	14.0	10.8	14	8.2	21.0
Percent change	4.7%	-24.3%	-22.9%	22.9%	-41.7	
MEAN TOTAL	44.7	37.7	27.5	33.3	23.5	48.9
Fawns:100 Does	101	82.1	92	92.4	59	97.8
Fawns:100 Adult Does	126.3	101	117	132	74	131
FALL POP'N ESTIMATES	345	294	232	266	191	
95% CI	225-465	170-417	55-409	208-324	164-217	
VEHICLE KILLS						
Adult males	1	0	0	2	0	1.4
Yearling males	0	0	1	0	3	1.2
Adult females	15	7	4	1	10	5.4
Fawns	9	6	7	4	7	5.3
Unknown	1	1	0	1	0	0.7
Total	**26**	**14**	**12**	**7**	**20**	**13.6**

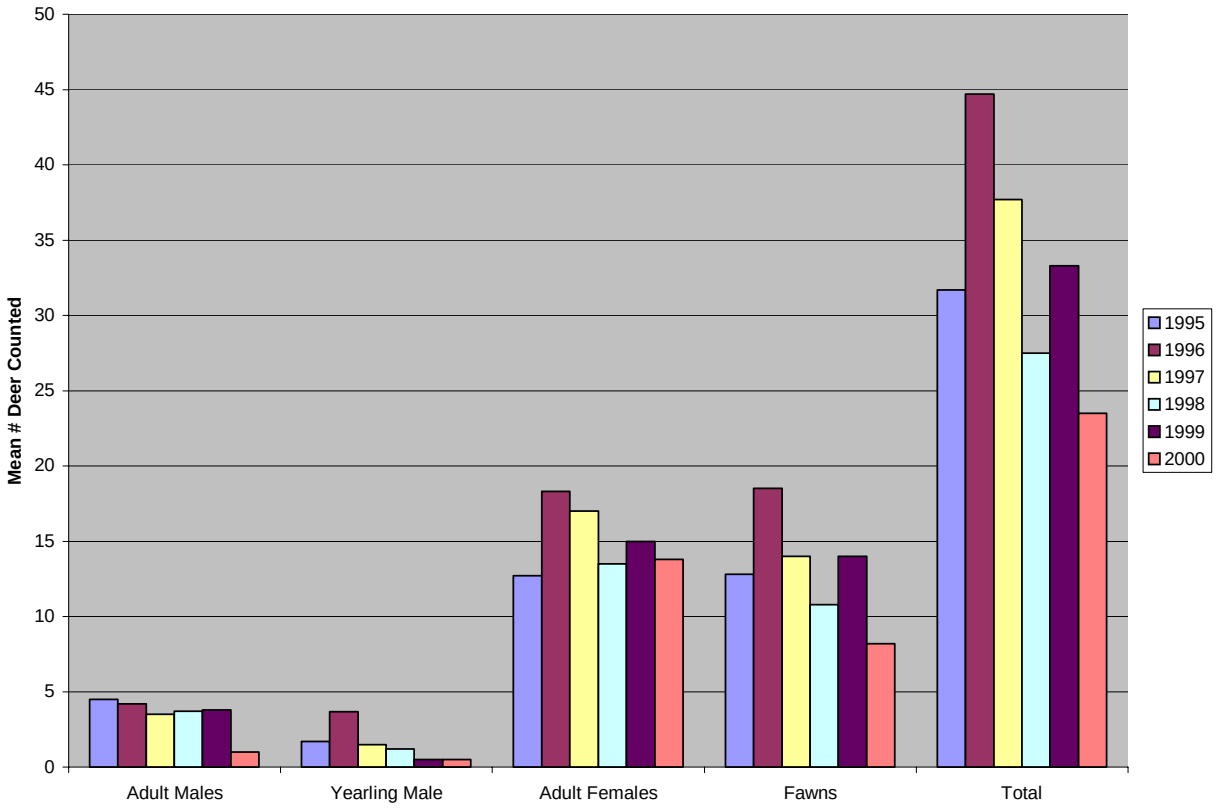


Figure 1. Mean number of mule deer counted in fall surveys 1995-2000.

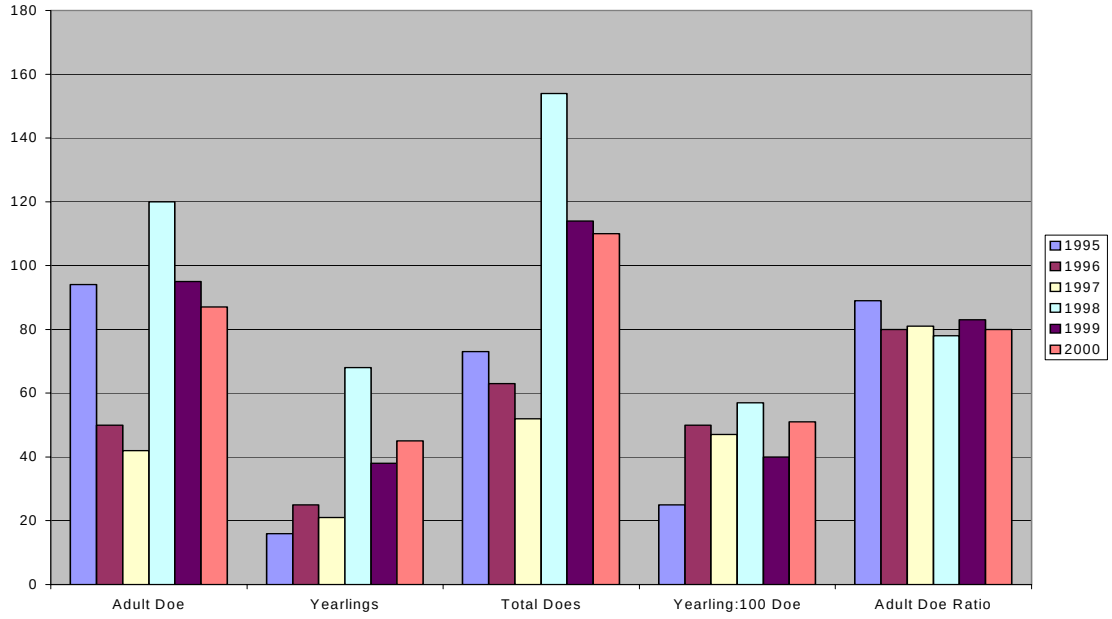


Figure 2. Number of deer counted in spring surveys 1995-2000.

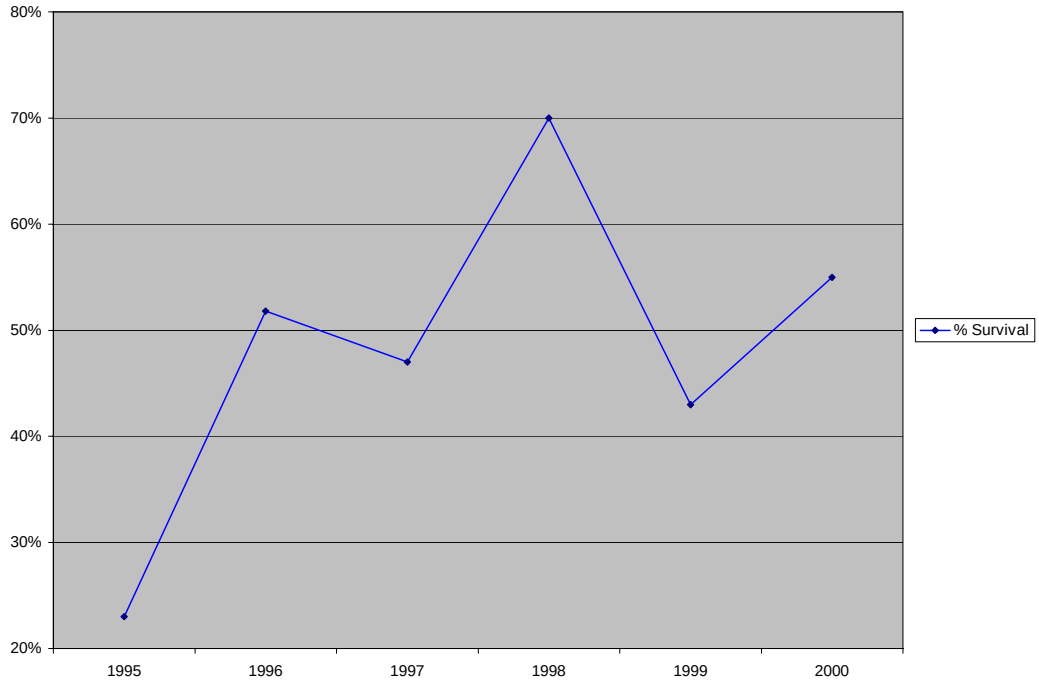


Figure 3. Percent over winter survival of fawns 1995-2000

Table 2. Daily survey totals, mean totals, and standard error figures for each class (age/sex) of deer in the 2000 Craters of the Moon National Monument Mule Deer Fall Survey.

		1st	2nd	3rd	4th	5th	6th	total	mean	SE	Significant Change
Ault males	#	0.0	6.0	0.0	0.0	0.0	0.0	6.0	1.0	1.0	0.099
	ratio	0.0	0.5	0.0	0.0	0.0	0.0		0.1		
Yrlg males	#	0.0	0.0	0.0	1.0	1.0	1.0	3.0	0.5	0.2	1.000
	ratio	0.0	0.0	0.0	0.1	0.1	0.1		0.0		
Females	#	14.0	11.0	10.0	13.0	17.0	18.0	83.0	13.8	1.3	0.578
	ratio	100.0	100.0	100.0	100.0	100.0	100.0		100.0		
Fawns	#	9.0	9.0	5.0	9.0	9.0	8.0	49.0	8.2	0.7	0.001
	ratio	64.3	81.8	50.0	69.2	52.9	44.4		60.5		
Unknown		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total		23.0	26.0	15.0	23.0	27.0	27.0	141.0	23.5	1.9	0.044

Significant change is the P value from a student t-test between means for 2000 and 1999 counts
ratio = the age/sex class to adult doe ratio for a survey

Table 3. Craters of the Moon National Monument Mule Deer Survey Summaries in 3 year intervals for the period 1984-2000.

	1984-86	1987-89	1990-92	1993-95	1996-98
SPRING					
Adult Doe	71	59	47	48	71
Yearlings	62	40	41	16	38
Yearling:100 Doe	71	65	85	44	51
Over-winter Survival	68%	66%	79%	55%	56%
Total Does	120	79.5	67	56	90
Adult Doe Ratio	0.74	0.76	0.71	0.82	0.80
FALL					
Mean # Adult Males	2.4	3.2	5.6	3.4	3.8
Percent change		33%	75%	-39%	12%
Mean # Yearling Male	4.8	4.0	2.4	1.2	2.2
Percent change		-17%	-40%	-50%	83%
Mean # Adult Females	29	27	27	12.2	16
Percent change		-7%	0%	-55%	27%
Mean # Fawns	30	22	29	12	14
Percent change		-26%	32%	-60%	17%
MEAN TOTAL	66	55	64	28	37
Fawns:100 Does	106	93	105	96	92
Fawns:100 Adult Does	144	123	170	116	115
VEHICLE KILLS					
Adult males	1.3	1.7	1.3	1.3	0.3
Yearling males	3.0	2.0	0.0	0.7	0.3
Adult females	7.0	3.3	5.6	3.7	8.7
Fawns	9.0	5.0	1.0	2.3	7.3
Unknown	1.0	0.3	1.0	0.3	0.7
TOTALS	**21.3**	**12.3**	**8.9**	**8.3**	**17.3**
FALL POP'N ESTIMATES	**502**	**417**	**486**	**228**	**290**

Table 3. Craters of the Moon National Monument Mule Deer Survey Summaries in 3 year intervals for the period 1984-2000.

	1984-86	1987-89	1990-92	1993-95	1996-98	1999-2000
SPRING						
Adult Doe	71	59	47	48	71	91
Yearling	62	40	41	16	38	42
Yearling:100 Doe	71	65	85	44	51	46
Over-winter Survival	68%	66%	79%	55%	56%	49%
Total Does	120	80	67	56	90	112
Adult Doe Ratio	0.74	0.76	0.71	0.82	0.80	0.82
FALL						
Mean # Adult Males	2.4	3.2	5.6	3.4	3.8	2.4
Percent Change		33%	75%	-39%	12%	-37%
Mean # Yearling Males	4.8	4.0	2.4	1.2	2.2	0.5
Percent Change		-17%	-40%	-50%	83%	-77%
Mean # Adult Females	29	27	27	12	16	14.4
Percent Change		-7%	0%	-55%	27%	-10%
Mean # Fawns	30	22	29	12	14	11.1
Percent Change		-26%	32%	-60%	17%	-21%
MEAN TOTAL	66	55	64	28	37	28.4
Fawns:100 Does	106	93	105	96	92	78
Fawns:100 Adult Does	144	123	170	116	115	103
VEHICLE KILLS						
Adult Males	1.3	1.7	1.3	1.3	0.3	1
Yearling Males	3.0	2.0	0.0	0.7	0.3	1.5
Adult Females	7.0	3.3	5.6	3.7	8.7	7.7
Fawns	9.0	5.0	1.0	2.3	7.3	5.5
Unknown	1.0	0.3	1.0	0.3	0.7	0.5
TOTALS	21.3	12.3	8.9	8.3	17.3	13.5
FALL POPULATION ESTIMATES	502	417	486	228	290	179

Appendix 1. Summaries for the Craters of the Moon National Monument Annual Mule Deer Survey from 1984-1994.

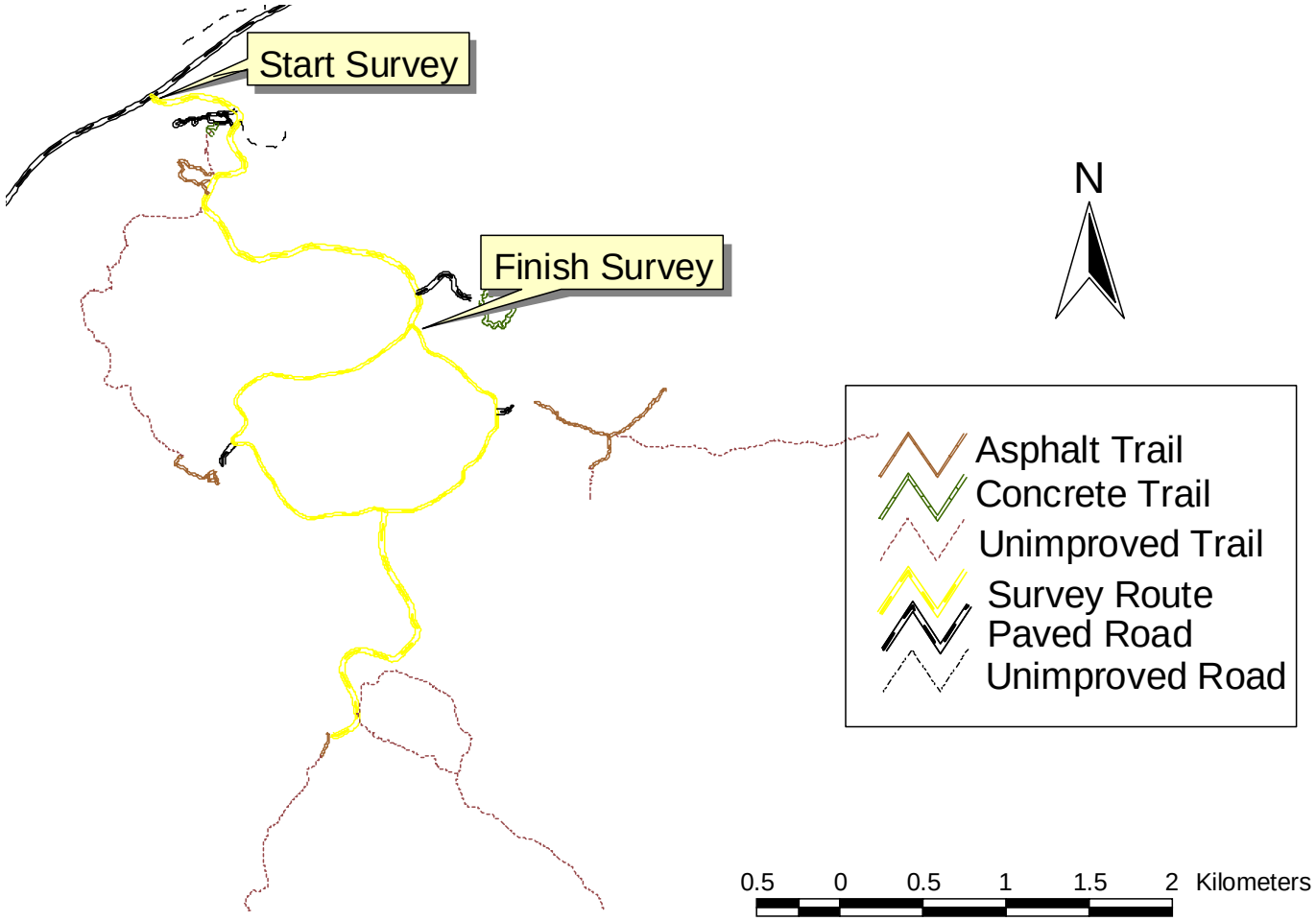
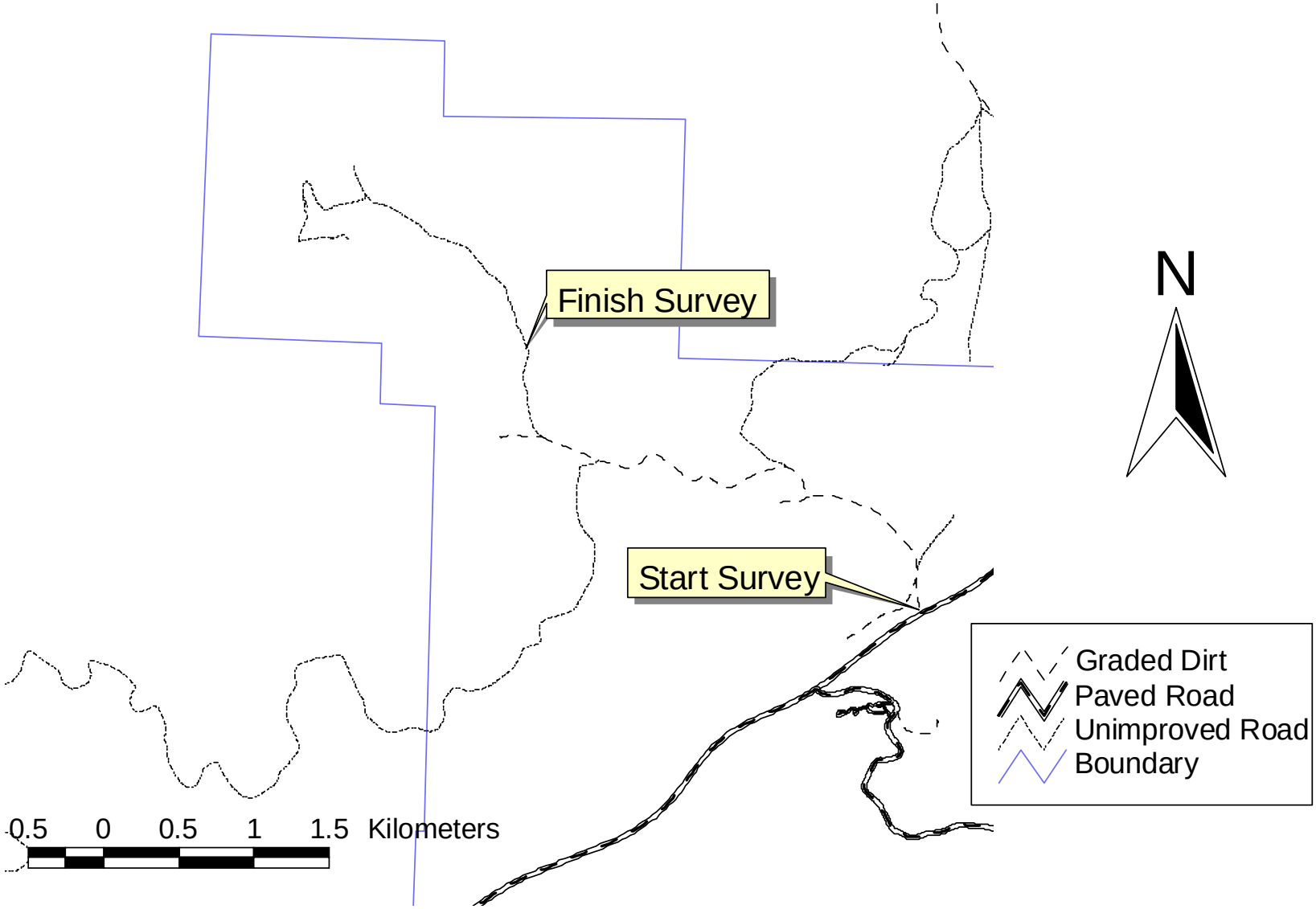
	1984	1985	1986	1987	1988	1989
SPRING						
Adult Doe	55	51	106	71	58	49
Yearlings	47	31	109	47	60	13
Yearling:100 Doe	85.5	60.80	68.10	66.20	103.05	26.05
Over-winter Survival	84.0%	55.00%	65.90%	64.20	100.00%	34.50%
Total Does	78.05	66.50	214.50	94.50	88.00	56
Adult Doe Ratio	0.70	0.77	0.75	0.75	0.66	0.88
FALL						
Mean # Adult Males	4.10	1.33	1.83	2.5	3.7	3.33
Percent change	-2.40%	-67.60%	37.60%	36.60%	48.00%	-10.00%
Mean # Yearling Male	6.60	5.67	2.00	4.00	6.30	1.83
Percent change	37.50%	-14.15	-64.70%	100.00%	57.50%	-70.00%
Mean # Adult Females	30.00	30.00	26.00	25.50	26.70	28.83
Percent change	-17.80%	0.0%	-13.30%	-1.90%	4.70%	-10.75%
Mean # Fawns	33.10	31.00	26.83	25.33	20.50	20.33
Percent change	-11.00%	-6.40%	-13.50%	-5.60%	-19.00%	-0.83%
MEAN TOTAL	74.00	68.00	56.67	57.30	57.20	49.33
Fawns:100 Does	110.50	103.30	103.20	116.3	77.0	85.30
Fawns:100 Adult Does	157.90	134.70	138.30	154.80	116.80	96.50
VEHICLE KILLS						
Adult males	1	1	2	2	3	0
Yearling males	1	4	4	3	3	0
Adult females	4	8	9	5	2	3
Fawns	8	11	8	7	6	2
Unknown	1	0	2	1	0	0
TOTALS	**15**	**24**	**25**	**18**	**14**	**5**
HUNTER KILLS						
Adult males	1	11	14	4	14	9
Yearling males	1	23	21	19	27	13
Adult females	3	29	17	11	18	18
Fawns	8	5	5	7	6	1
Unknown	1	0	0	0	0	0
TOTALS	**14**	**68**	**57**	**41**	**65**	**41**
ILLEGAL KILLS						
Adult males	3	1	1	MD	MD	4
Yearling males	0	1	1	MD	MD	0
Adult females	0	6	5	MD	MD	1
Fawns	0	1	1	MD	MD	0
Unknown	0	0	1	MD	MD	0
TOTALS	**3**	**9**	**9**	**MD**	**MD**	**5**
FALL POP'N ESTIMATES	***559***	***515***	***432***	***437***	***436***	***379***
95% CI	***436-682***	***408-622***	***335-529***	***340-534***	***339-533***	***272-486***

Appendix I continued....

	1990	1991	1992	1993	1994
SPRING					
Adult Doe	42	52	MD	10	68
Yearlings	31	50	MD	7	25
Yearling:100 Doe	73.80	96.15	MD	70	36.8
Over-winter Survival	86.00%	72.64%	MD	96.50%	44.0%
Total Does	57	77	MD	13.50	80.5
Adult Doe Ratio	0.74	0.68	MD	0.74	.84
FALL					
Mean # Adult Males	6.67	7.83	2.30	0.17	5.5
Percent change	100.00%	17.39%	-70.62%	-92.60%	3135%
Mean # Yearling Male	2.83	2.83	1.50	0	1.8
Percent change	54.64%	0.00%	46.99%	-100.00%	0%
Mean # Adult Females	23.67	37.67	20	5.70	18.3
Percent change	-0.67%	59.15%	-46.91%	-71.50%	221%
Mean # Fawns	31.33	41	14.50	4.70	17.0
Percent change	54.11%	30.86%	-64.63%	-67.59	262%
MEAN TOTAL	64.50	89.33	38.30	10.50	42.6
Fawns:100 Does	132.40	108.80	72.50	82.50	108
Fawns:100 Adult Does	178.90	161.11	MD	111.50	128.6
VEHICLE KILLS					
Adult males	1	1	2	1	2
Yearling males	0	0	0	0	0
Adult females	3	4	3	2	6
Fawns	1	1	1	2	4
Unknown	0	0	3	1	0
TOTALS	**5**	**5**	**9**	**6**	**12**
HUNTER KILLS					
Adult males	20	7	17	7	9
Yearling males	6	3	0	0	0
Adult females	9	0	8	0	4
Fawns	4	0	0	0	0
Unknown	0	4	0	0	0
TOTALS	**39**	**14**	**25**	**7**	**13**
ILLEGAL KILLS					
Adult males	0	1	3	0	0
Yearling males	0	0	0	0	0
Adult females	3	0	0	0	0
Fawns	3	0	0	0	0
Unknown	0	1	0	0	0
TOTALS	**6**	**2**	**3**	**0**	**0**
FALL POP'N ESTIMATES	***490***	***671***	***298****	***96***	***330****
95% CI	***389-591***	***490-852***	***157-439***	***0-357***	***204-456***

MD = missing data
* = indicates significant change using the 95% Confidence Intervals

Spring Survey Route



Fall Survey Route