

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5

**Grant Type:** Survey and Inventory

**Period Covered:** July 1, 2004 – June 30, 2005

**Project II:** MOOSE RESEARCH AND MANAGEMENT

**Job 1:** Harvest Data Collection, Entry and Analysis

**Job Objective:** To efficiently gather information on harvested moose including age, sex, date, method and location of take. To collect biological samples from harvested moose for toxicological and pathological examination and condition evaluation.

**Summary:** The 2004 season ran from October 17<sup>th</sup> through October 24<sup>th</sup>. The entire state was open. Both either-sex (505) and antlerless-only (20) permits were drawn. Antlerless-only permits were issued in units A2. A total of 525 permits were drawn and 522 were issued statewide. Three hundred and eighty-eight animals were taken during the 2004 season for an overall success rate of 74%. All animals had a tooth pulled for aging. Age structure was similar to past years (see Table 1). Mean corpora lutea count was 1.34 for animals 4.5 years of age or older and 0.29 for yearlings. The five-year trend analysis suggests an increase in the percentage of kill that is bulls (71.53%). In addition the either-sex success rate (73.8%) has increased (2.35,  $R^2 = 0.80$ ,  $\text{Prob}>F 0.0392$ ). All other indices remain stable. The statewide take consisted of approximately 72% bulls (280), 25% cows (96) and 3% calves (12). Sixty-six percent of animals were taken in the first three days of the season. While 94.07% of animals were taken using rifles, animals were also taken using shotguns (1.29%), muzzleloaders (2.06%), bow (1.55%) and handgun (0.26%). Moose were taken in all management units. Liver and kidney samples were not collected and ectoparasite checks were not conducted this year. All information can be found in Tables 1 through 2 and **Appendix I**.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None

**Total Cost:**

**Procedures:** All harvested moose were registered at one of seven biological moose check stations, strategically distributed throughout the state. During registration, check station staff consisting of at least one Fish and Game Department wildlife biologist, collected information from harvested moose that included: sex, weight, age, antler characteristics, location of kill, and biological samples that include an incisor for aging, and ovaries for reproductive assessments. All data were entered into an historic computer data set. Five-year trend analysis was performed using SAS (Statistical Analysis Systems) software.

**Results:** Statewide indices reflected an increase in the percentage of bulls taken (3.4 bulls/cow in 2004 vs 2.4 in 2000). In addition either-sex permit hunting success rate has increased from 63.8% in 2000 to 73.8% in 2004. Moose seen/hour by moose hunters has remained stable during this same time rising only slightly from 0.18 to 0.20.

Comparison of regional data bases reveals that moose hunters in the northern region saw the greatest numbers of moose at .030 seen/hour and this index declined from north to southeast with the Southeastern

region seeing the fewest moose at 0.04 moose seen/hour. Success rates mimic this pattern with the highest success rate found in the North region (91.2%) declining to 45.0% in the Southeast. Small sample sizes in the two southern regions preclude comparing the remaining indices across all regions.

Five-year trend analysis of regional either-sex permit success rates increased significantly in the White Mountains (2.79,  $R^2=0.82$ ) but did not change significantly for any other region. Antlerless-only permit success rates in the North region remain high at 89.5%. The Southeast region continues to have the lowest either-sex success rate (45.0%) but this was the highest success rate experienced in that region since the season started in 1994. The North region continues to have the highest either-sex success rate at 91.4%.

The North region showed significant increases in the proportion of bulls to cows (0.49,  $R^2=0.91$ ) in the kill. Bulls/cow has increased steadily since 1999, increasing from 2.1 to 4.8. Moose seen per hour has also increased steadily from 2000 to 2003 and has stayed at the 2003 high of 0.30. Either-sex success rates declined slightly from 2003 (95.2% – 91.4%) although this decline was not significant. No other values exhibited any significant change.

Success rate for the White Mountains continued to exhibit a small increasing annual trend (2.79,  $R^2=0.82$ ). This was felt to be in response to a reduction in permits in 2002 (170 permits issued in 1999 to 98 issued in 2003). However, success rates have remained high (72.2 %) after an increase in permits from 98 – 115 in 2004. Moose seen per hour has increased from 0.13 in 2000 to 0.17 in 2004 although this change is not significant. All other parameters remained stable.

Trend analysis for the Central region suggests very little change here. There has been a slight but steady decline in numbers of moose seen by moose hunters (0.14, 2000 to 0.11 in 2004) in the past five years and this is significant ( $R^2 = 0.88$ ). The success rate at 60% is within normal limits for this region.

There are no significant changes coming from the Southwest region. The apparent significant change in yearling copora lutea counts is sample size related. Success rate in this region has been quite variable over the years and continues to exhibit large fluctuations from year to year.

Small sample sizes in the Southeast region make interpretation of data difficult. All trend indices are stable with the exception of moose seen/hour which has declined from 0.08 in 2000 to 0.04 in 2004 (annual trend;  $-0.01, R^2 = 0.72$ ). Success rate at 45.0% was the highest it's been since the inception of the hunt in this region in 1994.

**Conclusions:** Mandatory moose registration coupled with the operation of 7 biological moose check stations successfully facilitates the collection of biological data that serves as the cornerstone of moose management decision making in New Hampshire. Overall copora lutea information, carcass weights and antler measurements indicate animals are in good health.

**Recommendations:** Continue this job as planned. Trend analysis of parameters with very small sample sizes is very misleading. To make this information more useful, years of data should be grouped together and trend analysis done on the groups of data.

Prepared by: \_\_\_\_\_  
Kristine M Bontaites  
Moose Project Leader

Date: \_\_\_\_\_

**Table 1. Results of Cementum Aging for Moose Taken in the 2004 Season.**

<b>CALVES</b>	<b>YEARLINGS</b>	<b>2.5 AND 3.5 YEARS</b>	<b>4.5 YEARS AND OLDER</b>
3.09%	20.88%	36.86%	39.18%

**Table 2.** 2004 NORTH REGION MOOSE HARVEST SUMMARY WITH PREVIOUS 4 YEARS  
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YEAR	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS HARVEST ISSUED*	PERMITS SUCCESS RATE*	TOTAL KILL/ SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/ HOUR	YEAR			
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	AGE 4.5+ N			MEAN	MEAN	
2000	185	225	82.2	136	160	85.0	49	65	75.4	0.132	33.1 (49.7)	2.3 ( 1.1)	16.1	20	0.40	24	1.38	0.23	2000
2001	197	224	87.9	144	159	90.6	53	65	81.5	0.140	31.9 (49.7)	2.4 ( 1.1)	15.2	31	0.58	28	1.32	0.28	2001
2002	164	175	93.7	117	125	93.6	47	50	94.0	0.117	28.2 (48.2)	2.8 ( 1.3)	20.0	16	0.19	24	0.88	0.29	2002
2003	160	174	92.0	118	124	95.2	42	50	84.0	0.114	20.8 (40.7)	3.8 ( 1.5)	19.8	24	0.38	17	1.41	0.30	2003
2004	198	217	91.2	181	198	91.4	17	19	89.5	0.141	21.5 (27.8)	4.1 ( 2.9)	19.6	11	0.09	19	1.32	0.30	2004

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 NORTH REGION MOOSE HARVEST SUMMARY (UNIT DETAIL)

UNIT	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS HARVEST ISSUED*	PERMITS SUCCESS RATE*	TOTAL KILL/ SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/ HOUR	UNIT			
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	AGE 4.5+ N			MEAN	MEAN	
A1	13	15	86.7	13	15	86.7	.	0	.	0.085	23.1 (23.1)	3.3 ( 3.3)	40.0	1	0.00	0	.	0.35	A1
A2	86	92	93.5	69	73	94.5	17	19	89.5	0.205	29.0 (41.9)	2.7 ( 1.5)	18.0	7	0.00	12	1.17	0.26	A2
B	47	49	95.9	47	49	95.9	.	0	.	0.136	8.5 ( 8.5)	10.8 (10.8)	20.9	1	1.00	2	1.50	0.47	B
C2	34	40	85.0	34	40	85.0	.	0	.	0.136	26.5 (26.5)	3.6 ( 3.6)	12.0	1	0.00	4	1.50	0.29	C2
D1	18	21	85.7	18	21	85.7	.	0	.	0.075	16.7 (16.7)	5.0 ( 5.0)	20.0	1	0.00	1	2.00	0.19	D1

\* - NOTE: Permits issues and success rates prior to 1996 based on old unit boundaries.

2004 NORTH REGION HARVEST TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ES SUCCESS RATE	5	1.74	0.50	0.1796
ES ADULT BULLS/COW	5	0.49	0.91	0.0112
ES % COWS & CALVES	5	-3.42	0.89	0.0149
CL COUNT (AGE 1.5)	5	-0.08	0.46	0.2074
% ANT. BULLS AGE 1.5	5	1.15	0.63	0.1102
MOOSE SEEN/HOUR	5	0.02	0.75	0.0566
AGE 1.5 BULL ABD	5	-0.42	0.25	0.3877
AGE 1.5 BULL WEIGHT	5	-0.27	0.00	0.9622
AGE 1.5 BULL SPREAD	5	0.29	0.21	0.4430

2004 NORTH REGION SUMMARY OF MISCELLANEOUS BIOLOGICAL VARIABLES

VARIABLE	----- AGE 1.5 -----				----- AGE 5.5+ -----			
	N	MIN.	MAX.	MEAN (SE)	N	MIN.	MAX.	MEAN (SE)
ANTLER BEAM DIAMETER	26	18.0	48.0	33.4 ( 1.2)	42	44.0	78.0	60.5 ( 1.1)
ANTLER SPREAD	25	11.5	40.0	23.7 ( 1.3)	41	41.0	66.3	53.0 ( 0.9)
TOTAL POINTS	26	2	8	4.5 ( 0.3)	41	7	25	17.4 ( 0.7)
CARCASS WEIGHT (BULLS)	24	350	570	456.9 ( 11.1)	38	630	910	797.5 ( 11.7)
CARCASS WEIGHT (COWS)	12	210	570	414.2 ( 27.6)	7	425	660	550.7 ( 30.4)
CARCASS WEIGHT (CALVES)	5	140	235	199.0 ( 19.6)				

NOTE: 2 CALVES ( 40%) WEIGHED LESS THAN 200 POUNDS

2004 W. MTN. REGION MOOSE HARVEST SUMMARY WITH PREVIOUS 4 YEARS  
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YEAR	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS HARVEST ISSUED*	PERMITS SUCCESS RATE*	TOTAL KILL/ SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/ HOUR	YEAR
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N MEAN	AGE 4.5+ N MEAN		
2000	78	129	60.5	78	129	60.5	.	0	0.040	30.8 (30.8)	2.6 ( 2.6)	22.2	3 0.33	5 1.60	0.13	2000
2001	87	130	66.9	87	130	66.9	.	0	0.045	37.9 (37.9)	2.1 ( 2.1)	33.3	5 0.40	12 1.58	0.14	2001
2002	71	100	71.0	71	100	71.0	.	0	0.036	35.2 (35.2)	2.2 ( 2.2)	17.4	4 0.50	12 1.17	0.15	2002
2003	70	98	71.4	70	98	71.4	.	0	0.036	28.6 (28.6)	2.5 ( 2.5)	12.0	5 0.60	11 1.18	0.12	2003
2004	83	115	72.2	83	115	72.2	.	0	0.043	26.5 (26.5)	3.2 ( 3.2)	21.3	5 0.40	7 1.29	0.17	2004

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 W. MTN. REGION MOOSE HARVEST SUMMARY (UNIT DETAIL)

UNIT	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS HARVEST ISSUED*	PERMITS SUCCESS RATE*	TOTAL KILL/ SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/ HOUR	UNIT
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N MEAN	AGE 4.5+ N MEAN		
C1	23	25	92.0	23	25	92.0	.	0	0.112	21.7 (21.7)	3.6 ( 3.6)	33.3	1 0.00	2 1.50	0.21	C1
D2	16	25	64.0	16	25	64.0	.	0	0.033	18.8 (18.8)	4.3 ( 4.3)	7.7	0 .	1 2.00	0.13	D2
E1	10	15	66.7	10	15	66.7	.	0	0.045	30.0 (30.0)	2.3 ( 2.3)	28.6	1 0.00	2 1.50	0.25	E1
E2	5	5	100.0	5	5	100.0	.	0	0.020	20.0 (20.0)	4.0 ( 4.0)	0.0	1 1.00	0 .	0.29	E2
E3	12	19	63.2	12	19	63.2	.	0	0.039	50.0 (50.0)	2.0 ( 2.0)	33.3	1 0.00	1 0.00	0.23	E3
F	17	26	65.4	17	26	65.4	.	0	0.035	23.5 (23.5)	3.3 ( 3.3)	15.4	1 1.00	1 1.00	0.12	F

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 W. MTN. REGION HARVEST TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS			
	USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ES SUCCESS RATE	5	2.79	0.82	0.0350
ES ADULT BULLS/COW	5	0.17	0.37	0.2771
ES % COWS & CALVES	5	-1.79	0.36	0.2843
CL COUNT (AGE 1.5)	5	0.03	0.26	0.3854
% ANT. BULLS AGE 1.5	5	-2.32	0.22	0.4295
MOOSE SEEN/HOUR	5	0.01	0.24	0.3985
AGE 1.5 BULL ABD	5	0.55	0.22	0.4227
AGE 1.5 BULL WEIGHT	5	-1.88	0.06	0.6972
AGE 1.5 BULL SPREAD	5	-0.49	0.21	0.4388

2004 W. MTN. REGION SUMMARY OF MISCELLANEOUS BIOLOGICAL VARIABLES

VARIABLE	AGE 1.5				AGE 5.5+			
	N	MIN.	MAX.	MEAN (SE)	N	MIN.	MAX.	MEAN (SE)
ANTLER BEAM DIAMETER	13	18.0	51.0	36.1 ( 2.4)	15	47.0	75.0	60.1 ( 1.8)
ANTLER SPREAD	13	12.3	30.5	22.9 ( 1.3)	15	39.0	58.5	53.1 ( 1.5)
TOTAL POINTS	12	2	10	4.6 ( 0.6)	15	14	22	17.5 ( 0.7)
CARCASS WEIGHT (BULLS)	10	360	570	452.5 ( 16.7)	13	570	875	755.0 ( 22.0)
CARCASS WEIGHT (COWS)	5	460	500	476.0 ( 7.5)	5	450	620	549.0 ( 33.7)
CARCASS WEIGHT (CALVES)	3	170	210	193.3 ( 12.0)				

NOTE: 1 CALVES ( 33%) WEIGHED LESS THAN 200 POUNDS

2004 CENTRAL REGION MOOSE HARVEST SUMMARY WITH PREVIOUS 4 YEARS  
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YEAR	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS	PERMITS SUCCESS RATE*	TOTAL KILL/SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/HOUR	YEAR		
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	MEAN			AGE 4.5+ N	MEAN
2000	79	134	59.0	79	134	59.0	.	0	0.025	27.8 (27.8)	2.7 ( 2.7)	14.0	3	0.33	8	1.25	0.14	2000
2001	88	135	65.2	88	135	65.2	.	0	0.028	26.1 (26.1)	3.6 ( 3.6)	12.3	2	1.00	9	1.33	0.14	2001
2002	89	141	63.1	89	141	63.1	.	0	0.029	34.8 (34.8)	2.0 ( 2.0)	17.2	7	0.71	13	1.54	0.13	2002
2003	101	140	72.1	101	140	72.1	.	0	0.032	29.7 (29.7)	2.5 ( 2.5)	21.1	4	1.00	14	1.43	0.11	2003
2004	84	140	60.0	84	140	60.0	.	0	0.027	26.2 (26.2)	3.1 ( 3.1)	17.7	7	0.57	8	1.50	0.11	2004

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 CENTRAL REGION MOOSE HARVEST SUMMARY (UNIT DETAIL)

UNIT	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS	PERMITS SUCCESS RATE*	TOTAL KILL/SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/HOUR	UNIT		
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	MEAN			AGE 4.5+ N	MEAN
G	25	40	62.5	25	40	62.5	.	0	0.038	32.0 (32.0)	2.1 ( 2.1)	11.8	4	0.50	3	1.67	0.16	G
H1	8	10	80.0	8	10	80.0	.	0	0.020	50.0 (50.0)	2.0 ( 2.0)	25.0	0	.	0	.	0.10	H1
I1	7	20	35.0	7	20	35.0	.	0	0.019	14.3 (14.3)	6.0 ( 6.0)	66.7	1	1.00	0	.	0.08	I1
I2	20	30	66.7	20	30	66.7	.	0	0.052	15.0 (15.0)	5.7 ( 5.7)	11.8	0	.	1	1.00	0.10	I2
J1	9	15	60.0	9	15	60.0	.	0	0.019	0.0 ( 0.0)	. ( . )	0.0	0	.	0	.	0.10	J1
J2	15	25	60.0	15	25	60.0	.	0	0.018	40.0 (40.0)	1.5 ( 1.5)	22.2	2	0.50	4	1.50	0.09	J2

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

\*\* - NOTE: Permits issued and success rates based on I as a whole, prior to 2000 unit split.

2004 CENTRAL REGION HARVEST TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ES SUCCESS RATE	5	0.90	0.07	0.6568
ES ADULT BULLS/COW	5	-0.03	0.01	0.8990
ES % COWS & CALVES	5	0.03	0.00	0.9860
CL COUNT (AGE 1.5)	5	0.05	0.07	0.6693
% ANT. BULLS AGE 1.5	5	1.62	0.56	0.1463
MOOSE SEEN/HOUR	5	-0.01	0.88	0.0182
AGE 1.5 BULL ABD	5	0.28	0.07	0.6571
AGE 1.5 BULL WEIGHT	5	-1.35	0.02	0.8108
AGE 1.5 BULL SPREAD	5	0.32	0.11	0.5884

2004 CENTRAL REGION SUMMARY OF MISCELLANEOUS BIOLOGICAL VARIABLES

VARIABLE	----- AGE 1.5 -----				----- AGE 5.5+ -----			
	N	MIN.	MAX.	MEAN (SE)	N	MIN.	MAX.	MEAN (SE)
ANTLER BEAM DIAMETER	11	30.0	50.0	36.6 ( 1.9)	19	45.0	67.0	55.6 ( 1.3)
ANTLER SPREAD	11	22.0	36.8	26.1 ( 1.2)	19	26.0	58.8	47.9 ( 1.6)
TOTAL POINTS	11	3	12	6.0 ( 0.8)	18	4	25	15.2 ( 1.2)
CARCASS WEIGHT (BULLS)	10	370	520	441.0 ( 13.6)	17	630	790	735.0 ( 12.3)
CARCASS WEIGHT (COWS)	6	250	510	431.7 ( 37.8)	4	470	750	602.5 ( 57.4)
CARCASS WEIGHT (CALVES)	2	220	260	240.0 ( 20.0)				

NOTE: 0 CALVES ( 0%) WEIGHED LESS THAN 200 POUNDS

2004 S. WEST REGION MOOSE HARVEST SUMMARY WITH PREVIOUS 4 YEARS  
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YEAR	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS	PERMITS SUCCESS RATE*	TOTAL KILL/SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/HOUR	YEAR		
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	MEAN			AGE 4.5+ N	MEAN
2000	17	35	48.6	17	35	48.6	.	0	0.013	29.4 (29.4)	2.4 ( 2.4)	16.7	2	0.50	3	1.33	0.21	2000
2001	28	35	80.0	28	35	80.0	.	0	0.021	28.6 (28.6)	3.3 ( 3.3)	10.0	0	.	4	1.00	0.09	2001
2002	19	34	55.9	19	34	55.9	.	0	0.014	21.1 (21.1)	5.0 ( 5.0)	0.0	1	0.00	1	2.00	0.08	2002
2003	24	35	68.6	24	35	68.6	.	0	0.018	25.0 (25.0)	3.6 ( 3.6)	5.6	2	0.00	2	1.50	0.10	2003
2004	14	30	46.7	14	30	46.7	.	0	0.010	21.4 (21.4)	3.7 ( 3.7)	18.2	0	.	0	.	0.10	2004

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 S. WEST REGION MOOSE HARVEST SUMMARY (UNIT DETAIL)

UNIT	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS	PERMITS SUCCESS RATE*	TOTAL KILL/SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/HOUR	UNIT		
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	MEAN			AGE 4.5+ N	MEAN
H2N	7	10	70.0	7	10	70.0	.	0	0.019	14.3 (14.3)	6.0 ( 6.0)	33.3	0	.	0	.	0.11	H2N
H2S	1	5	20.0	1	5	20.0	.	0	0.003	100 ( 100)	0.0 ( 0.0)	.	0	.	0	.	0.08	H2S
K	6	15	40.0	6	15	40.0	.	0	0.009	16.7 (16.7)	5.0 ( 5.0)	0.0	0	.	0	.	0.08	K

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

\*\* - NOTE: Permits issued and success rates based on H2 as a whole, prior to 2000 unit split.

2004 S. WEST REGION HARVEST TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ES SUCCESS RATE	5	-1.52	0.03	0.7840
ES ADULT BULLS/COW	5	0.28	0.23	0.4189
ES % COWS & CALVES	5	-1.95	0.63	0.1085
CL COUNT (AGE 1.5)	3	-0.18	0.89	0.2123
% ANT. BULLS AGE 1.5	5	-0.14	0.00	0.9626
MOOSE SEEN/HOUR	5	-0.02	0.39	0.2604
AGE 1.5 BULL ABD	3	0.30	0.08	0.8160
AGE 1.5 BULL WEIGHT	4	-17.50	0.68	0.1766
AGE 1.5 BULL SPREAD	3	-0.65	0.08	0.8211

2004 S. WEST REGION SUMMARY OF MISCELLANEOUS BIOLOGICAL VARIABLES

VARIABLE	N	AGE 1.5			AGE 5.5+		
		MIN.	MAX.	MEAN (SE)	MIN.	MAX.	MEAN (SE)
ANTLER BEAM DIAMETER	1	36.0	36.0	36.0 ( . )	0	.	. ( . )
ANTLER SPREAD	1	23.0	23.0	23.0 ( . )	0	.	. ( . )
TOTAL POINTS	2	4	4	4.0 ( 0.0)	0	.	. ( . )
CARCASS WEIGHT (BULLS)	1	380	380	380.0 ( . )	0	.	. ( . )
CARCASS WEIGHT (COWS)	1	270	270	270.0 ( . )	0	.	. ( . )
CARCASS WEIGHT (CALVES)	0	.	.	. ( . )			

NOTE: 0 CALVES ( .%) WEIGHED LESS THAN 200 POUNDS

2004 S. EAST REGION MOOSE HARVEST SUMMARY WITH PREVIOUS 4 YEARS  
[C:\SAS FILES\MOOSE\MOOSHNT3.SAS]

YEAR	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS	PERMITS SUCCESS RATE*	TOTAL KILL/SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/HOUR	YEAR	
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	MEAN			AGE 4.5+ N
2000	19	58	32.8	19	58	32.8	.	0	0.016	52.6 (52.6)	1.1 ( 1.1)	22.2	0	.	3 0.67	0.08	2000
2001	19	60	31.7	19	60	31.7	.	0	0.016	36.8 (36.8)	1.7 ( 1.7)	0.0	0	.	3 1.00	0.10	2001
2002	12	34	35.3	12	34	35.3	.	0	0.010	58.3 (58.3)	0.8 ( 0.8)	20.0	1	0.00	4 1.25	0.07	2002
2003	7	35	20.0	7	35	20.0	.	0	0.006	57.1 (57.1)	1.0 ( 1.0)	33.3	1	0.00	1 1.00	0.06	2003
2004	9	20	45.0	9	20	45.0	.	0	0.007	66.7 (66.7)	0.8 ( 0.8)	33.3	1	0.00	1 1.00	0.04	2004

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 S. EAST REGION MOOSE HARVEST SUMMARY (UNIT DETAIL)

UNIT	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY PERMITS	PERMITS SUCCESS RATE*	TOTAL KILL/SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/HOUR	UNIT	
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*				PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N	MEAN			AGE 4.5+ N
L	5	10	50.0	5	10	50.0	.	0	0.010	80.0 (80.0)	0.3 ( 0.3)	0.0	1	0.00	1 1.00	0.04	L
M	4	10	40.0	4	10	40.0	.	0	0.006	50.0 (50.0)	2.0 ( 2.0)	50.0	0	.	0	0.04	M

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 S. EAST REGION HARVEST TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED		ANNUAL TREND	R SQUARE	PROB>F
	(N)				
ES SUCCESS RATE	5	1.28	0.05	0.7141	
ES ADULT BULLS/COW	5	-0.15	0.37	0.2768	
ES % COWS & CALVES	5	4.84	0.48	0.1930	
CL COUNT (AGE 1.5)	.	.	.	.	
% ANT. BULLS AGE 1.5	5	5.56	0.41	0.2411	
MOOSE SEEN/HOUR	5	-0.01	0.72	0.0691	
AGE 1.5 BULL ABD	3	-1.14	0.39	0.5719	
AGE 1.5 BULL WEIGHT	4	-22.63	0.68	0.1759	
AGE 1.5 BULL SPREAD	3	-0.41	0.10	0.7992	

2004 S. EAST REGION SUMMARY OF MISCELLANEOUS BIOLOGICAL VARIABLES

VARIABLE	AGE 1.5			AGE 5.5+		
	N	MIN.	MAX.	N	MIN.	MAX.
ANTLER BEAM DIAMETER	0	.	.	0	.	.
ANTLER SPREAD	0	.	.	0	.	.
TOTAL POINTS	1	1	1	0	.	.
CARCASS WEIGHT (BULLS)	1	385	385	0	.	.
CARCASS WEIGHT (COWS)	1	360	360	1	500	500
CARCASS WEIGHT (CALVES)	2	205	240			

NOTE: 0 CALVES ( 0%) WEIGHED LESS THAN 200 POUNDS



2004 OVERALL STATEWIDE MOOSE HARVEST SUMMARY WITH PREVIOUS 4 YEARS  
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YEAR	-----ALL PERMITS-----			--EITHER SEX PERMITS---			ANTLERLESS ONLY HARVEST	PERMITS ISSUED*	SUCCESS RATE*	TOTAL KILL/ SQ MI	FOR EITHER SEX AND (ALL PERMITS)...		% ANT. BULLS AGE 1.5	CORP. LUTEA COUNTS		MOOSE SEEN/ HOUR	YEAR
	TOTAL HARVEST	PERMITS ISSUED*	SUCCESS RATE*	HARVEST	PERMITS ISSUED*	SUCCESS RATE*					PERCENT ANTLERLESS	ADULT BULLS PER COW		AGE 1.5 N MEAN	AGE 4.5+ N MEAN		
2000	378	581	65.1	329	516	63.8	49	65	75.4	0.042	32.2 (40.5)	2.4 ( 1.6)	17.3	28 0.39	43 1.33	0.18	2000
2001	419	584	71.7	366	519	70.5	53	65	81.5	0.046	32.0 (40.3)	2.5 ( 1.7)	17.2	38 0.58	56 1.34	0.19	2001
2002	355	484	73.3	308	434	71.0	47	50	94.0	0.039	32.5 (41.1)	2.3 ( 1.6)	17.2	29 0.34	54 1.15	0.19	2002
2003	362	482	75.1	320	432	74.1	42	50	84.0	0.040	26.4 (34.6)	2.9 ( 2.0)	17.6	36 0.44	45 1.36	0.19	2003
2004	388	522	74.3	371	503	73.8	17	19	89.5	0.043	24.8 (27.8)	3.4 ( 2.9)	19.6	24 0.29	35 1.34	0.20	2004

\* - NOTE: Permits issued and success rates prior to 1996 based on old unit boundaries.

2004 OVERALL HARVEST TREND ANALYSES  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ES SUCCESS RATE	5	2.35	0.80	0.0392
ES ADULT BULLS/COW	5	0.25	0.74	0.0621
ES % COWS & CALVES	5	-2.04	0.77	0.0500
CL COUNT (AGE 1.5)	5	-0.03	0.24	0.4078
% ANT. BULLS AGE 1.5	5	0.51	0.59	0.1277
MOOSE SEEN/HOUR	5	0.00	0.80	0.0405
AGE 1.5 BULL ABD	5	-0.03	0.00	0.9348
AGE 1.5 BULL WEIGHT	5	-1.87	0.09	0.6221
AGE 1.5 BULL SPREAD	5	0.04	0.00	0.9362

2004 OVERALL SUMMARY OF MISCELLANEOUS BIOLOGICAL VARIABLES

VARIABLE	----- AGE 1.5 -----				----- AGE 5.5+ -----			
	N	MIN.	MAX.	MEAN (SE)	N	MIN.	MAX.	MEAN (SE)
ANTLER BEAM DIAMETER	51	18.0	51.0	34.8 ( 1.0)	76	44.0	78.0	59.2 ( 0.8)
ANTLER SPREAD	50	11.5	40.0	24.0 ( 0.8)	75	26.0	66.3	51.8 ( 0.7)
TOTAL POINTS	52	1	12	4.7 ( 0.3)	74	4	25	16.9 ( 0.5)
CARCASS WEIGHT (BULLS)	46	350	570	449.2 ( 7.6)	68	570	910	773.8 ( 8.9)
CARCASS WEIGHT (COWS)	25	210	570	422.8 ( 17.7)	17	425	750	559.4 ( 20.4)
CARCASS WEIGHT (CALVES)	12	140	260	208.3 ( 10.1)				

NOTE: 3 CALVES ( 25%) WEIGHED LESS THAN 200 POUNDS

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5

**Grant Type:** Survey and Inventory

**Period Covered:** July 1, 2004 – June 30, 2005

**Project II:** MOOSE RESEARCH AND MANAGEMENT

**Job 2:** Non-Harvested Data Collection, Entry and Analysis

**Job Objective:** To annually determine sex, age class and cause, location and timing of non-harvest moose mortalities in a reliable and cost effective fashion.

**Summary:** Two hundred and eighty-six animals were documented killed by means other than legal hunting in 2004. Vehicle kills accounted for 265 of these; up from 221 in 2003. The bull/cow ratio of all kills was 0.9/1.0; down from 1.0 /1.0 in 2003. Linear trend analysis of accident/nuisance and vehicle kill was not significant. Brainworm related deaths were higher than normal at 13; the highest since reporting began in 1986. Tick related deaths at 0 were within the normal range of 0-1. All information can be found in Table 3.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None.

**Total Cost:**

**Procedures:** Moose found killed by means other than legal hunting are reported by Fish and Game Department staff. Information entered into a historic database includes cause, date and location of death, approximate age and sex of the moose. Cause of death is determined by gross field exam. Trend analysis of vehicle kill, accident and nuisance kill and adult sex ratio is performed by region using current year and the four preceding years of data.

**Results:** Two hundred and sixty-five animals were killed by vehicle in 2004. Statewide the vehicle kill has fluctuated around the 250 mark since 1996. An additional 21 animals were killed by other causes. The sex ratio for these animals was 0.9 bulls per cow. Thirteen animals were reported to have died of brainworm this year, compared to twelve in 2003. Three of the brainworm kills were reported from the Southwest region and eight from the Central region. No animals were reported killed by winter tick which is lower than the five reported in 2003 and seven in 2002. Regional linear trend analysis of these data shows no statistically significant trends.

Only the Southeast region had a significant trend ( $-2.60$ ,  $R^2=0.85$ ,  $\text{Prob}>F=0.0272$ ) in vehicle kill. Five animals were killed by vehicle in this region which is the lowest kill rate since 1989. The White Mountain region while exhibiting no significant trend did have the highest kill rate ever recorded (102 kills). Both the North and Central regions saw increases from the previous year but these were within previous limits. The Southwest region experienced a reduction from 28 in 2003 to 19 in 2004. The three northern regions account for the majority of these accidents; 91% in 2004. WMU D1 in the northern region accounted for 42 of this region's 74 vehicle kills. This unit consistently reports the greatest number of vehicle kills in the north region and 42 is the highest kill rate ever recorded in this unit. C1 and E3 also reported the greatest number of vehicle kills ever reported for these units at 27 and 30, respectively. All three of these units share common boundaries.

**Conclusions:** Incidental reporting of non-harvest and non-vehicle related mortality is insufficient to determine rates or causes of mortality. Vehicle related mortality is well reported and while only capturing those mortalities that occur on the road, is probably accurately portraying both trends and trouble areas.

**Recommendations:** The department should work with DOT to increase moose crossing signage in WMU D1, E3 and C1.

**Prepared by:** \_\_\_\_\_

Kristine M Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_

Table 3.2004 NORTH REGION ACCIDENTAL KILL SUMMARY WITH PREVIOUS 4 YEARS (DECEMBER-NOVEMBER YEAR)

NOTE: Final year's data may be incomplete.

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----- NUMBER OF KILLS BY CAUSE -----															
YEAR	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	YEAR
2000	1	0	1	0	0	74	3	79	1	31	46	0.5	0.7	0.9	2000
2001	1	2	0	0	0	87	2	92	1	39	51	0.6	0.8	1.0	2001
2002	0	3	0	0	4	69	5	81	0	27	48	0.4	0.6	0.8	2002
2003	0	3	0	0	0	58	3	64	0	35	28	0.9	1.3	1.8	2003
2004	0	0	1	0	0	74	0	75	0	35	40	0.6	0.9	1.2	2004

2004 NORTH REGION ACCIDENTAL KILL SUMMARY (UNIT DETAIL)

NOTE: Data may be incomplete.

----- NUMBER OF KILLS BY CAUSE -----															
UNIT	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	UNIT
A1	0	0	0	0	0	4	0	4	0	1	3	0.0	0.3	2.1	A1
A2	0	0	0	0	0	6	0	6	0	3	3	0.3	1.0	4.0	A2
B	0	0	0	0	0	11	0	11	0	4	7	0.2	0.6	1.5	B
C2	0	0	0	0	0	11	0	11	0	3	8	0.1	0.4	1.0	C2
D1	0	0	1	0	0	42	0	43	0	24	19	0.8	1.3	2.0	D1

2004 NORTH REGION ACCIDENTAL KILL TREND ANALYSIS

(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ACCIDENT+NUISANCE KILL	5	-0.30	0.75	0.0577
VEHICULAR KILL	5	-2.90	0.19	0.4600
MALES / FEMALE	5	0.09	0.28	0.3563

2004 W. MTN. REGION ACCIDENTAL KILL SUMMARY WITH PREVIOUS 4 YEARS (DECEMBER-NOVEMBER YEAR)  
 NOTE: Final year's data may be incomplete.  
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----- NUMBER OF KILLS BY CAUSE -----															
YEAR	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	YEAR
2000	0	0	1	0	0	86	0	87	0	49	36	1.0	1.4	1.8	2000
2001	1	0	0	2	0	55	1	59	3	18	41	0.3	0.4	0.7	2001
2002	0	0	3	0	0	79	1	83	0	38	39	0.7	1.0	1.3	2002
2003	1	1	0	0	1	84	0	87	1	37	49	0.6	0.8	1.0	2003
2004	1	1	1	0	0	102	0	105	1	53	50	0.8	1.1	1.4	2004

2004 W. MTN. REGION ACCIDENTAL KILL SUMMARY (UNIT DETAIL)  
 NOTE: Data may be incomplete.

----- NUMBER OF KILLS BY CAUSE -----															
UNIT	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	UNIT
C1	0	1	0	0	0	27	0	28	0	10	17	0.3	0.6	1.0	C1
D2	1	0	0	0	0	13	0	14	1	5	9	0.2	0.6	1.3	D2
E1	0	0	1	0	0	11	0	12	0	4	7	0.2	0.6	1.5	E1
E2	0	0	0	0	0	7	0	7	0	5	2	0.7	2.5	11.7	E2
E3	0	0	0	0	0	30	0	30	0	18	12	0.9	1.5	2.6	E3
F	0	0	0	0	0	14	0	14	0	11	3	1.4	3.7	11.3	F

2004 W. MTN. REGION ACCIDENTAL KILL TREND ANALYSIS  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ACCIDENT+NUISANCE KILL	5	0.00	0.00	1.0000
VEHICULAR KILL	5	6.10	0.32	0.3182
MALES / FEMALE	5	-0.03	0.02	0.8334

2004 CENTRAL REGION ACCIDENTAL KILL SUMMARY WITH PREVIOUS 4 YEARS (DECEMBER-NOVEMBER YEAR)

NOTE: Final year's data may be incomplete.

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----- NUMBER OF KILLS BY CAUSE -----															
YEAR	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	YEAR
2000	1	1	1	0	0	72	2	77	1	44	32	1.0	1.4	1.9	2000
2001	1	1	0	0	1	71	6	80	1	35	42	0.6	0.8	1.1	2001
2002	1	1	0	0	2	66	1	71	1	36	32	0.8	1.1	1.6	2002
2003	2	2	0	0	3	42	2	51	2	28	20	0.9	1.4	2.1	2003
2004	0	8	0	1	0	65	2	76	1	37	38	0.7	1.0	1.3	2004

2004 CENTRAL REGION ACCIDENTAL KILL SUMMARY (UNIT DETAIL)

NOTE: Data may be incomplete.

----- NUMBER OF KILLS BY CAUSE -----															
UNIT	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	UNIT
G	0	2	0	1	0	17	0	20	1	10	10	0.5	1.0	2.0	G
H1	0	0	0	0	0	5	0	5	0	2	3	0.1	0.7	3.1	H1
I1	0	1	0	0	0	4	0	5	0	2	3	0.1	0.7	3.1	I1
I2	0	1	0	0	0	10	0	11	0	5	6	0.3	0.8	2.1	I2
J1	0	1	0	0	0	12	2	15	0	5	9	0.2	0.6	1.3	J1
J2	0	3	0	0	0	17	0	20	0	13	7	0.9	1.9	3.8	J2

2004 CENTRAL REGION ACCIDENTAL KILL TREND ANALYSIS

(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ACCIDENT+NUISANCE KILL	5	0.10	0.13	0.5594
VEHICULAR KILL	5	-4.30	0.31	0.3308
MALES / FEMALE	5	-0.02	0.02	0.8087

2004 S. WEST REGION ACCIDENTAL KILL SUMMARY WITH PREVIOUS 4 YEARS (DECEMBER-NOVEMBER YEAR)

NOTE: Final year's data may be incomplete.

[C:\SAS FILES\MOOSE\MOOSAK03.SAS]

----- NUMBER OF KILLS BY CAUSE -----															
YEAR	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	YEAR
2000	0	4	0	0	0	15	0	19	0	7	12	0.3	0.6	1.2	2000
2001	0	1	0	0	0	16	2	19	0	8	11	0.4	0.7	1.5	2001
2002	1	1	0	0	1	22	1	26	1	15	11	0.8	1.4	2.5	2002
2003	1	6	3	0	1	28	0	39	1	14	25	0.3	0.6	0.9	2003
2004	1	3	0	0	0	19	1	24	1	10	12	0.4	0.8	1.6	2004

2004 S. WEST REGION ACCIDENTAL KILL SUMMARY (UNIT DETAIL)

NOTE: Data may be incomplete.

----- NUMBER OF KILLS BY CAUSE -----															
UNIT	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	UNIT
H2N	1	0	0	0	0	3	0	4	1	2	2	0.2	1.0	6.0	H2N
H2S	0	2	0	0	0	5	0	7	0	1	5	0.0	0.2	1.0	H2S
K	0	1	0	0	0	11	1	13	0	7	5	0.6	1.4	3.6	K

2004 S. WEST REGION ACCIDENTAL KILL TREND ANALYSIS

(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ACCIDENT+NUISANCE KILL	5	0.30	0.75	0.0577
VEHICULAR KILL	5	2.00	0.36	0.2817
MALES / FEMALE	5	0.03	0.03	0.7960

2004 S. EAST REGION ACCIDENTAL KILL SUMMARY WITH PREVIOUS 4 YEARS (DECEMBER-NOVEMBER YEAR)  
 NOTE: Final year's data may be incomplete.  
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----- NUMBER OF KILLS BY CAUSE -----															
YEAR	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	YEAR
2000	0	0	0	0	0	16	0	16	0	8	8	0.5	1.0	2.1	2000
2001	0	0	0	0	0	13	0	13	0	6	7	0.4	0.9	2.0	2001
2002	0	0	0	0	0	7	0	7	0	2	4	0.1	0.5	2.0	2002
2003	0	0	0	0	0	9	0	9	0	3	6	0.1	0.5	1.5	2003
2004	0	1	0	0	0	5	0	6	0	0	6	.	0.0	0.5	2004

2004 S. EAST REGION ACCIDENTAL KILL SUMMARY (UNIT DETAIL)  
 NOTE: Data may be incomplete.

----- NUMBER OF KILLS BY CAUSE -----															
UNIT	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	UNIT
L	0	1	0	0	0	4	0	5	0	0	5	.	0.0	0.6	L
M	0	0	0	0	0	1	0	1	0	0	1	.	0.0	9.0	M

2004 S. EAST REGION ACCIDENTAL KILL TREND ANALYSIS  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ACCIDENT+NUISANCE KILL	.	.	.	.
VEHICULAR KILL	5	-2.60	0.85	0.0272
MALES / FEMALE	5	-0.24	0.92	0.0093



2004 OVERALL ACCIDENTAL KILL SUMMARY WITH PREVIOUS 4 YEARS (DECEMBER-NOVEMBER YEAR)

NOTE: Final year's data may be incomplete.

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----- NUMBER OF KILLS BY CAUSE -----															
YEAR	ACCIDENTS	BRAINWORM	ILLEGAL	NUISANCE	TICK RELATED	VEHICLE	OTHER	TOTAL	ACCIDENT+ NUISANCE	MALES	FEMALES	80% LCL	MALES / FEMALE	80% UCL	YEAR
2000	2	5	3	0	0	263	5	278	2	139	134	0.9	1.0	1.2	2000
2001	3	4	0	2	1	242	11	263	5	106	152	0.6	0.7	0.8	2001
2002	2	5	3	0	7	243	8	268	2	118	134	0.7	0.9	1.0	2002
2003	4	12	3	0	5	221	5	250	4	117	128	0.8	0.9	1.1	2003
2004	2	13	2	1	0	265	3	286	3	135	146	0.8	0.9	1.1	2004

2004 OVERALL ACCIDENTAL KILL TREND ANALYSIS

(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS			
	USED (N)	ANNUAL TREND	R SQUARE	PROB>F
ACCIDENT+NUISANCE KILL	5	0.10	0.01	0.8460
VEHICULAR KILL	5	-1.70	0.02	0.8106
MALES / FEMALE	5	-0.00	0.00	0.9859

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5

**Grant Type:** Survey and Inventory

**Period Covered:** July 1, 2004 – June 30, 2005

**Project II:** MOOSE RESEARCH AND MANAGEMENT

**Job 3:** Formulation of Moose Population Management Recommendations

**Job Objective:** To efficiently formulate scientifically based moose population management recommendations.

**Summary:** Recommendations for year 2005 can be found in **Appendix II** (rules & regs). Biennial season setting took place in 2004. Changes in regional permit numbers can be seen in Table 4. Permit numbers were changed from 2003 in several regions in order to achieve the goals outlined in Table 5. Procedures for season setting are outlined below.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None.

### **Total Cost:**

**Procedures:** The previous years regional data sets are analyzed and compared against the historic regional data using SAS software. Determination of growth or decline is based on linear trend analysis of moose sightings per hundred deer hunter hours. Other information taken into consideration includes past harvest success rate and sex ratios, physiological indices, other sources of mortality and recruitment and field personnel's perception of local populations and habitats. Permit numbers are set based on population estimates and growth rates predicted through mathematical models based on data taken from the regional population data sets. A combination of peer critique and literature review enhances data analysis and provides initial recommendations. Recommendations are not allowed to fall outside of management goals set in the long range plan. These recommendations are further refined through additional peer review and inclusion of public input gathered at public hearings held in various locations around the state. Permits are assigned on a regional basis and further distributed by zones to more effectively distribute hunting pressure. While management recommendations are only made biennially, all data sets are analyzed annually to assure continued progress towards management objectives. Current management objectives differ by region.

**Results:** The permit levels set in 2004 have allowed the North Region to achieve goal and moved the White Mountain Region closer towards goal (desired change going from 86% to 65%). It has allowed a slight increase away from goal in the Central Region ( desired change going from -4% to -9%) and allowed the Southwest Region to continue a slight decline away from goal (desired change going from 34 – 41%). It has also allowed the Southeast Region to continue to grow away from goal (desired change going from -9 to -17%.)

**Conclusions:** Stabilization is desired in the North and Central regions. Slow growth is desired in the White Mountain and Southwest region while the Southeast desires a reduction. Permit levels will be set in 2006 to maintain or move regional populations towards the desired goals.

**Recommendations:** Continue this job as planned.

**Prepared By:** \_\_\_\_\_  
Kristine M. Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_

TABLE 4. PERMIT ISSUANCE 2003 - 2004

WMU/REGION	2003 PERMITS		2004 PERMITS	
	EITHER SEX	ANTLERLESS	EITHER SEX	ANTLERLESS
A1	10	5	15	
A2	45	15	75	20
B	35	15	50	
C2	24	10	40	
D1	10	5	20	
<b>NORTH</b>	<b>124</b>	<b>50</b>	<b>200</b>	<b>20</b>
C1	20		25	
D2	25		25	
E1	10		15	
E2	5		5	
E3	15		20	
F	23		25	
<b>W. MTNS</b>	<b>98</b>		<b>115</b>	
G	40		40	
H1	10		10	
I1	20		20	
I2	20		30	
J1	15		15	
J2	35		25	
<b>CENTRAL</b>	<b>140</b>		<b>140</b>	
H2N	10		10	
H2S	10		5	
K	15		15	
<b>S.WEST</b>	<b>35</b>		<b>30</b>	
L	15		10	
M	20		10	
<b>S.EAST</b>	<b>35</b>		<b>20</b>	
<b>TOTAL</b>	<b>432</b>	<b>50</b>	<b>505</b>	<b>20</b>

TABLE 5. N.H. MOOSE POPULATION MANAGEMENT GOALS BY REGION.

Moose seen per hundred hunter hours from mail survey

REGION	LOWER LIMIT	UPPER LIMIT	CURRENT LEVEL*	RECOMMENDED GOAL	DESIRED % CHANGE
NORTH	7.70	9.59	8.66	8.63	0%
WHITE MOUNTAINS	3.15	4.73	2.39	3.94	65%
CENTRAL	1.06	1.60	1.64	1.50	-9%
SOUTH WEST	0.90	1.34	0.95	1.34	41%
SOUTH EAST	0.73	1.09	0.60	0.50	-17%

\* Moose seen per hundred hunter hours during the three years 2001-2003.

NOTE: Moose in New Hampshire are managed by regions rather than units (i.e. WMU's). This is because sample sizes on data collected are too small at the unit level to yield reliable information. Thus, several WMU's are consolidated into each region.

## PERFORMANCE REPORT

**State:** New Hampshire **Grant: W-89-R-5**

**Grant Type:** Survey and Inventory

**Period Covered:** July 1, 2004 – June 30, 2005

**Project II:** MOOSE RESEARCH AND MANAGEMENT

**Job 4:** Hunter Observation Data Collection, Entry and Analysis

**Job Objective:** To annually determine sex ratios, rate of change, fall recruitment, distribution, relative density patterns and age structure of the statewide moose population in a cost effective and reliable manner.

### **Summary:**

#### Deer Hunter Mail Survey

The number of reported deer hunter days declined from approximately 17,097 in 2003 to 13,002 in 2004. This accounted for 1,762 moose observations statewide; 1,644 of which could be sexed and aged. The average number of moose seen per hundred deer hunter hours was 2.25 up from 2.09 in 2003. Calves/cow averaged 0.43/1.0. Approximately 40.7% of adults were bulls, and calves comprised 20% of the population. Four-year trend analysis of these parameters suggests that all parameters have been relatively stable during the past five year period. All information can be found in Table 6.

#### Moose Hunter Diary Card

Moose hunters saw similar numbers of moose/hour as in past years (0.15). There has been little change in the sex ratio or age structure of observed animals. Successful hunters averaged 2.88 days of hunting. All information can be found in Table 7.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None

**Total Cost:**

**Procedures:**

Deer Hunter Mail Survey: Successful deer hunters from the previous year are mailed a diary card to report their hunting observations for the current year. They are asked to fill the card out each day they hunt. Daily information includes date, town and number of hours of hunting activity, number sex and age class (calf or adult) of moose seen. This information is collected during the start of the deer muzzleloader season through the end of the second week of the rifle deer season. Hunters are asked to mail the completed diary back to Fish and Game headquarters. Data is entered into the historic data base and five year trend analysis is conducted using SAS software.

Moose Hunter Diary Card: The current year moose hunters are given a diary card at the moose seminar and required to collect the following information each day hunted during the moose season. Zone, date, number of hours hunted, sex and age class (calf or adult) of moose seen. In addition hunters are required to provide information on number of hours scouted and moose seen during scouting and type of animal desired. Cards are turned in at the moose check station or mailed to Fish and Game headquarters. Data are entered into an historic data base and five year trend analysis is conducted using SAS software.

## **Results:**

### Deer Hunter Mail Survey

Number of hunter days decreased from 17,097 in 2003 to 13,002 in 2004 . This is similar to hunter days in 2002. The mail survey recorded 1,762 moose in 70,954 hours of hunter effort. Sixteen hundred and forty- four of these animals could be identified by sex and age cohort (calf or adult). Less than 200 moose were observed in the White Mountains (189), Southwest (136) and Southeast (129). Numbers of moose seen per hundred hunter hours declined as one traveled from the North region (8.19) to the Southeast (0.72). Calves were observed in all zones. Statewide five year trend analysis exhibited no significant changes in observation rate parameters.

There was no significant change in five year trend analysis of the North region parameters. Percentage of adults that were bulls was below 40% (37.3%) for the third time in five years. This is being driven by bull/cow ratios seen in WMUs A1, A2 and B. A1 and A2 have been at or below 40% for four of the previous five years while B has dipped below 40% twice.

There were no significant changes in the trend data for the White Mountain or Central Regions.

The Southwest region is experiencing a slight upward trend (0.73,  $R^2=0.96$ ) in the percentage of calves in the population (22%) and a corresponding negative trend (-1.73,  $R^2=0.78$ ) in the percentage of barren cows (56%). There is also a slight increase in the observation rate over the previous year (1.07 from 0.85) and this reverses a four year decline from a high of 1.31 in 2000.

The Southeast region is exhibiting a significant negative trend (-3.69,  $R^2 = 0.75$ ) in the percentage of calves (15%) in the population. This is the lowest regional calf percentage. Calves/adult cow is declining although not significantly while % of barren cows is increasing but also not significantly. The bull/cow ratio has been below 40% for three of the past five years.

Regional adult sex ratios are all above 40% with the exception of the North (37.3%). This region which has the highest moose density, has fallen below 40% three of the last five years. The units responsible for this are A1, A2 and this year B as well. The Southeast also had it's bull/cow ratio fall below 40% in three of the preceeding five years although it is at 41.4 this year. It is desirable to maintain the sex ratio at or above 40% to provide maximum reproductive success. The Southeast is exhibiting the smallest calf component at 15% of its population and has been at this low level for two years. Regional percentage of the population that is calves ranges from 15% to 22%. Calf/cow ratios range from 0.49 to 0.29; percentage of adult cows which were barren ranges from 73% to 56% and bull percentages range from 46.5% to 37.3%.

### Moose Hunter Diary Card

In the North region five year trend analysis showed significant increases in moose seen/hour (0.02,  $R^2=0.76$ ) for successful hunters. All other parameters were relatively stable or the changes were not significant. In the White Mountains the number of bulls/cow seen by all hunters has been steadily increasing from 0.91 in 2000 to 1.30 in 2004 ( increasing trend of 0.09,  $R^2=0.96$ ). The Central region has seen a decline in moose seen/hour for both successful and all hunters. Both of these declines have been small and only the decline in moose seen/hour by successful hunters has been significant (-0.01,  $R^2=0.94$ ). The Southwest and Southeast regions exhibited no significant trends.

As expected, numbers of moose seen per hour declined from the North (0.27) to Southeast (0.03) Region with the lowest sighting rate in the Southeast region. Hunters saw good numbers of bulls in all regions with the highest bull/cow ratios being seen in the Southwest (3.71/1.00) and Central(1.61/1.00) regions.

**Conclusions:** Currently, the deer hunter mail survey is providing sufficient number of sightings to stand as a representative sample of the populations each region. The low bull/cow ratio in the North region is cause for concern. When looked at by WMU A1 and A2 are routinely exhibiting low ratios and B has been below 40 % bulls in two of the preceeding five years. The low bull/cow ratio as seen by deer hunters is not always reflected in the bull/cow ratios as seen by moose hunters. A1 is the only north region unit that exhibited a low bull/cow ratio in both the deer hunter and the moose hunter surveys. Unit L in the

Southeast Region was the only other unit to do so. The deer hunter data is a better index due to larger sample sizes and timing of the sightings. Deer hunters are on the landscape during a time when sightings of both bulls and cows should be equally possible. Moose hunters are seeing moose at the tail end of the rut and so are more likely to see bulls. The fact that neither group was able to see bulls suggests bulls are in short supply in these units. As moose are an important component of the economy in the North region, an effort should be made to increase the bull component in both A1 and A2.

The increasing observation rate and apparent increase in reproduction in the Southwest region is moving the population closer to the goal. This region's observation rate has always declined the year following a calf percentage of 18% or less.

The low reproductive parameters and bull/cow ratio of the Southeast region suggest this population will begin to decline unless immigration contributes substantially to the population.

**Recommendations:** Continue this job as planned. Make adjustments to allowable antlered take in A1 and A2 for the 2006 season to rectify the low bull/cow ratio.

**Prepared By:** \_\_\_\_\_  
Kristine M Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_

TABLE 6. 2004 NORTH REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
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YEAR	# OF HUNTER DAYS (N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE			80% LCL	80% UCL	% CALVES	80% LCL	80% UCL	% BARREN COWS	80% LCL	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	80% /ADULT COW	80% UCL	80% LCL	80% UCL	80% UCL									
2000	2774	17108	581	680	257	105	1623	8.68	9.13	9.57	0.34	0.38	0.42	44.2	46.1	47.9	16	17	18	56	60	63	307		
2001	2213	14001	331	510	197	77	1115	6.73	7.10	7.47	0.35	0.39	0.43	37.2	39.4	41.6	17	19	21	54	58	62	251		
2002	1721	10870	249	411	202	51	913	7.66	8.15	8.64	0.44	0.49	0.55	35.3	37.7	40.2	22	23	25	51	56	60	210		
2003	1947	12936	400	581	221	86	1288	9.02	9.51	10.01	0.34	0.38	0.42	38.7	40.8	42.8	17	18	20	58	63	67	222		
2004	1717	10912	263	443	187	50	943	7.72	8.19	8.65	0.38	0.42	0.47	34.9	37.3	39.7	19	21	23	55	59	63	252		

2004 NORTH REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	# OF HUNTER DAYS (N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE			80% LCL	80% UCL	% CALVES	80% LCL	80% UCL	% BARREN COWS	80% LCL	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	80% /ADULT COW	80% UCL	80% LCL	80% UCL	80% UCL									
A1	280	1926	46	88	42	9	185	8.12	9.42	10.73	0.37	0.48	0.62	28.9	34.3	40.1	20	24	28	44	55	65	44		
A2	596	3880	96	179	81	25	381	8.31	9.15	10.00	0.38	0.45	0.54	31.1	34.9	38.8	20	23	26	52	59	66	95		
B	382	2235	56	91	34	10	191	6.96	7.90	8.86	0.28	0.37	0.49	32.8	38.1	43.7	15	19	23	50	60	68	57		
C2	263	1673	45	62	22	5	134	6.83	7.91	9.01	0.25	0.35	0.50	35.6	42.1	48.7	13	17	22	51	63	74	38		
D1	196	1200	20	23	8	1	52	3.37	4.41	5.46	0.19	0.35	0.63	35.9	46.5	57.4	9	16	24	43	61	77	18		

2004 NORTH REGION MAIL SURVEY MOOSE OBSERVATION TREND ANALYSIS  
OBSERVATIONS  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MEAN TOTAL #OBSERVED/100 HOURS	5	0.05	0.01	0.8866
CALVES / ADULT COW	5	0.01	0.07	0.6589
% OF ADULTS THAT ARE BULLS	5	-1.62	0.52	0.1673
% CALVES	5	0.74	0.22	0.4287
% BARREN COWS	5	0.39	0.06	0.6952

NOTE: % BARREN COWS IS BASED ON  
OF SINGLE (LONE) COWS AND CALVES.

004 W. MTN. REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
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YEAR	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE BULLS			80% LCL	% CALVES	80% UCL	80% LCL	% BARREN COWS	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				LCL	/ADULT COW	UCL	LCL	BULLS	UCL							
2000	1983	10384	109	110	49	34	302	2.86	3.17	3.48	0.35	0.45	0.56	45.2	49.8	54.3	15	18	22	53	62	69	73
2001	1874	10142	54	80	37	12	183	1.57	1.76	1.96	0.35	0.46	0.61	34.6	40.3	46.2	18	22	26	55	64	72	61
2002	1218	6180	46	51	19	3	119	1.72	1.99	2.27	0.25	0.37	0.54	40.5	47.4	54.4	12	16	22	61	73	82	40
2003	1529	8271	93	71	40	13	217	2.35	2.66	2.97	0.43	0.56	0.74	51.4	56.7	61.9	16	20	24	31	42	54	38
2004	1308	7069	66	81	35	7	189	2.17	2.46	2.74	0.33	0.43	0.57	39.4	44.9	50.5	15	19	23	51	60	68	67

2004 W. MTN. REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE BULLS			80% LCL	% CALVES	80% UCL	80% LCL	% BARREN COWS	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				LCL	/ADULT COW	UCL	LCL	BULLS	UCL							
C1	199	1166	25	36	14	3	78	5.44	6.63	7.84	0.25	0.39	0.61	32.4	41.0	50.0	13	19	26	43	58	71	26
D2	674	3428	28	30	15	3	76	1.58	1.94	2.29	0.32	0.50	0.78	39.2	48.3	57.5	14	21	28	40	54	68	26
E1	61	356	3	8	4	0	15	2.50	4.15	5.84	0.18	0.50	1.27	10.5	27.3	51.1	12	27	46	34	63	85	8
E2	69	421	1	3	0	0	4	0.31	0.77	1.23	.	0.00	1.15	2.6	25.0	68.0	.	0	44	46	100	.	3
E3	68	438	2	2	0	0	4	0.25	0.94	1.63	.	0.00	2.16	14.3	50.0	85.7	.	0	44	32	100	.	2
F	237	1261	7	2	2	1	12	0.49	0.92	1.36	0.17	1.00	6.01	51.0	77.8	93.9	5	18	42	5	50	95	2

2004 W. MTN. REGION MAIL SURVEY MOOSE OBSERVATION TREND ANALYSIS  
OBSERVATIONS  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

NOTE: % BARREN COWS IS BASED ON  
OF SINGLE (LONE) COWS AND CALVES.

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MEAN TOTAL #OBSERVED/100 HOURS	5	-0.05	0.02	0.8084
CALVES / ADULT COW	5	0.01	0.03	0.7856
% OF ADULTS THAT ARE BULLS	5	0.67	0.03	0.7807
% CALVES	5	-0.01	0.00	0.9858
% BARREN COWS	5	-2.57	0.13	0.5451



2004 CENTRAL REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
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YEAR	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE BULLS			80% LCL	% CALVES	80% UCL	80% LCL	% BARREN COWS	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	/ADULT COW	80% UCL	80% LCL	BULLS	80% UCL							
2000	6045	33630	197	220	109	65	591	1.75	1.88	2.01	0.42	0.50	0.58	44.0	47.2	50.5	18	21	23	57	63	68	153
2001	4696	26225	136	145	52	66	399	1.33	1.45	1.57	0.29	0.36	0.45	44.4	48.4	52.4	13	16	18	50	57	64	98
2002	4194	23487	149	164	57	54	424	1.61	1.75	1.88	0.28	0.35	0.43	43.8	47.6	51.4	13	15	18	48	55	62	96
2003	5748	32117	167	164	90	44	465	1.39	1.51	1.62	0.46	0.55	0.65	46.8	50.5	54.1	19	21	24	41	47	53	128
2004	4012	21956	120	138	70	37	365	1.57	1.71	1.86	0.42	0.51	0.62	42.4	46.5	50.7	18	21	25	51	58	65	93

2004 CENTRAL REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE BULLS			80% LCL	% CALVES	80% UCL	80% LCL	% BARREN COWS	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	/ADULT COW	80% UCL	80% LCL	BULLS	80% UCL							
G	591	3168	31	34	13	5	83	1.90	2.31	2.72	0.24	0.38	0.61	39.1	47.7	56.4	11	17	23	43	58	71	26
H1	701	3990	16	18	8	6	48	0.89	1.17	1.46	0.23	0.44	0.82	35.0	47.1	59.4	11	19	29	22	42	64	12
I1	526	2889	17	22	16	6	61	1.62	2.04	2.45	0.45	0.73	1.16	32.6	43.6	55.1	21	29	38	38	56	72	18
I2	316	1525	10	22	7	10	49	2.36	3.08	3.81	0.16	0.32	0.59	20.4	31.3	44.0	10	18	28	40	62	80	13
J1	415	2320	12	8	7	2	29	0.90	1.29	1.67	0.39	0.88	1.93	43.3	60.0	75.1	15	26	40	32	75	97	4
J2	1463	8066	34	34	19	8	95	1.21	1.44	1.67	0.37	0.56	0.84	41.6	50.0	58.4	16	22	29	48	65	79	20

2004 CENTRAL REGION MAIL SURVEY MOOSE OBSERVATION TREND ANALYSIS  
 OBSERVATIONS  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

NOTE: % BARREN COWS IS BASED ON  
 OF SINGLE (LONE) COWS AND CALVES.

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MEAN TOTAL #OBSERVED/100 HOURS	5	-0.03	0.06	0.6920
CALVES / ADULT COW	5	0.02	0.13	0.5435
% OF ADULTS THAT ARE BULLS	5	0.06	0.00	0.9209
% CALVES	5	0.70	0.13	0.5551
% BARREN COWS	5	-1.96	0.29	0.3536

2004 S. WEST REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
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YEAR	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE			80% LCL	%	80% UCL	80% LCL	%	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	/ADULT COW	80% UCL	80% LCL	BULLS	80% UCL							
2000	3327	17839	67	62	29	22	180	1.15	1.31	1.47	0.34	0.47	0.64	45.9	51.9	57.9	14	18	23	52	63	73	43
2001	2557	14353	51	64	26	30	171	1.09	1.24	1.40	0.29	0.41	0.56	38.1	44.3	50.8	14	18	23	51	61	70	51
2002	2640	13988	52	56	24	8	140	0.82	0.95	1.09	0.30	0.43	0.60	41.6	48.1	54.8	14	18	23	43	56	68	32
2003	3244	17320	52	50	28	25	155	0.75	0.85	0.95	0.40	0.56	0.78	44.2	51.0	57.8	17	22	27	46	56	66	48
2004	2481	13281	43	55	27	11	136	0.93	1.07	1.20	0.35	0.49	0.68	37.1	43.9	50.9	17	22	27	45	56	67	39

2004 S. WEST REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE			80% LCL	%	80% UCL	80% LCL	%	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	/ADULT COW	80% UCL	80% LCL	BULLS	80% UCL							
H2N	750	4032	12	14	6	4	36	0.73	0.98	1.22	0.20	0.43	0.88	32.4	46.2	60.4	10	19	31	35	60	81	10
H2S	573	3284	8	8	5	6	27	0.64	0.90	1.15	0.25	0.63	1.49	31.8	50.0	68.2	12	24	40	20	50	80	6
K	1158	5964	23	33	16	1	73	0.99	1.21	1.43	0.31	0.48	0.74	32.1	41.1	50.5	16	22	30	41	57	71	23

2004 S. WEST REGION MAIL SURVEY MOOSE OBSERVATION TREND ANALYSIS  
 OBSERVATIONS  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

NOTE: % BARREN COWS IS BASED ON  
 OF SINGLE (LONE) COWS AND CALVES.

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MEAN TOTAL #OBSERVED/100 HOURS	5	-0.09	0.52	0.1679
CALVES / ADULT COW	5	0.02	0.28	0.3596
% OF ADULTS THAT ARE BULLS	5	-0.95	0.16	0.4978
% CALVES	5	0.96	0.73	0.0667
% BARREN COWS	5	-1.73	0.78	0.0455

2004 S. EAST REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
 [C:\SAS FILES\MOOSE\MOOSMS03.SAS]

YEAR	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE BULLS			80% LCL	80% UCL	% CALVES	80% LCL	80% UCL	% BARREN COWS	80% LCL	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	80% UCL	80% LCL	80% UCL	80% LCL	80% UCL									
2000	4639	23305	39	71	39	7	156	0.53	0.61	0.68	0.42	0.55	0.72	29.4	35.5	41.9	21	26	31	55	64	72	61		
2001	4036	22339	22	48	28	13	111	0.48	0.55	0.63	0.42	0.58	0.81	24.1	31.4	39.6	23	29	35	38	50	62	36		
2002	3431	17301	39	50	31	7	127	0.67	0.78	0.88	0.45	0.62	0.85	36.7	43.8	51.2	21	26	32	52	65	76	34		
2003	4629	23582	21	37	10	12	80	0.31	0.38	0.45	0.16	0.27	0.45	27.7	36.2	45.4	9	15	22	56	70	82	27		
2004	3484	17738	41	58	17	13	129	0.62	0.72	0.82	0.20	0.29	0.43	34.7	41.4	48.3	11	15	20	62	73	81	44		

2004 S. EAST REGION MAIL SURVEY MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					80% LCL	MEAN TOTAL # OBSERVED /100 HOURS	80% UCL	CALVES			% OF ADULTS THAT ARE BULLS			80% LCL	80% UCL	% CALVES	80% LCL	80% UCL	% BARREN COWS	80% LCL	80% UCL	LONE COWS (N)
			BULL	COW	CALF	UNK.	TOTAL				80% LCL	80% UCL	80% LCL	80% UCL	80% LCL	80% UCL									
L	1588	8421	17	35	13	6	71	0.70	0.86	1.03	0.23	0.37	0.59	24.0	32.7	42.4	14	20	28	49	63	76	27		
M	1896	9317	24	23	4	7	58	0.48	0.60	0.72	0.07	0.17	0.38	40.8	51.1	61.3	3	8	15	72	88	97	17		

2004 S. EAST REGION MAIL SURVEY MOOSE OBSERVATION TREND ANALYSIS  
 OBSERVATIONS  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

NOTE: % BARREN COWS IS BASED ON  
 OF SINGLE (LONE) COWS AND CALVES.

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MEAN TOTAL #OBSERVED/100 HOURS	5	0.01	0.00	0.9310
CALVES / ADULT COW	5	-0.08	0.61	0.1213
% OF ADULTS THAT ARE BULLS	5	1.67	0.28	0.3542
% CALVES	5	-3.69	0.75	0.0590
% BARREN COWS	5	3.80	0.46	0.2077

2004 OVERALL MAIL SURVEY MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
 [C:\SAS FILES\MOOSE\MOOSMS03.SAS]

YEAR	# OF HUNTER DAYS(N)	TOTAL HOURS OF EFFORT	-- # OF MOOSE OBSERVED --					MEAN TOTAL			CALVES			% OF ADULTS THAT ARE			% BARREN			LONE COWS (N)			
			BULL	COW	CALF	UNK.	TOTAL	80% LCL	# OBSERVED /100 HOURS	80% UCL	80% LCL	/ADULT COW	80% UCL	80% LCL	BULLS	80% UCL	80% LCL	% CALVES	80% UCL		80% LCL	COWS	80% UCL
2000	18768	102266	993	1143	483	233	2852	2.58	2.67	2.76	0.39	0.42	0.45	45.1	46.5	47.9	17	18	19	59	61	64	637
2001	15376	87060	594	847	340	198	1979	1.95	2.03	2.11	0.37	0.40	0.44	39.5	41.2	42.9	18	19	20	55	58	61	497
2002	13204	71826	535	732	333	123	1723	2.10	2.19	2.28	0.42	0.45	0.50	40.4	42.2	44.1	20	21	22	55	58	61	412
2003	17097	94226	733	903	389	180	2205	2.01	2.09	2.17	0.40	0.43	0.47	43.2	44.8	46.4	18	19	20	53	56	59	463
2004	13002	70954	533	775	336	118	1762	2.16	2.25	2.34	0.40	0.43	0.47	39.0	40.7	42.5	19	20	22	57	60	63	495

2004 OVERALL MAIL SURVEY MOOSE OBSERVATION TREND ANALYSIS  
 OBSERVATIONS  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

NOTE: % BARREN COWS IS BASED ON  
 OF SINGLE (LONE) COWS AND CALVES.

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MEAN TOTAL #OBSERVED/100 HOURS	5	-0.08	0.24	0.4049
CALVES / ADULT COW	5	0.01	0.18	0.4821
% OF ADULTS THAT ARE BULLS	5	-0.79	0.26	0.3828
% CALVES	5	0.41	0.43	0.2291
% BARREN COWS	5	-0.42	0.13	0.5588

TABLE 7. 2004 NORTH REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
[C:\SAS FILES\MOOSE\MDIARY03.SAS]

YEAR	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					TOTAL SEEN	YEAR
	MOOSE SEEN/HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN/HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN/HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES			
2000	0.23	2.71 (0.13)	0.10	6.67 (0.46)	0.20	0.84	0.26	12.4	896	2000	
2001	0.28	2.75 (0.13)	0.10	6.14 (0.67)	0.25	0.86	0.36	25.1	1082	2001	
2002	0.29	2.57 (0.13)	0.10	4.83 (1.11)	0.28	0.94	0.40	17.1	892	2002	
2003	0.30	2.73 (0.15)	0.18	6.14 (0.80)	0.29	1.11	0.27	19.0	1074	2003	
2004	0.30	2.56 (0.11)	0.11	5.92 (0.45)	0.27	0.88	0.25	11.8	1124	2004	

2004 NORTH REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					TOTAL SEEN	UNIT
	MOOSE SEEN/HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN/HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN/HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES			
A1	0.35	3.15 (0.63)	0.00	6.00 ( . )	0.30	0.55	0.28	15.5	119	A1	
A2	0.26	2.70 (0.16)	0.06	4.33 (0.88)	0.25	0.89	0.27	12.4	462	A2	
B	0.47	1.89 (0.16)	0.07	6.00 ( . )	0.44	1.11	0.23	9.9	241	B	
C2	0.29	2.63 (0.29)	0.18	6.40 (0.75)	0.25	0.77	0.21	10.7	213	C2	
D1	0.19	3.00 (0.44)	0.07	7.00 (0.00)	0.17	1.12	0.29	12.2	89	D1	

2004 NORTH REGION MOOSE HUNTER DIARY OBSERVATION TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE		PROB>F
			SQUARE	PROB>F	
MOOSE SEEN / HOUR (SUCCESSFUL HUNTERS) -	5	0.02	0.76	0.0535	
MOOSE SEEN / HOUR (ALL HUNTERS) -----	5	0.02	0.64	0.1021	
ADULT BULLS / COW (ALL HUNTERS) -----	5	0.03	0.24	0.4060	
CALVES SEEN / COW (ALL HUNTERS) -----	5	-0.01	0.06	0.6888	
PERCENT CALVES (ALL HUNTERS) -----	5	-0.73	0.05	0.7314	

2004 W. MTN. REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
[C:\SAS FILES\MOOSE\MDIARY03.SAS]

YEAR	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					YEAR
	MOOSE SEEN/ HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN/ HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN/ HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES	TOTAL SEEN	
2000	0.13	3.13 (0.22)	0.05	6.42 (0.34)	0.09	0.91	0.27	12.3	311	2000
2001	0.14	3.19 (0.22)	0.04	6.63 (0.53)	0.10	1.05	0.37	31.4	312	2001
2002	0.15	3.03 (0.22)	0.06	5.25 (0.75)	0.13	1.13	0.53	19.8	257	2002
2003	0.12	3.68 (0.29)	0.02	7.82 (0.50)	0.09	1.17	0.29	17.8	231	2003
2004	0.17	2.66 (0.21)	0.02	7.07 (0.52)	0.12	1.30	0.43	15.6	277	2004

2004 W. MTN. REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					UNIT
	MOOSE SEEN/ HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN/ HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN/ HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES	TOTAL SEEN	
C1	0.21	2.36 (0.32)	0.04	5.00 ( . )	0.20	1.00	0.31	13.5	75	C1
D2	0.13	3.31 (0.58)	0.00	8.33 (0.67)	0.08	1.47	0.24	8.7	51	D2
E1	0.25	2.00 (0.60)	0.07	8.00 ( . )	0.18	1.08	0.38	15.6	34	E1
E2	0.29	2.60 (1.17)	.	. ( . )	0.29	2.20	0.20	5.9	18	E2
E3	0.23	1.92 (0.23)	0.00	5.50 (0.50)	0.14	0.89	1.22	39.3	31	E3
F	0.12	3.35 (0.48)	0.03	7.14 (0.86)	0.07	1.75	0.50	15.4	68	F

2004 W. MTN. REGION MOOSE HUNTER DIARY OBSERVATION TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MOOSE SEEN / HOUR (SUCCESSFUL HUNTERS) -	5	0.01	0.23	0.4133
MOOSE SEEN / HOUR (ALL HUNTERS) -----	5	0.00	0.09	0.6167
ADULT BULLS / COW (ALL HUNTERS) -----	5	0.09	0.96	0.0031
CALVES SEEN / COW (ALL HUNTERS) -----	5	0.02	0.13	0.5438
PERCENT CALVES (ALL HUNTERS) -----	5	-0.68	0.02	0.8123

2004 CENTRAL REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
[C:\SAS FILES\MOOSE\MDIARY03.SAS]

YEAR	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					YEAR
	MOOSE SEEN/HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN/HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN/HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES	TOTAL SEEN	
2000	0.15	2.95 (0.26)	0.04	6.90 (0.38)	0.09	1.46	0.42	14.7	308	2000
2001	0.14	3.10 (0.23)	0.02	7.60 (0.35)	0.09	1.79	0.47	23.1	309	2001
2002	0.13	3.21 (0.24)	0.02	7.74 (0.39)	0.09	1.32	0.33	12.5	301	2002
2003	0.11	3.61 (0.24)	0.02	6.58 (0.44)	0.08	1.35	0.38	26.3	340	2003
2004	0.11	3.52 (0.26)	0.03	7.61 (0.39)	0.08	1.61	0.30	10.3	291	2004

2004 CENTRAL REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					UNIT
	MOOSE SEEN/HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN/HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN/HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES	TOTAL SEEN	
G	0.16	2.88 (0.39)	0.05	7.83 (0.65)	0.11	1.69	0.17	6.0	106	G
H1	0.10	4.25 (1.10)	0.00	4.00 ( . )	0.09	0.90	0.40	17.4	23	H1
I1	0.08	2.29 (0.57)	0.02	7.43 (0.92)	0.04	1.14	0.00	0.0	21	I1
I2	0.10	4.05 (0.59)	0.02	8.67 (0.33)	0.08	2.47	0.73	17.5	75	I2
J1	0.10	4.25 (0.84)	0.02	8.00 (0.58)	0.06	2.67	0.33	8.3	29	J1
J2	0.09	3.67 (0.60)	0.01	7.33 (1.20)	0.06	0.94	0.19	8.8	37	J2

\* - NOTE: Observation data prior to 2000 reflects unit I as a whole, prior to unit split.

2004 CENTRAL REGION MOOSE HUNTER DIARY OBSERVATION TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MOOSE SEEN / HOUR (SUCCESSFUL HUNTERS) -	5	-0.01	0.94	0.0066
MOOSE SEEN / HOUR (ALL HUNTERS) -----	5	-0.00	0.71	0.0738
ADULT BULLS / COW (ALL HUNTERS) -----	5	-0.01	0.01	0.8657
CALVES SEEN / COW (ALL HUNTERS) -----	5	-0.03	0.61	0.1169
PERCENT CALVES (ALL HUNTERS) -----	5	-0.56	0.02	0.8379

2004 S. WEST REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
[C:\SAS FILES\MOOSE\MDIARY03.SAS]

YEAR	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					TOTAL SEEN	YEAR
	MOOSE SEEN / HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN / HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN / HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES			
2000	0.21	1.75 (0.35)	0.01	9.00 (0.00)	0.05	1.91	0.55	15.8	40	2000	
2001	0.09	3.39 (0.45)	0.04	7.67 (0.67)	0.08	1.63	0.37	20.0	69	2001	
2002	0.08	3.56 (0.63)	0.02	5.67 (0.99)	0.06	1.50	0.50	16.7	44	2002	
2003	0.10	3.14 (0.42)	0.07	7.00 (0.91)	0.09	1.37	0.32	20.7	71	2003	
2004	0.10	3.83 (0.55)	0.01	7.56 (0.82)	0.04	3.71	0.57	10.8	44	2004	

2004 S. WEST REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					TOTAL SEEN	UNIT
	MOOSE SEEN / HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN / HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN / HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES			
H2N	0.11	4.00 (1.05)	0.00	9.00 (0.00)	0.06	4.67	0.00	0.0	19	H2N	
H2S	0.08	6.00 ( . )	0.00	8.50 (0.50)	0.02	0.00	1.00	50.0	4	H2S	
K	0.08	3.33 (0.61)	0.02	6.60 (1.36)	0.04	6.00	1.00	12.5	21	K	

\* - NOTE: Observation data prior to 2000 reflects unit H2 as a whole, prior to unit split.

2004 S. WEST REGION MOOSE HUNTER DIARY OBSERVATION TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MOOSE SEEN / HOUR (SUCCESSFUL HUNTERS) -	5	-0.02	0.43	0.2330
MOOSE SEEN / HOUR (ALL HUNTERS) -----	5	-0.00	0.01	0.8924
ADULT BULLS / COW (ALL HUNTERS) -----	5	0.33	0.30	0.3388
CALVES SEEN / COW (ALL HUNTERS) -----	5	-0.00	0.00	0.9988
PERCENT CALVES (ALL HUNTERS) -----	5	-0.93	0.14	0.5383



2004 S. EAST REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
[C:\SAS FILES\MOOSE\MDIARY03.SAS]

YEAR	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					TOTAL SEEN	YEAR
	MOOSE SEEN / HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN / HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN / HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES			
2000	0.08	3.50 (0.64)	0.02	6.71 (0.58)	0.04	0.74	0.53	23.3	53	2000	
2001	0.10	2.68 (0.49)	0.00	7.31 (0.51)	0.03	1.23	0.38	25.0	41	2001	
2002	0.07	3.55 (0.81)	0.00	6.40 (0.60)	0.03	0.86	0.71	27.8	22	2002	
2003	0.06	4.33 (1.20)	0.01	8.17 (0.31)	0.03	0.57	0.14	25.0	14	2003	
2004	0.04	4.60 (0.96)	0.00	7.75 (0.48)	0.03	0.43	0.57	28.6	17	2004	

2004 S. EAST REGION MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (UNIT DETAIL)

UNIT	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					TOTAL SEEN	UNIT
	MOOSE SEEN / HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN / HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN / HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES			
L	0.04	5.00 (1.38)	0.00	7.50 (0.50)	0.03	0.25	0.75	37.5	9	L	
M	0.04	4.20 (1.46)	0.00	8.00 (1.00)	0.03	0.67	0.33	16.7	8	M	

2004 S. EAST REGION MOOSE HUNTER DIARY OBSERVATION TREND ANALYSES  
(BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MOOSE SEEN / HOUR (SUCCESSFUL HUNTERS) -	5	-0.01	0.66	0.0933
MOOSE SEEN / HOUR (ALL HUNTERS) -----	5	-0.00	0.54	0.1554
ADULT BULLS / COW (ALL HUNTERS) -----	5	-0.13	0.43	0.2281
CALVES SEEN / COW (ALL HUNTERS) -----	5	-0.02	0.01	0.8594
PERCENT CALVES (ALL HUNTERS) -----	5	1.06	0.59	0.1312

2004 OVERALL STATEWIDE MOOSE HUNTER DIARY - MOOSE OBSERVATION SUMMARY (WITH PREVIOUS 4 YEARS)  
 [C:\SAS FILES\MOOSE\MDIARY03.SAS]

YEAR	SUCCESSFUL HUNTERS		UNSUCCESSFUL HUNTERS		ALL HUNTERS					TOTAL SEEN	YEAR
	MOOSE SEEN/ HOUR	MEAN DAYS HUNTED/MOOSE KILLED (SE)	MOOSE SEEN/ HOUR	MEAN DAYS HUNTED DURING SEASON (SE)	MOOSE SEEN/ HOUR	ADULT BULLS / COW	CALVES SEEN / COW	PERCENT CALVES			
2000	0.18	2.84 (0.10)	0.05	6.85 (0.20)	0.12	0.95	0.30	13.2	1608	2000	
2001	0.19	2.96 (0.10)	0.03	7.04 (0.24)	0.14	1.02	0.37	25.5	1813	2001	
2002	0.19	2.91 (0.11)	0.03	6.45 (0.32)	0.15	1.05	0.41	16.8	1516	2002	
2003	0.19	3.21 (0.12)	0.04	6.98 (0.28)	0.15	1.16	0.29	20.1	1730	2003	
2004	0.20	2.88 (0.10)	0.03	7.16 (0.25)	0.15	1.06	0.29	12.3	1753	2004	

2004 OVERALL STATEWIDE MOOSE HUNTER DIARY OBSERVATION TREND ANALYSES  
 (BASED ON CURRENT AND PREVIOUS 4 YEARS)

TREND	YEARS USED (N)	ANNUAL TREND	R SQUARE	PROB>F
MOOSE SEEN / HOUR (SUCCESSFUL HUNTERS) -	5	0.00	0.56	0.1483
MOOSE SEEN / HOUR (ALL HUNTERS) -----	5	0.01	0.67	0.0886
ADULT BULLS / COW (ALL HUNTERS) -----	5	0.03	0.53	0.1610
CALVES SEEN / COW (ALL HUNTERS) -----	5	-0.01	0.07	0.6718
PERCENT CALVES (ALL HUNTERS) -----	5	-0.71	0.04	0.7378

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5

**Grant Type:** Survey and Inventory

**Period Covered:** July 1, 2004– June 30, 2005

**Project II:** MOOSE RESEARCH AND MANAGMENT

**Job 5:** Population Surveys Using Thermal Infrared Technology

**Objective:** To annually determine the relationship between moose observation rates and population density in the north region and WMU C1 using the deer hunter mail survey and aerial infrared thermal imagery. To determine regional moose densities using aerial infrared thermal imagery on an as needed basis.

**Summary:** No infrared surveys were conducted this segment. Previous research (see W-89-R-1, Project II, Job 5) allowed for the determination of the relationship between actual moose numbers (as determined through IR surveys) and hunter observation rates. Applying the regression equation ( $Y = .3003x + .0175$ ,  $R^2 = .6332$ ) to the average of this year's and the preceding two years deer hunter observation rates (x) for each region yields a population density (Y) for the regions as follows: North Region including WMU C1 (2.48 moose/mi<sup>2</sup>); White Mtn Region excluding WMU C1 (0.65 moose/mi<sup>2</sup>); Central Region (0.52 moose/mi<sup>2</sup>); Southwest Region (0.31 moose/mi<sup>2</sup>); Southeast Region (0.21 moose/mi<sup>2</sup>).

**Target Date:** June 31, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None

**Total Cost:**

**Results:** It is very important to remember that this regression (Figure 1) is best applied in the IR area where the regression was formulated. While it can be cautiously applied to other areas there is no way of knowing how closely the regression fits the local relationship between MSHHH (moose seen per hundred hunting hours) and moose densities. The infrared survey may occasionally be used to check on our management progress and/or check on populations of concern.

The estimated moose density in the IR area has declined from a high in 1998 of 2.78moose/mi<sup>2</sup> to 2.66 moose/mi<sup>2</sup> in 1999, 2.59 moose/mi<sup>2</sup> in 2000, 2.36 moose/mi<sup>2</sup> in 2001 and 2.30 moose/mi<sup>2</sup> in 2002. In 2003 the population began to increase again at 2.34moose/mi<sup>2</sup> and 2.48 moose/mi<sup>2</sup> in 2004. The predicted densities for the remainder of the state have neither a confidence interval (CI) nor a measurable variance around the prediction. As such, they are not directly used for any management purpose. These predicted densities follow the annual trend pattern of the MSHHH for these areas. This lends credence to the assumption that the regression holds true for areas outside of the survey area.

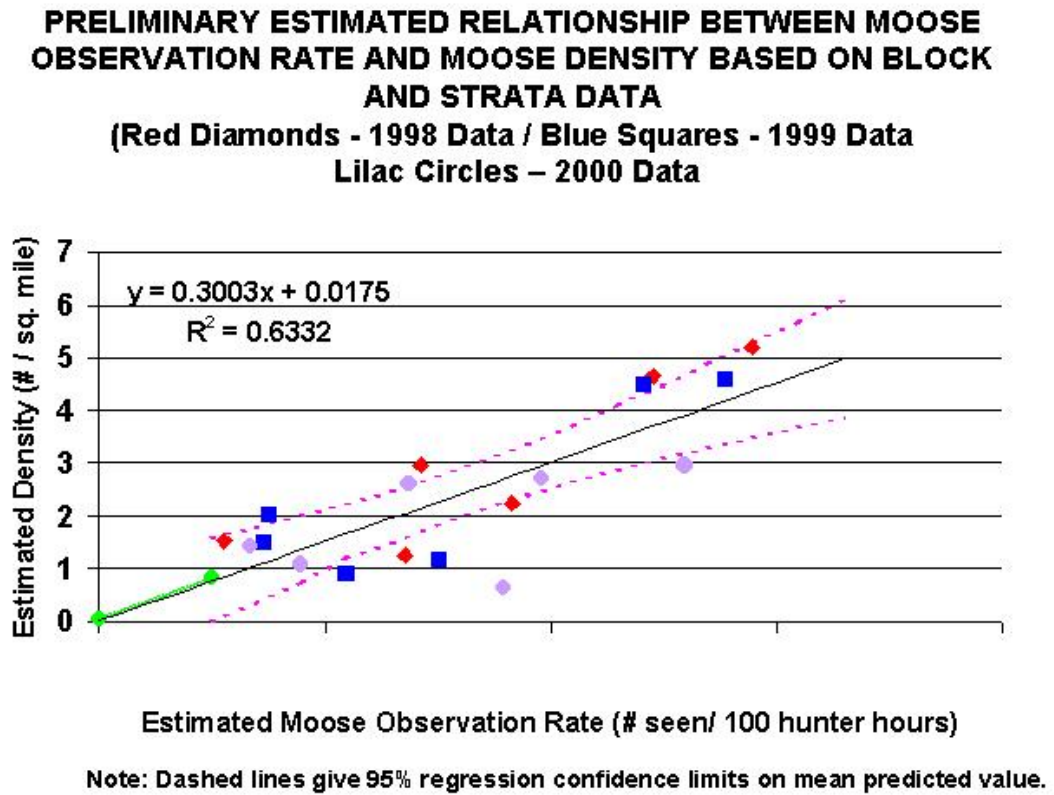
**Conclusions:** Using infrared technology in a Gasaway type aerial survey has proven to be an effective method for estimating moose numbers in the state of New Hampshire. Regressing this survey's results against the data collected in the deer hunter mail survey suggests that the mail survey can be relied on to accurately track changes in moose densities in the northern region.

**Recommendations:** Sightability of the infrared technology has only been partially tested. In order to have the best confidence in the population estimate of this survey a more rigorous test of sightability should be conducted. This test should include a large sample of known targets (i.e., radio collared moose) as well as unknown targets.

**Prepared by:** \_\_\_\_\_  
Kristine M Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_

Figure 1.



## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5

**Grant Type:** Survey and Inventory

**Period Covered:** July 1, 2004 – June 30, 2005

**Project II:** MOOSE RESEARCH AND MANAGMENT

**Job 6:** An Assessment of Moose Habitat Use and Natural Mortality

**Job Objective:** To determine the cause and rate of natural mortality for calf and adult moose and to identify and describe important components of moose habitat, their utility and season of use.

**Summary:** A four year telemetry study to determine cause and rate of calf and adult moose mortality and habitat use has been undertaken in conjunction with the University of New Hampshire Wildlife Unit. In December of 2003, Hawkins and Powers Aviation out of Grey Bull Wyoming captured 1 adult cow and 24 calf moose using helicopter net gunning. This was the final capture segment of this project. Of the 92 total moose captured and collared over three winters, eighteen have dropped their collars and thirty-nine have died leaving 35 moose still transmitting. These animals will continue to be monitored through the coming summer. Habitat data will be analyzed upon completion of monitoring.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None.

**Total Cost:**

**Procedures:** Animals were captured in the month of December after the close of the regular deer season by Hawkins and Powers Aviation out of Grey Bull, Wyoming. All animals were captured by helicopter net gunning or drugging. Drugs used for sedation were a mixture of Carfentanil/Xylazine. The reversal agent was a combination of Tolazalene and Naltrexone.

All animals were ear tagged with large yellow cattle tags in 2001 and pink cattle tags in 2002 and blue in 2003. Samples of hair, blood and fecal pellets were taken from all animals. All adult cows were checked for pregnancy using intrauterine ultrasonography. All transmitters are equipped with mortality modes. VHF collars were fitted to the adults or designed to expand with growth of the calves. GPS collars are programmed to obtain fixes 13 times in a 24 hour period and to automatically drop off on June 15, 2004 or October 2004. If GPS collared animals die prior to this drop off date, the collar's data will be downloaded and the collar redeployed as quickly as possible. If deployed by department staff, the capture method will be darting using 900 mg of xylazine as the animals come into salt licks at the side of the road. The reversal agent will be 900 mg of tolazaline.

Each spring the cows will be closely monitored to determine location and time of calf drop and number of calves born. All collared animals will be monitored at time intervals that will allow for accurate determination of cause of death. Animals will be monitored in all seasons and times of day. All adult cows are currently being visually checked at least once a week for presence of calves. Monitoring of VHF collars will be by ground triangulation or single fix by direct observation or fixed wing aircraft. Fixes will be accrued as often as necessary to insure accuracy of habitat use information. A more complete explanation of this job is found in Appendix III of the 2001 – 2002 PR report.

**Results:** Since June of 2004 six animals have died. Two cows, a yearling and a two year old, died in vehicle collisions and two bulls, (1.5 years and 2.5 years old) and two 4.5 year old cows were taken during the 2004 moose hunt. Five animals, one yearling bull, 2 two year old bulls and 2 adult cows lost their collars. However a rough estimate can be determined. All collars that fell off did so prior to 6/11. All mortalities occurred after 6/24. A rough estimate of adult mortality would be 6/45 or 13%. All adult mortality was due to anthropogenic causes. There were no calves collared during this segment. Thirty-five collared animals are still transmitting. See Table 8 for a synopsis of collared moose mortality status.

Twenty-one of 26 (81%) adult cows were seen with calves in spring of 2004. Of these 9% had twins (2 of 21). By comparison a review of the 2004 corpora lutea data for cows older than 2.5 in WMU's B, C1 and C2 yields 100% pregnancy rate and 50% twinning rate (N=10). Seventeen percent (4 of 24) of the collared cow's calves were lost from view by summer's end and an additional 20% (4 of 20) were lost from view by the end of December. See Table 9 for the reproductive history of collared cows.

**Conclusions:** Moose management requires good information on mortality, recruitment, reproduction, growth rate, adult sex ratio, age structure and health of the moose herd. To improve management in the state of New Hampshire, more precise information on causes and rates of natural mortality is needed. Accurate mortality rates for collared adults and calves will be determined through the use of a mortality model such as Micromort. The current rough estimate of 13% for adults is similar to that found in the literature for adults that have no hunting pressure but are subject to predation (Peterson, 1977; Ballard et al. 1991). Given our lack of predators for adult moose it would seem that hunting and vehicle collision have taken the place of natural predation.

At 81% pregnancy rate and 9% twinning rate Gasaway et al (1992) suggests that this population (if all animals are older than 2.5) is approaching carrying capacity. Given the difficulty of seeing calves, the possibility of predation before sighting and the fact that age is unknown for most of these animals, this measure of reproduction must be viewed as a minimum possible output.

**Recommendations:** Continue this job as planned.

**Prepared by:** \_\_\_\_\_  
Kristine M. Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_

Table 8. Mortality Status of Collared Moose as of June 30,2004

Collar Date	Tag #	Freq#	age	sex	Capture method	Collar type	Mortality date	Suspected Cause	Collar Drop Date	Notes
<b>2001</b>										
DEC 1	39	150.580	A	C	DRUG	VHF	4/19/02	unk		
DEC 2	12	150.690	C	C	DRUG	VHF			4/20/02	
	40	150.330	A	C	DRUG	VHF				
	24	150.360	A	C	NET	VHF				
	14	150.220	C	C	NET	VHF			6/13/02	
	35	150.610	A	C	DRUG	VHF	6/18/02	unk		
	16	150.880	C	C	NET	GPS	4/17/02	ticks		Collared as adult
	18	150.820	A	C	NET	GPS	10/19/02	hunt		
	19	150.780	A	C	NET	GPS	8/22/03	vehicle		
	37	150.530	A	C	DRUG	VHF	10/21/03	hunt		
DEC 3	2	150.200	C	C	NET	VHF	12/3/01	BROKEN NECK		
	20	150.900	A	C	NET	GPS			6/15/2004	
	15	150.099	C	B	NET	VHF			3/29/02	
	38	150.570	A	C	DRUG	VHF				
	10		C	C	NET					NO COLLAR
	32	150.670	A	C	NET	VHF				
	33	150.710	A	C	NET	VHF				
	36	150.110	A	C	NET	VHF				
	17	150.840	A	C	NET	GPS	4/11/02	tick		
DEC 4	30	150.010	A	C	DRUG	VHF			9/11/04	
	11	150.620	C	B	NET	VHF			4/18/02	
	5	150.130	A	C	NET	VHF				
	6	150.120	C	C	DRUG	VHF			2/7/02	
	29	150.370	A	C	NET	VHF				
	31	150.550	A	C	NET	VHF				
	28	150.230	A	C	DRUG	VHF	4/19/02	tick		
DEC 5	9	150.210	C	B	NET	VHF	4/27/02	tick		
	25	150.250	A	C	DRUG	VHF				
	23	150.090	A	C	DRUG	VHF				
	45	150.460	C	B	DRUG	VHF	2/19/02	tick		
	42	150.030	C	B	NET	VHF	4/16/02	tick		
	1	150.070	A	C	NET	VHF				
	8	150.470	C	B	NET	VHF			4/12/02	
	7	150.390	C	C	NET	VHF	6/20/02	vehicle		
	27	150.700	A	C	NET	VHF	10/17/04	hunt		
	26	150.260	A	C	NET	VHF				
DEC 6	34	150.000	A	C	NET	VHF	10/23/03	hunt		
DEC 7	41	150.431	C	C	NET	VHF	3/30/02	tick		
	43	150.270	A	C	NET	VHF				
	3	150.509	C	C	DRUG	VHF			4/11/02	
	4	150.320	C	B	NET	VHF	5/23/02	VEHICLE	5/20/02	
	13	150.350	C	B	NET	VHF	12/13/01	myopathy		
<b>2002</b>										
JUL 5	46	150.840	A	C	DRUG	GPS	10/16/04	hunt		
JUL 7	50, 275	150.880	A	C	DRUG	GPS			6/15/04	
DEC 9	126	150.140	C	C	NET	VHF	6/13/04	vehicle		
	128	150.470	C	C	NET	VHF	6/19/03	VEHICLE		
	135	150.509	C	B	NET	VHF			3/11/04	
	138	150.120	A	C	NET	VHF				
	144	150.420	C	C	NET	VHF	10/09/04	vehicle		
	146	150.650	C	B	NET	VHF	4/9/03	LUNGWORM/STARVED		
DEC 10	125	150.820	A	C	NET	GPS			6/15/04	GPS
	129	150.180	C	B	NET	VHF				
	131	150.489	C	B	NET	VHF	1/10/03	VEHICLE		
	133	150.630	A	C	NET	VHF				
	134	150.440	C	C	NET	VHF			3/06/05	

Collar Date	Tag #	Freq#	age	sex	Capture method	Collar type	Mortality date	Suspected Cause	Collar Drop Date	Notes
	136	150.449	C	C	NET	VHF	4/11/03	LUNGWORM STARVED		
	139	150.310	C	B	NET	VHF				
	141	150.340	C	C	NET	VHF				
	145	150.039	C	B	NET	VHF	12/24/03	VEHICLE		
	148	150.499	C	B	NET	VHF	3/27/03	LUNGWORM STARVED		
	149	150.639	C	B	NET	VHF	10/19/04	hunt		
DEC 11	119	150.460	A	C	NET	VHF				
	120	150.690	C	B	NET	VHF				
	130	150.620	C	B	NET	VHF	4/19/03	STARVED		
	132	150.410	C	C	NET	VHF				
	140	150.431	C	B	NET	VHF			2/03/04	
	142	150.280	C	B	NET	VHF	12/04/03	unknown		
	143	150.380	C	B	NET	VHF			5/26/04	
	150	150.060	C	C	NET	VHF	4/9/03	STARVED		
<b>2003</b>										
12/14	101	NA	C	C		VHF	12/14/03	capture		Leg injury
	118	150.600	C	B		VHF				
	152	150-030	C	B		VHF			3/11/04	
	153	150.300	C	B		VHF				
	154	150.220	C	C		VHF				
	155	150.320	C	C		VHF				
	156	150.350	C	C		VHF	4/28/04	Winter kill		
	158	150.099	C	B		VHF	4/30/04	Winter kill		
	161	150.620	C	C		VHF				
	162	150.280	C	C		VHF				
	163	NA	C	C		NA	12/14/03	capture		Pelvic injury
	164	150.160	C	C		VHF				
	165	150.290	C	B		VHF	5/05/04	Winter kill		
	166	150.479	C	B		VHF			5/05/05	
	159	150.210	C	B		VHF			6/10/05	
	168	150-189	C	C		VHF				
	172	150.499	C	B		VHF				
12/13	127	150.540	C	B		VHF	10/17/04	HUNT		
	129	150.020	C	B		VHF			4/21/05	
	157	150.240	C	B		VHF	4/28/04	unknown		
	160	150.780	A	C		GPS			6/15/04	GPS
	167	150.050	C	C		VHF				
	169	150.171	C	C		VHF				
	171	150.200	C	C		VHF	4/14/04	Winter kill		
	173	150.449	C	C		VHF	4/20/04	Vehicle		
	174	150.590	C	C		VHF	4/20/04	Winter kill		
	175	150.610	C	C		VHF	6/25/05	Winter kill	3/3/04	



Table 9. Reproductive Status of Collared Moose as of June 30, 2003

Year tagged	Tag #	Age Class	Preg Test 2002	# Calves 2002	Date Calf First Seen 2002	Calf mort date	Preg Test 2003	# Calves 2003	Date calf First seen 2003	Calf mort date	# calves 2004	Date calf First seen 2004	Calf mort date
2001	40	A	p	1	5/28	6/14	na	1	5/16	7/16	1	5/12	
	24	A	p	1	5/19	12/01	na	1	5/24/	6/12	1	5/16	5/21
	35	A	p	1	5/22	6/14	Died 6/18/02						
	16	A	np	0			Died 4/18/02						
	17	A	np	0			Died 4/12/02						
	18	A	np	0			Died 10/19/02						
	19	A	np	0			na	1	5/22	Died 8/22/03			
	37	A	p	2	5/22	12/01	na	0		Died 10/21/03			
	20	A	p	0			na	1	5/20		1	5/17	
	38	A	np	1	6/10	12/01	na	1	5/19	11/15	1	5/20	
	32	A	p	1	5/16	12/01	na	0	na	na	1	5/11	
	33	A	p	1	5/19	12/01	na	0	na	na	1	5/14	
	36	A	p	2	5/24	12/02	na	2	5/21		1	5/18	9/02
	30	A	p	2	5/21	5/27 (1)	na	1	5/24		1	5/19	
	28	A	np	0			Died 4/20/02						
	39	A	np	0			Died 4/21/02						
	29	A	p	1	5/18	12/01	na	0			1	5/18	
	31	A	p	1	6/1	6/13	na	0			0		
	25	A	p	1	5/24	12/01	na	1	5/22	1/12	1	5/30	12/01
	1	A	p	1	5/21	6/10	na	1	5/23	12/14	1	5/29	
	27	Y	np	0			na	1	6/02	5/20/04	1	5/20	
	26	A	np	0			na	1	7/14	4/28/04	0		
	34	Y	p	0			na	1	5/23	6/5	Died 12/03/03		
	43	A	p	1	5/29		na	0			1	5/17	
	23	A	na	0			na	2	5/21	6/09 (1)	2	5/12	?????
	5	A	na	1	6/16	4/9/03	na	1	5/29	6/24	1	5/22	
2002	46	A	na	1	7/5/02	12/01/02	na	1	6/02		2	5/20	6/02 (1)
	50/275	A	na	0			na	1	5/14	8/02	1	5/20	
	119	A	na				p	1	5/18		1	6/03	
	125	A	na				p	1	5/22		1	5/19	
	132	C					NA				0		
	133	A	na				p	1	5/29		1	5/17	

	134	C					NA				0		
	138	A	na				p	1	5/27		1	5/20	
	141	C					NA				0		
	144	C					NA				0		
	149	C					NA				0		
12/ 03	160	A									1	5/21	

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5  
**Grant Type:** Survey and Inventory  
**Period Covered:** July 1, 2004– June 30, 2005  
**Project II:** MOOSE RESEARCH AND MANAGEMENT  
**Job 7:** Habitat Identification and Mapping

**Job Objective:** To accurately identify and map moose habitats statewide on an annual or biennial basis in a reliable and cost effective fashion.

**Summary:** No habitat work was done on this project segment.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None.

**Total Cost:**

**Procedures:** Moose habitat is defined based on both collaring work done in this state and appropriate literature review. These definitions are then applied to various GIS (geographic information systems) data bases and mapping software to produce maps of various habitat types.

**Results:** Not applicable.

**Conclusions:** This job has been in the past and will be in the future a very helpful adjunct to other jobs in this project.

**Recommendations:** This job should be continued as planned. A future job would be to map all vehicle-kill locations perhaps with the help of the Department of Transportation.

**Prepared by:** \_\_\_\_\_  
Kristine M Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_ -

## PERFORMANCE REPORT

**State:** New Hampshire **Grant: W-89-R-5**

**Grant Type:** Survey and Inventory

**Period Covered:** July 1, 2004 – June 30, 2005

**Project II:** MOOSE RESEARCH AND MANAGEMENT

**Job 8:** Moose Browse Assessment

**Job Objective:** To measure available browse and or browsing impacts as needed, using methods that are cost effective and reliable.

**Summary:** The department entered into a contract with Joseph Nelson of Upland Resource Group Inc., in Bristol Vermont to develop an estimate of the browse based carrying capacity for moose in a portion of wildlife management units A1 and A2. Available browse estimates were based on both 1997 cruise data and current available stand data for the Connecticut Lakes Working Forest and Natural Areas. Estimates of browse consumption rates were developed from the literature. From this information and using established habitat models, possible moose densities were derived at 10, 20, 30, 40, and 50% browse cropping rates for 2004 and predicted for 2014 and 2024 based on timber harvest plans.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None.

### **Total Cost:**

**Procedures:** Browse biomass was estimated for the Connecticut Lakes Working Forest and Natural Area (portions of WMU A1 & A2) using 1997 cruise data and current stand data. Daily moose browse consumption rates were determined through a literature search. Nine different habitat based models (six HIS's, one land cover, and three that estimated either twig or stem density) were then used to determine possible supportable 2004 moose densities at a 50% cropping or available browse consumption rate. Estimates of possible 2004 moose densities at 10, 20, 30, 40, and 50% cropping rates were then derived using three models that best encompassed the range of values expressed by the majority of the models. Using these same three models, estimates of moose densities at a 50% cropping rate were also predicted for 2014 and 2024 based on existing forest management plans. A complete description of procedures and results can be found in Appendix III.

**Results:** Moose densities calculated to be sustainable at a 50% cropping rate ranged from approximately 2.5 to 0.5 moose/mi<sup>2</sup>. All models fell within a similar range of values with the exception of the Allen et al. model (1993) which differed significantly from the other models (0.05 vs 1.5 – 2.5) Three models encompassed the range of values generated by the majority of the models and were used for all remaining calculations. Densities of moose (per square mile) at different cropping rates ranged from approximately 0.25 at 10% cropping rate to 3.1 moose at 60% cropping rate. The difference in the range of values between the three models became greater at the higher cropping rates with the difference being approximately 0.25 at a 10% cropping rate and 1.0 at a 60% cropping rate. Carrying capacity is often listed in the literature as 50% cropping rate. Based on this cropping rate, carrying capacity of the study area is estimated to be between 1.8 and 2.6 moose/mi<sup>2</sup>. Based on existing timber harvest management plans, this should increase to 3.0 – 5.4 moose/mi<sup>2</sup> in 2014 and 2024.

**Conclusions:** The current moose density in this area is approximately 3.25 moose/mi<sup>2</sup>. To avoid overbrowsing in the study area, the moose population should be reduced.

**Recommendations:** Continue this job as planned.

**Prepared by:** \_\_\_\_\_  
**Kristine M. Bontaites**  
**Moose Project Leader**

**Date:** \_\_\_\_\_

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5  
**Grant Type:** Survey and Inventory  
**Period Covered:** July 1, 2004 – June 30, 2005  
**Project II:** MOOSE RESEARCH AND MANAGEMENT  
**Job 9:** Grant Administration

**Job Objective:** To effectively and efficiently administer the moose management program through participation in peer, legislative and public review.

a) Summary:

All active jobs in this project were administered in order to ensure the efficient and effective management of New Hampshire's moose resources. Administration included 1) communications with peer professionals, Department staff, Commission members and the general public, 2) the acquisition/production of all necessary project supplies, materials and data forms, 3) distribution of supplies and materials, 4) oversight and implementation of data collection and field projects, 5) coordination with participating staff, and 6) attendance and participation in professional workshops.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:**

**Total Cost:**

**Procedures:** All work completed and data collected on the moose project during the calendar year is reported in the Federal Aid Pittman – Robertson report during the fiscal year as seen here. New research or management proposals are developed and peer reviewed under this program. Depending on the scope of the proposal, legislative and or public review may also be necessary. Staff members attend conferences and conduct literature searches in order to stay current with research results and management practices. Scientific papers are submitted to accepted wildlife journals for peer review and acceptance.

**Results:** Federal Aid reports were prepared and submitted in a timely manner. A new Application For Federal Aid for moose management in New Hampshire was formulated, submitted and accepted by the Fish and Wildlife Service. Two members of the Big Game Team attended the Northeast Moose Group meeting held in Shelburne, New Hampshire. The moose project leader attended the North American Moose Conference held in White Fish, Montana. The Northeast Moose Group explored ways to better share data bases and cooperatively manage the northeast moose population. The North American Moose Conference provided information on the status of western moose populations, new management techniques, new research on predator impacts to moose populations and ecology and management of moose in North America

**Conclusions:** This review/educational process is essential to the success of all other jobs in this project.

**Recommendations:** Continue this job as planned.

**Prepared by:** \_\_\_\_\_  
Kristine M Bontaites  
Wildlife Biologist

**Date:** \_\_\_\_\_

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5  
**Grant Type:** Survey and Inventory  
**Period Covered:** July 1, 2004 – June 30, 2005  
**Project II:** MOOSE RESEARCH AND MANAGEMENT  
**Job 10:** Grant Planning

**Job Objective:** To develop a long range management plan for moose research and management.

**Summary:** An extensive literature review and analysis of existing moose data was completed. Results of this review and analysis were used in the formulation of a comprehensive 173 page New Hampshire Moose Assessment report. This assessment was a summary of the history of moose in the state, life history, current population and habitat status, limiting factors, management activities, and past and present use and demand of the moose resource and projections of same. This document was used to educate the members of the Public Working Group whose charge was to develop goals and objectives for moose management. Twelve meetings were attended by staff and the public working group to develop the goals and objectives for the moose project for the time period of 2006-2015.

**Target Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None.

### Total Cost:

**Procedures:** A planning process (New Hampshire Big Game Plan: 2006-2015) was completed during this reporting segment to establish moose management goals for the period 2006 through 2015. This process included: 1) writing a comprehensive New Hampshire moose assessment report; 2) conducting a public survey of randomly selected New Hampshire residents and hunters to quantify opinions on the status and management of moose populations in the state; 3) forming a 33-member public working group consisting of key stakeholders to identify management issues and formulate moose population goals and objectives; 4) soliciting public input regarding proposed moose management goals and objectives through 4 open house sessions held in Concord and Lancaster; and 5) submitting the final draft plan to the Executive Director of the New Hampshire Fish and Game Department and the New Hampshire Fish and Game Commission for their review and approval.

**Results:** The goals and objectives established in the newly established long range plan define clear boundaries within which the department establishes management recommendations each biennium. A summary of these moose goals and objectives can be found in Appendix IV . A copy of the New Hampshire Moose Assessment can be found at the Wildlife Division in Concord.

**Conclusions:** This job is essential for development and maintenance of clearly defined objectives and goals.

**Recommendations:** Continue this job as planned.

**Prepared by:** \_\_\_\_\_

Kristine M Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_

## PERFORMANCE REPORT

**State:** New Hampshire **Grant:** W-89-R-5  
**Grant Type:** Survey and Inventory  
**Period Covered:** July 1, 2004 – June 30, 2005  
**Project II:** MOOSE RESEARCH AND MANAGEMENT  
**Job 11:** Outreach and Education

**Job Objective:** To inform the public, legislature and Governor and Council of the biological status and management needs of the state's moose herd; to provide information regarding the performances of the moose management program and; to maintain a high level of public and governmental knowledge regarding current moose research activities and management techniques.

**Summary:** The project leader gave two presentations to the general public on the moose management program. The canned slide show was sent to schools numerous times. The annual moose harvest summary was written and distributed (Appendix I). Public service announcements regarding safe driving practices (Brake for Moose) were aired in the spring on both radio and television. Six moose hunting seminars were given to all moose hunting permittees. The 2004 Legislative Report was written and submitted to the legislature in September.

**Date:** June 30, annually.

**Status of Progress:** On schedule.

**Significant Deviations:** None.

**Total Cost:**

**Procedures:** A variety of media techniques are used to educate the public and government on all aspects of moose life history, management and research.

**Results:** The results of educational efforts are difficult to assess quantitatively. They are best assessed by the level of general knowledge expressed by the general public and level of acceptance of current management and research practices. This level of acceptance appears at this time to be high.

**Conclusions:** This project is essential to maintenance of well informed constituents and to a good general working relationship with the public.

**Recommendations:** Continue this job as planned.

**Prepared by:** \_\_\_\_\_  
Kristine M. Bontaites  
Moose Project Leader

**Date:** \_\_\_\_\_



## REFERENCES

Ballard, W.B., J.S. Whitman and D.J. Reed. 1991. Population dynamics of moose in south-central Alaska. *Wildl. Monogr.* 114. 49pp.

Gasaway, W.C., R.D. Boertje, D.V. Garndgard, K.G. Kellyhouse, R.O. Stephenson and D.G. Larsen. 1992. The role of predation in limiting moose at low densities in Alaska and Yukon and implications for conservation. *Wildl. Monogr.* 120. 59pp.

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## APPENDIX I.

### 2004 MOOSE HARVEST SUMMARY REPORT

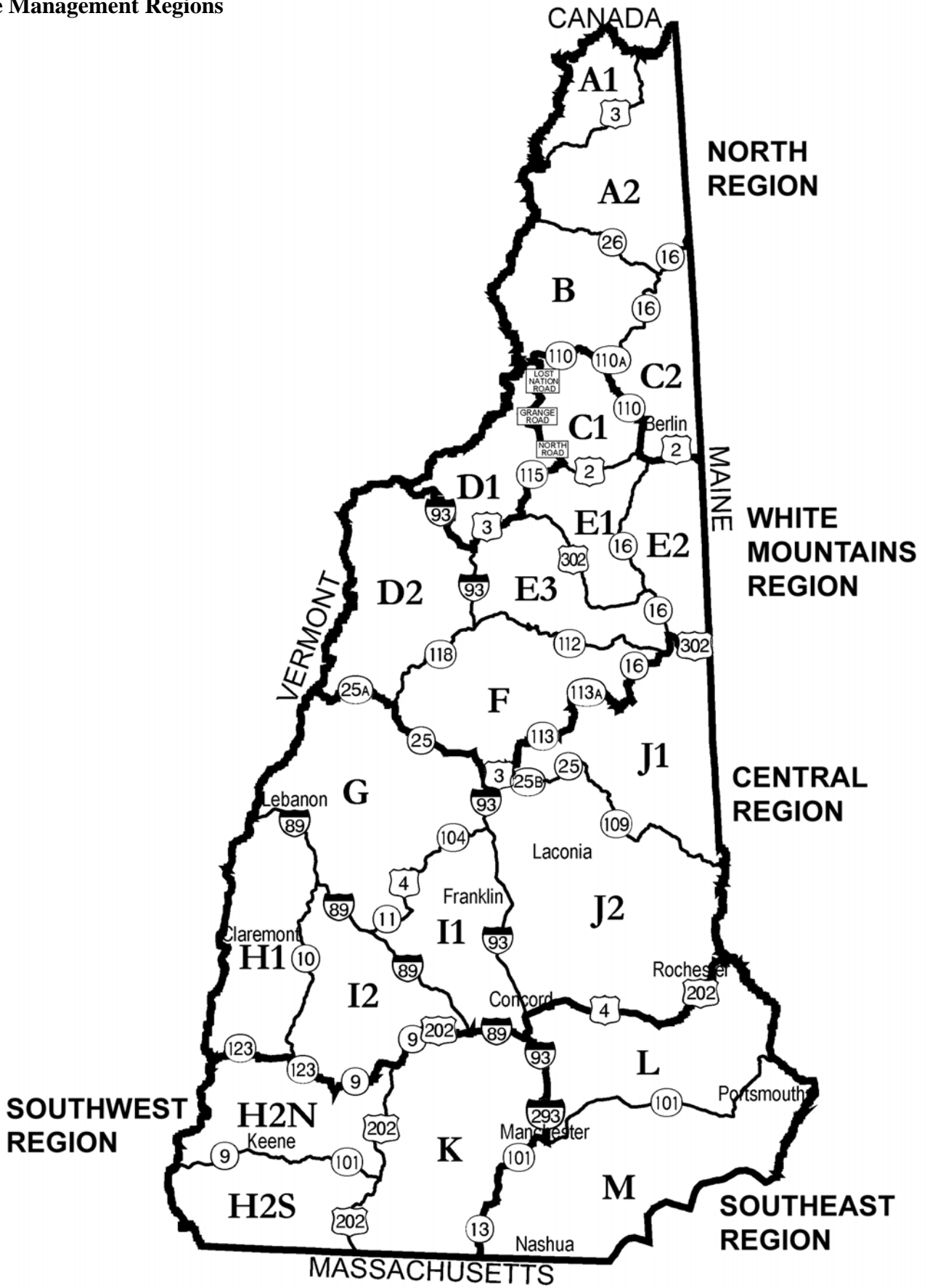
The New Hampshire 2004 moose season took place from October 16<sup>th</sup> through October 24<sup>th</sup>. The weather was excellent for hunting with most days in the 30's and 40's and little sun. Sunshine can significantly reduce movement in fall as moose easily overheat at this time of year. Permit issuance was up from 2003; increasing from four hundred and eighty-two permits to five hundred and twenty-two permits. Permit increases occurred in the North (174 to 217) and the White Mountain (98 to 115) regions while permits were reduced in the Southwest (35 to 30) and Southeast (35 to 20) regions. In addition, antlerless-only permits were reduced from 50 to 19. The antlerless-only permits were issued only in the North region where they are necessary to balance the adult sex ratio.

Three hundred and eighty-eight moose were taken during the nine-day season. The take consisted of 280 (72%) antlered bulls, 96 (25%) cows and 12 (3%) calves. The statewide success rate of 74% was slightly lower than last year's 75%. Regional success rates were comparable to past years with the exception of the Southeast region, which had the highest success rate (45%) since that region was first opened to hunting in 1994.

Regional either-sex permit adult sex ratios (bulls/cow) were: Southeast (0.75:1), Southwest (3.7:1), Central (3.1:1), White Mountains (3.2:1) and North (2.9:1). These sex ratios are similar to those of past years. Hunters traveled from 21 different states and one Canadian province to participate in this year's hunt. Non-residents took 75 (19%) moose while residents took the remaining 313 (81%). Moose were taken by rifle (365), muzzleloader (8), archery (6), shotgun (5) and handgun (1). Two hundred and ninety-one permittees and 97 sub-permittees were the primary shooters. Of these, twenty were women.

Additional information on the lottery and season results can be found in the accompanying tables. The first table lists the management goals for each region. Moose goals are indexed annually using regional moose observation rates of deer hunters participating in an annual deer hunter mail survey. This observation rate, in conjunction with population estimates derived from three years of infrared surveys, gives New Hampshire one of the most accurate moose assessments in North America. A negative (-) value under "desired % change" indicates a need to decrease the population to meet the desired goal while a positive (+) value reflects a need to increase the population.

**Moose Management Regions**



## N.H. MOOSE POPULATION MANAGEMENT GOALS BY REGION

Moose seen per hundred hunter hours from mail survey

REGION	RECOMMENDED GOAL	CURRENT LEVEL*	DESIRED % CHANGE
NORTH	8.63	8.66	0%
WHITE MOUNTAINS	3.94	2.39	+65%
CENTRAL	1.50	1.64	-9%
SOUTH WEST	1.34	0.95	+41%
SOUTH EAST	0.50	0.60	-17%

\* Moose seen per hundred hunter hours during the three years 2002-2004.

NOTE: Moose in New Hampshire are managed by regions rather than WMU's. This is because sample sizes on data collected are too small at the WMU level to yield reliable information.

## SUMMARY OF N.H. MOOSE LOTTERY AND HARVEST

YEAR	TOTAL APPLI-CATIONS	TOTAL PERMITS DRAWN (ISSUED*)	RESIDENT ODDS OF BEING DRAWN	STATEWIDE HARVEST				PERCENT CALVES & COWS	HUNTER SUCCESS RATE
				BULLS	COWS	CALVES	TOTAL		
1988	5,915	75 (75)	1 IN 76	37	15	5	57	35%	76%
1989	5,504	75 (75)	1 IN 71	33	22	4	59	44%	79%
1990	5,707	75 (75)	1 IN 72	39	11	3	53	26%	71%
1991	5,122	100 (100)	1 IN 49	64	21	4	89	28%	89%
1992	8,702	190 (190)	1 IN 45	117	48	7	172	32%	91%
1993	10,044	317 (317)	1 IN 30	188	79	14	281	33%	89%
1994	11,572	405 (405)	1 IN 27	204	84	17	305	33%	75%
1995	14,150	495 (495)	1 IN 26	256	104	24	384	33%	78%
1996	14,398	495 (493)	1 IN 26	257	97	20	374	31%	76%
1997	15,161	570 (569)	1 IN 23	248	152	28	428	42%	75%
1998	15,942	570 (569)	1 IN 25	235	139	33	407	42%	72%
1999	13,090	570 (570)	1 IN 20	227	155	24	406	44%	71%
2000	13,984	585 (581)	1 IN 20	225	138	15	378	40%	65%
2001	14,943	585 (584)	1 IN 20	250	144	25	419	40%	72%
2002	14,888	485 (484)	1 IN 23	209	127	19	355	41%	73%
2003	14,402	485 (482)	1 IN 23	236	118	8	362	35%	75%
2004	15,505	525 (522)	1 IN 23	280	96	12	388	28%	74%

NOTES: \* - Permit numbers may differ from permits drawn in the lottery due to the failure of permittees to attend a seminar, to meet other eligibility requirements or as a result of Fis 301.09(y) or (z).

1988 - First modern moose hunt. Season length was 3 days in Units A1, A2, B, C1, C2, D1, E1, E2, E3, F and J1.

1991 - Season lengthened to 10 days.

1992 - Season set at 9 days. Units D2 and G opened.

1993 - Units H1, I and J2 opened.

1994 - Units H2, K, L and M opened.

1997 - Began issuance of either-sex and antlerless-only permits in Units A1, A2, B and C2.

2000 - Units H2 and I split into H2N/H2S and I1/I2.

## AGE AND SEX OF THE 2004 MOOSE HARVEST BY MANAGEMENT REGION AND WMU

REGION	WMU	ADULT BULLS (AGE 2.5+)	YEARLING BULLS (AGE 1.5)	ADULT COWS (AGE 2.5+)	YEARLING COWS (AGE 1.5)	CALVES	TOTAL	% COWS AND CALVES	% ADULT BULLS (AGE 2.5+)
NORTH	A1	6	4	2	1	0	13	23%	46%
	A2	41	9	25	8	3	86	42%	48%
	B	34	9	3	1	0	47	9%	72%
	C2	22	3	6	1	2	34	26%	65%
	D1	12	3	2	1	0	18	17%	67%
	<b>ALL</b>	<b>115</b>	<b>28</b>	<b>38</b>	<b>12</b>	<b>5</b>	<b>198</b>	<b>28%</b>	<b>58%</b>
W. MTN.	C1	12	6	4	1	0	23	22%	52%
	D2	12	1	3	0	0	16	19%	75%
	E1	5	2	2	1	0	10	30%	50%
	E2	4	0	0	1	0	5	20%	80%
	E3	4	2	2	1	3	12	50%	33%
	F	11	2	3	1	0	17	24%	65%
	<b>ALL</b>	<b>48</b>	<b>13</b>	<b>14</b>	<b>5</b>	<b>3</b>	<b>83</b>	<b>27%</b>	<b>58%</b>
CENTRAL	G	15	2	4	4	0	25	32%	60%
	H1	3	1	2	0	2	8	50%	38%
	I1	2	4	0	1	0	7	14%	29%
	I2	15	2	3	0	0	20	15%	75%
	J1	9	0	0	0	0	9	0%	100%
	J2	7	2	4	2	0	15	40%	47%
	<b>ALL</b>	<b>51</b>	<b>11</b>	<b>13</b>	<b>7</b>	<b>2</b>	<b>84</b>	<b>26%</b>	<b>61%</b>
S. WEST	H2N	4	2	0	1	0	7	14%	57%
	H2S	0	0	1	0	0	1	100%	0%
	K	5	0	1	0	0	6	17%	83%
	<b>ALL</b>	<b>9</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>14</b>	<b>21%</b>	<b>64%</b>
S. EAST	L	1	0	2	1	1	5	80%	20%
	M	1	1	1	0	1	4	50%	25%
	<b>ALL</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>9</b>	<b>67%</b>	<b>22%</b>
<b>STATEWIDE</b>	<b>ALL</b>	<b>225</b>	<b>55</b>	<b>70</b>	<b>26</b>	<b>12</b>	<b>388</b>	<b>28%</b>	<b>58%</b>

## METHOD OF HARVEST USED BY SUCCESSFUL HUNTERS DURING THE 2004 MOOSE HUNT

METHOD	# OF HUNTERS	% OF HUNTERS
ARCHERY	6	1.55%
HANDGUN	1	0.26%
MUZZLELOADER	8	2.06%
RIFLE	365	94.07%
SHOTGUN	5	1.29%
UNKNOWN	3	0.77%
<b>TOTALS</b>	<b>388</b>	<b>100.00%</b>

## PERMITS ISSUED, HARVEST, SUCCESS RATE AND HARVEST PER SQUARE MILE OF LAND AREA FOR THE 2004 MOOSE HUNT BY MANAGEMENT REGION AND WMU

REGION	WMU	ANTLER-		TOTAL PERMITS ISSUED	TOTAL HARVEST	HUNTER SUCCESS RATE	HARVEST PER SQUARE MILE
		EITHER SEX PERMITS ISSUED	LESS ONLY PERMITS ISSUED				
NORTH	A1	15	0	15	13	87%	0.09
	A2	73	19	92	86	94%	0.21
	B	49	0	49	47	96%	0.14
	C2	40	0	40	34	85%	0.14
	D1	21	0	21	18	86%	0.08
	<b>ALL</b>	<b>198</b>	<b>19</b>	<b>217</b>	<b>198</b>	<b>91%</b>	<b>0.14</b>
W. MTN.	C1	25	0	25	23	92%	0.11
	D2	25	0	25	16	64%	0.03
	E1	15	0	15	10	67%	0.05
	E2	5	0	5	5	100%	0.02
	E3	19	0	19	12	63%	0.04
	F	26	0	26	17	65%	0.04
	<b>ALL</b>	<b>115</b>	<b>0</b>	<b>115</b>	<b>83</b>	<b>72%</b>	<b>0.04</b>
CENTRAL	G	40	0	40	25	63%	0.04
	H1	10	0	10	8	80%	0.02
	I1	20	0	20	7	35%	0.02
	I2	30	0	30	20	67%	0.05
	J1	15	0	15	9	60%	0.02
	J2	25	0	25	15	60%	0.02
	<b>ALL</b>	<b>140</b>	<b>0</b>	<b>140</b>	<b>84</b>	<b>60%</b>	<b>0.03</b>
S. WEST	H2N	10	0	10	7	70%	0.02
	H2S	5	0	5	1	20%	<0.01
	K	15	0	15	6	40%	0.01
	<b>ALL</b>	<b>30</b>	<b>0</b>	<b>30</b>	<b>14</b>	<b>47%</b>	<b>0.01</b>
S. EAST	L	10	0	10	5	50%	0.01
	M	10	0	10	4	40%	0.01
	<b>ALL</b>	<b>20</b>	<b>0</b>	<b>20</b>	<b>9</b>	<b>45%</b>	<b>0.01</b>
<b>STATEWIDE</b>	<b>ALL</b>	<b>503</b>	<b>19</b>	<b>522</b>	<b>388</b>	<b>74%</b>	<b>0.04</b>

Note: Permit numbers may differ from permits drawn in the lottery due to failure of permittees to attend a seminar, to meet other eligibility requirements or as a result of Fis 301.09(y) or (z).

## SUMMARY OF MOOSE PHYSICAL CHARACTERISTICS FROM THE 2004 MOOSE HARVEST BY MANAGEMENT REGION AND AGE

MANAGEMENT REGION	AGE IN YEARS	-----BULLS-----						----COWS----	
		ANTLER BEAM		ANTLER SPREAD		WEIGHT		WEIGHT	
		DIAMETER (MM)		(INCHES)		(POUNDS)		(POUNDS)	
		MEAN	MAXIMUM	MEAN	MAXIMUM	MEAN	MAXIMUM	MEAN	MAXIMUM
<b>NORTH</b>	0.5	.	.	.	.	230	235	153	165
	1.5	33.4	48.00	23.7	40.00	457	570	414	570
	2.5-4.5	48.7	69.00	41.1	62.00	673	870	566	650
	5.5+	60.5	78.00	53.0	66.25	798	910	551	660
W. MTN.	0.5	.	.	.	.	185	200	210	210
	1.5	36.1	51.00	22.9	30.50	453	570	476	500
	2.5-4.5	48.8	58.00	38.7	49.75	624	760	568	615
	5.5+	60.1	75.00	53.1	58.50	755	875	549	620
<b>CENTRAL</b>	0.5	.	.	.	.	260	260	220	220
	1.5	36.6	50.00	26.1	36.75	441	520	432	510
	2.5-4.5	46.7	54.00	37.4	50.00	627	780	558	730
	5.5+	55.6	67.00	47.9	58.75	735	790	603	750
<b>S. WEST</b>	0.5	.	.	.	.	.	.	.	.
	1.5	36.0	36.00	23.0	23.00	380	380	270	270
	2.5-4.5	46.1	61.00	36.4	42.00	621	770	460	510
	5.5+	.	.	.	.	.	.	.	.
<b>S. EAST</b>	0.5	.	.	.	.	240	240	205	205
	1.5	.	.	.	.	385	385	360	360
	2.5-4.5	43.0	44.00	37.3	39.00	590	590	455	460
	5.5+	.	.	.	.	.	.	500	500

## TEN-YEAR MOOSE HUNTER SUCCESS RATES BY MANAGEMENT REGION AND WMU

REGION	UNIT	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	MEAN
NORTH	A1	90%	95%	71%	77%	74%	69%	94%	93%	100%	87%	85%
	A2	99%	95%	97%	93%	92%	84%	83%	95%	93%	94%	93%
	B	97%	97%	96%	93%	82%	87%	91%	92%	92%	96%	92%
	C2	95%	85%	95%	95%	88%	85%	95%	94%	94%	85%	91%
	D1	80%	87%	100%	80%	93%	80%	73%	93%	93%	73%	86%
	<b>ALL</b>	<b>95%</b>	<b>92%</b>	<b>92%</b>	<b>90%</b>	<b>87%</b>	<b>82%</b>	<b>88%</b>	<b>94%</b>	<b>92%</b>	<b>91%</b>	<b>90%</b>
W. MTN.	C1	100%	90%	87%	86%	67%	83%	83%	75%	75%	92%	84%
	D2	85%	70%	77%	73%	77%	52%	63%	76%	84%	64%	72%
	E1	84%	76%	57%	51%	63%	50%	70%	70%	70%	67%	66%
	E2	80%	68%	75%	75%	50%	50%	60%	80%	100%	100%	74%
	E3	80%	72%	67%	37%	33%	45%	55%	47%	40%	63%	54%
	F	80%	67%	80%	60%	72%	63%	63%	76%	70%	65%	70%
	<b>ALL</b>	<b>84%</b>	<b>73%</b>	<b>73%</b>	<b>63%</b>	<b>61%</b>	<b>60%</b>	<b>67%</b>	<b>71%</b>	<b>71%</b>	<b>72%</b>	<b>70%</b>
CENTRAL	G	67%	70%	67%	83%	83%	77%	80%	88%	78%	63%	75%
	H1	70%	80%	70%	40%	70%	47%	60%	80%	90%	80%	69%
	I1*	60%	55%	75%	55%	70%	67%	67%	30%	60%	35%	57%
	I2*	60%	55%	75%	55%	70%	45%	60%	70%	90%	67%	65%
	J1	70%	75%	75%	60%	47%	40%	73%	60%	60%	60%	62%
	J2	45%	60%	50%	45%	70%	59%	51%	46%	63%	60%	55%
	<b>ALL</b>	<b>63%</b>	<b>67%</b>	<b>67%</b>	<b>62%</b>	<b>71%</b>	<b>59%</b>	<b>65%</b>	<b>63%</b>	<b>72%</b>	<b>60%</b>	<b>65%</b>
S. WEST	H2N*	40%	60%	60%	60%	55%	40%	70%	70%	80%	70%	61%
	H2S*	40%	60%	60%	60%	55%	40%	80%	22%	60%	20%	50%
	K	47%	60%	33%	67%	73%	55%	85%	67%	67%	40%	59%
	<b>ALL</b>	<b>43%</b>	<b>60%</b>	<b>49%</b>	<b>63%</b>	<b>63%</b>	<b>49%</b>	<b>80%</b>	<b>56%</b>	<b>69%</b>	<b>47%</b>	<b>58%</b>
S. EAST	L	20%	33%	35%	40%	50%	31%	40%	40%	27%	50%	37%
	M	33%	40%	30%	30%	25%	34%	23%	32%	15%	40%	30%
	<b>ALL</b>	<b>27%</b>	<b>37%</b>	<b>32%</b>	<b>35%</b>	<b>38%</b>	<b>33%</b>	<b>32%</b>	<b>35%</b>	<b>20%</b>	<b>45%</b>	<b>33%</b>
<b>STATEWIDE</b>	<b>ALL</b>	<b>78%</b>	<b>76%</b>	<b>75%</b>	<b>72%</b>	<b>71%</b>	<b>65%</b>	<b>72%</b>	<b>73%</b>	<b>75%</b>	<b>74%</b>	<b>73%</b>

NOTES: Success rates prior to 1996 based on old unit boundaries.  
 \* - Values prior to 2000 are for units H2 or I as a whole.

## APPENDIX II. Rules and Regulations

### Fis 301.02 Wildlife Management Units.

(a) For purposes of this chapter, the state shall be divided into wildlife management units, also referred to as WMU's, described as follows:

(1) Wildlife management unit - A<sub>1</sub>: From Stewartstown Beecher Falls Bridge in Stewartstown east to Rte. 3 then north on Rte. 3 to the Canadian border then following the Canadian/US border west and south to the VT/NH border, Connecticut River and continuing south to the Stewartstown Beecher Falls Bridge;

(2) Wildlife management unit - A<sub>2</sub>: From the Stewartstown/Beecher Falls Bridge in Stewartstown east to Rte. 3 in Stewartstown then north on Rte. 3 to the Canadian/US border northeast to the ME/NH border then following this south to Rte. 16 in Wentworth's Location, south on Rte. 16 to Rte. 26 in Errol, west on Rte. 26 in Errol to Colebrook, west on Lemington Rd. to the Colebrook-Lemington Bridge, then north along the NH/VT state line to the Stewartstown/Beecher Falls Bridge;

(3) Wildlife management unit - B: From the junction of the Connecticut River and the Upper Ammonoosuc River in Northumberland, north along the NH/VT state line to the Colebrook/Lemington bridge in Colebrook, east on Lemington Rd. to Rte. 3 in Colebrook, south on Rte. 3 to Rte. 26 in Colebrook, east on Rte. 26 to Rte. 16 in Errol, south on Rte. 16 to Rte. 110-A in Dummer, west on 110-A to Rte. 110 in West Milan, west on Rte. 110 to Rte. 3 in Groveton, north on Rte. 3 in Groveton to the Upper Ammonoosuc Bridge, west along the Upper Ammonoosuc River to its junction with the Connecticut River;

(4) Wildlife management unit - C<sub>1</sub>: From the junction of the Lost Nation Rd. in Northumberland and Rte. 110, east on Rte. 110 to Rte. 16 in Berlin, south on Rte. 16 to Rte. 2 in Gorham, west on Rte. 2 to North Rd. in Jefferson, north along North Rd. to Grange Rd., north on Grange Rd. to Lost Nation Rd., north on Lost Nation Rd. to the junction of Lost Nation Rd. and Rte. 110 in Northumberland;

(5) Wildlife management unit - C<sub>2</sub>: From the junction of Rte. 16 in Wentworth's Location and the ME/NH line, south on Rte. 16 to Rte. 110-A in Dummer, west on 110-A to Rte. 110 in Milan, south on 110 to Rte. 16 in Berlin, south on Rte. 16 to Rte. 2 in Gorham, east on Rte. 2 to the NH/ME state line, north on the NH/ME state line to its junction with Rte. 16 in Wentworth's Location;

(6) Wildlife management unit - D<sub>1</sub>: From the junction of the Lost Nation Rd. in Northumberland and Rte. 110, south along Lost Nation Rd. to Grange Rd., south on Grange Rd. to North Rd., south on North Rd. to Rte. 2 in Jefferson, east on Rte. 2 to Rte. 115 in Jefferson, south on Rte. 115 to Rte. 3 in Carroll, south on Rte. 3 to I-93 in Franconia, north on I-93 to the NH/VT state line, north on the NH/VT state line, to the junction of the Connecticut and Upper Ammonoosuc River in Northumberland, east along the Upper Ammonoosuc River to the Groveton/Rte. 3 bridge, south along Rte. 3 in Groveton, east on Rte. 110 to the junction of Rte. 110 and the Lost Nation Rd;

(7) Wildlife management unit - D<sub>2</sub>: From the junction of Rte. I-93 and the Vermont border in Littleton, south on I-93 to Rte. 118 in Woodstock, south west on Rte. 118 to Rte. 25 in Warren, south on Rte. 25 to Rte. 25-A in Wentworth, west on Rte. 25-A to Rte. 10 in Orford, north on Rte. 10 to Rte. 25-A, west on Rte. 25-A to the VT/NH border, north on the VT/NH border to its intersection with Rte. I-93 in Littleton;

(8) Wildlife management unit - E<sub>1</sub>: From the junction of Rte. 2 and Rte. 115 in Jefferson east on Rte. 2 to Rte. 16 in Gorham, south on Rte. 16 to Rte. 302 in Glen, north on Rte. 302 to Rte. 3 in Twin Mountain, north on Rte. 3 to Rte. 115 in Carroll, north on Rte. 115 to its junction with Rte. 2 in Jefferson;

(9) Wildlife management unit - E<sub>2</sub>: From the junction of Rte. 2 and Rte. 16 in Gorham, south on Rte. 16 to Rte. 302 in Conway, east on Rte. 302 to the NH/ME state line, then north along the state line to its junction with Rte. 2;

(10) Wildlife management unit - E<sub>3</sub>: From the junction of Rte. 302 and Rte. 3 in Twin Mountain, south on Rte. 3 to I-93, south on I-93 to Rte. 112 in Lincoln, east on Rte. 112 to Rte. 16 in Conway, north on Rte. 16 to Rte. 302 in Glen, north on Rte. 302 to its junction with Rte. 3 in Twin Mountain;

(11) Wildlife management unit - F: From the junction of Rte. 25-A and Rte. 25 in Wentworth, north on Rte. 25 to Rte. 118 in Warren, north on Rte. 118 to Rte. 112 in Woodstock, east on Rte. 112 to Rte. 16 in Conway, south on Rte. 16 to Rte. 113 in Chocorua, west on Rte. 113 to Rte. 113-A in Tamworth, west on Rte. 113-



A in Tamworth to Rte. 113 in Sandwich, west on Rte. 113 to Rte. 3 in Holderness, west on Rte. 3 to Exit 24 of I-93 in Ashland, north on I-93 to Rte. 25, exit 26 in Plymouth, west on Rte. 25 to the junction with Rte. 25-A;

(12) Wildlife management unit - G: From the junction of Rte. 25-A and the VT/NH border in Orford, east on Rte. 25-A to Rte. 10 in Orford, south on Rte. 10 to Rte. 25-A in Orford, east on Rte. 25-A to Rte. 25 in Wentworth, southeast on Rte. 25 to Rte. I-93 in Plymouth, south on Rte. I-93 to Rte. 104 in New Hampton, south on Rte. 104 to Rte. 4 in Danbury, south on Rte. 4 to Rte. 11 in Andover, west on Rte. 11 to Rte. I-89 in New London, west on Rte. I-89 to the VT/NH border, north on the VT/NH border to its intersection with Rte. 25-A in Orford;

(13) Wildlife Management Unit - H<sub>1</sub>: From the junction of I-89 and the NH/VT state line in Lebanon, south on I-89 to Rte. 10 in Grantham, south on Rte. 10 to Rte. 123 in Marlow, west on Rte. 123 to its junction with the Cold River in Walpole, west on Cold River to the NH/VT border, Connecticut River, north on the NH/VT border to I-89 in Lebanon.

(14) Wildlife management unit - H<sub>2-north</sub>: From the junction of Cold River and NH/VT border Connecticut River, in Walpole, east on Cold River to Rte. 123, east on Rte. 123 to Rte. 9 in Stoddard, east on Rte. 9 to Rte. 202 in Hillsborough, south on Rte. 202 to Rte. 101 in Peterborough, west on Rte. 101 to Rte. 9 in Keene, west on Rte. 9 to the VT/NH border, north to the Cold River.

(15) Wildlife management unit - H<sub>2-south</sub>: From the junction of Rte. 9 and the NH/VT border, east on Rte. 9 to Rte. 101 in Keene, east on Rte. 101 to Rte. 202 in Peterborough, south on Rte. 202 to the NH/MA border, west on the NH/MA border to the NH/VT border (Connecticut River), north on the NH/VT border, Connecticut River to its intersection with Rte. 9.

(16) Wildlife management unit - I<sub>1</sub>: From the junction of I-89 and Rte. 11 in New London, north on Rte. 11 to Rte. 4 in Andover, north on Rte. 4 to Rte. 104 in Danbury, north on Rte. 104 to I-93 in New Hampton, south on I-93 to I-89 in Concord, north on I-89 to Rte. 11 in New London.

(17) Wildlife management unit - I<sub>2</sub>: From the junction of I-89 and Rte. 10 in Grantham, south on I-89 to Rte. 9 in Hopkinton, south on Rte. 9 to Rte. 123 in Stoddard, west on Rte. 123 to Rte. 10 in Marlow, north on Rte. 10 to I-89 in Grantham.

(18) Wildlife management unit - J<sub>1</sub>: From the junction of Rte. 113 and Rte. 3 in Holderness, north on Rte. 113 to Rte. 113-A in Sandwich, north on Rte. 113-A to Rte. 113 in Tamworth, east on Rte. 113 to Rte. 16 in Chocorua, north on Rte. 16 to Rte. 302 in Conway, east on Rte. 302 to the ME/NH line, south on ME/NH line to Rte. 109, west on Rte. 109 to Rte. 28 in Wolfeboro Center, south on Rte. 28/109 to Rte. 109 in Wolfeboro, north on Rte. 109 to Rte. 25 in Moultonboro, west on Rte. 25 to Rte. 25B in Center Harbor, along Rte. 25B to Rte. 3, north on Rte. 3 to its junction with Rte. 113 in Holderness.

(19) Wildlife management unit - J<sub>2</sub>: From the junction of Rte. 113 and Rte. 3 in Holderness, south on Rte. 3 to Rte. 25B in East Holderness, east on Rte. 25B to Rte. 25 in Center Harbor, east on Rte. 25 to Rte. 109 in Moultonboro, southeast on Rte. 109 to Rte. 28/109 in Wolfeboro, north on Rte. 28/109 to Rte. 109 in Wolfeboro Center, east on Rte. 109 to its intersection with the ME/NH border, south along the ME/NH border to Rte. 202 in Rochester, south on Rte. 202 to Rte. 4 in Northwood, west on Rte. 4 to I-393 in Concord, west on I-393 to I-93 in Concord, north on I-93 to junction of Rte. 3, exit 24 in Ashland, south on Rte. 3 to the junction of Rte. 113 in Holderness.

(20) Wildlife Management Unit - K: From the junction of Rte. 9 and Rte. 202 in Hillsborough, south on Rte. 202 to the NH/MA state line, east on the NH/MA state line to Rte. 13 in Brookline, north on Rte. 13 to Rte. 101 in Milford, north on Rte. 101 to I-293 in Manchester, north on I-293 to I-93, north on I-93 to I-89 in Concord, west on I-89 to Rte. 9 in Hopkinton, south on Rte. 9 to its junction with Rte. 202 in Hillsborough.

(21) Wildlife management unit - L: From the junction of I-93 and I-393 in Concord, east on I-393 to Rte. 4, east on Rte. 4 to Rte. 202 in Northwood, north on Rte. 202 to NH/ME state line, south along the NH/ME state line to Little Bay, south along the Rockingham/Stafford County line in Little and Great Bay to the Squamscott River, south along the Squamscott River to Rte. 101, west along Rte. 101 to I-93 in Manchester, south on I-93 to I-293, north on I-293 to I-93 in Concord.

(22) Wildlife Management Unit - M: From the junction of Rte. 13 in Brookline and the NH/MA border, north on Rte. 13 to Rte. 101 in Milford, north on Rte. 101 to Rte. I-293 in Manchester, east on I-293 to I-93, north on I-93 to Rte. 101 in Manchester, east on Rte. 101 to its junction with the Squamscott River in Exeter, north along the Squamscott River to Great Bay, north along the Strafford/Rockingham County line in Great and Little Bay to the NH/ME state line, east along the NH/ME state line to the Atlantic Ocean, south along the NH coast line to the NH/MA line, west along the NH/MA state line to its junction with Rte. 13 in Brookline.

(b) Whenever a wildlife management unit is referenced with only a letter, and that WMU has been divided into subwildlife management units with number, that reference shall include all of the area enclosed by those subunits. For example, WMU - J shall include WMU's J<sub>1</sub> and J<sub>2</sub>.

(c) Whenever a subwildlife management unit is referenced with a letter and number and that WMU has been further divided into smaller units, that reference shall include all of the area enclosed by those units. For example, WMU -H<sub>2</sub> shall include H<sub>2-north</sub> and H<sub>2-south</sub>.

#### Fis 301.07 Moose Season.

(a) "Antlered moose" means a moose which has at least one antler 6 inches long measured from the tip of the main beam along the distal edge of the antler to the base of the antler burr at the skull.

(b) For purposes of this section the state shall be divided into wildlife management units, as described in Fis 301.02.

(c) The moose season shall be 9 consecutive days and shall open on the third Saturday in October.

(d) No moose shall be taken with the aid or use of dogs.

(e) No person other than the permittee and subpermittee shall participate in a joint hunt to take moose except that the permittee may employ one licensed guide. The licensed guide may direct, aid, assist, or instruct the permittee and subpermittee but shall not shoot a moose.

(f) No aircraft shall be used to locate moose or communicate the location of moose during the open moose season.

(g) No radio telemetry equipment, electronic calls, cell phones, radio transceivers, pagers or other communication devices shall be used to attract or take moose.

(h) No moose shall be taken within 300 feet of a class 1, 2, 3, 4 or 5 highway, as classified pursuant to RSA 229:5. For purposes of this section both the hunter and the moose shall be not less than 300 feet from a class 1, 2, 3, 4, or 5 highway.

(i) No moose shall be taken with .22 caliber rimfire firearms or with shotguns using shot loads including buckshot. In towns restricted to weapon types pursuant to RSA 207:3-b, 208:3, 208:3-a, 208:3-b, and 208:3-c, only shotguns loaded with a single ball, muzzle-loading rifle, or bow and arrow shall be permitted for the taking of moose.

(j) A person holding a current moose permit or subpermittee's permit may hunt moose with a muzzle loading firearm of not less than .50 caliber.

(k) No bow shall be used for hunting moose unless it will pull at least 60 pounds peak weight measured at 28 inches or less draw.

(l) No mechanically-drawn or released bow shall be used, and moose shall not be taken by a strung bow from a motor vehicle.

(m) No arrow head shall be used other than broadheads as follows:

(1) Fixed blade broadheads shall not be less than 7/8 of an inch or more than 1 1/2 inches wide;

(2) Retractable blade broadheads may be smaller than 7/8 of an inch wide in flight, but shall not be less than 7/8 of an inch wide when open;

(3) There shall be no upper size limit on retractable blade broadheads; and

(4) When arrows are used in such hunting the name and address of the person shall be plainly printed on each arrow.

(n) Only one moose shall be taken per permittee/subpermittee combination.

(o) Moose may be taken in the water.

(p) The permittee or the subpermittee may shoot the moose, but it shall be the responsibility of the permittee to tag the moose immediately upon killing, remove the moose and transport it to the biological check station as required by Fis 301.08.

(q) The moose tag shall contain the following:

(1) The licensee's signature;

(2) The date and time of kill;

(3) Town of kill;

(4) Specific location of kill; and

(5) The wildlife management unit in which the kill occurred.

(r) The permittee shall remain with the moose during transportation to the biological check station. If the moose is shot by the subpermittee, both the permittee and subpermittee shall go to the check station to check the moose.

(s) The permittee and subpermittee shall only hunt in the wildlife management unit to which they are assigned by the department.

(t) The subpermittee shall always be accompanied by the permittee while hunting moose. All subpermittees shall be within sight and hearing, excluding electronic devices, when actual physical direction and control can be effected pursuant to RSA 207:1, XXX. All subpermittees under the age of 16 shall be accompanied by a permittee 18 years of age or older.

**(u) The moose tag shall remain with the moose at all times until the moose is sealed at the biological check station, pursuant to RSA 208:9.**

(v) Once the moose has been sealed as provided in Fis 301.07(u), a moose may be transported during the open season, and for 10 days after, if the moose is accompanied by the person who legally took the moose.

(w) If the moose carcass is placed in the custody of another person or a licensed common carrier, the moose shall, in addition to the registration tag, have a tag plainly marked with the name of the consignor, the name of the consignee, the point of shipment, and the destination.

(x) The permittee, subpermittee, or both if requested, shall return with or without fish and game department personnel to the kill site, the site of evisceration or both for purposes such as, but not limited to, verification of kill site or to obtain ovaries or other biological samples left behind.

(y) Each permittee or subpermittee shall carry a moose permit and each permittee and subpermittee 16 years of age or older shall carry a hunting license at all times when hunting for moose and registering the moose at the check station. Subpermittees under the age of 16 shall not be required to carry a hunting license.

(z) Any person leaving moose parts in the field shall place parts out of sight of roads traveled by conventional vehicles.

**Fis 301.08 Moose Registration at Biological Check Stations.**

(a) The moose shall be presented at the nearest biological check station within 24 hours of the kill.

(b) The moose shall be transported in such a manner that a portion of the moose is open to view.

(c) Biological check stations shall be open daily during the open moose hunting season. The day after the season closes moose shall be registered at any fish and game department regional office or at headquarters in Concord.

(d) The permittee shall provide the following on the moose kill report:

(1) Date and time of kill;

(2) Wildlife management unit, town, and locality of kill;

(3) Weapon used;

(4) Hunter's name, address, telephone number, date of birth, sex, and license number;

(5) Biological information on the moose including the sex, beam diameter, number of points, estimated weight, estimated age, and

(6) The hunter's signature, signed subject to the penalties for making unsworn false statements under RSA 641:3.

(e) The permittee shall bring in to the biological check station at least the following:

(1) The lower jaw;

(2) The intact antler rack on an antlered moose;

(3) The skull plate on a male antlerless moose;

(4) The female reproductive tract including the ovaries and mammary sack; and

(5) All edible portions of the moose.

(f) A moose registration seal as provided in RSA 208:9 shall be affixed by fish and game personnel to the moose for transportation.

**Fis 301.09 Moose Season Lottery.**

(a) Application for the moose season lottery shall be made on an application described in Fis 1102.20.

(b) The applicant shall be at least 16 years of age by the application deadline.

(c) A non-refundable fee of \$10 payable to New Hampshire fish and game department by cash, check or money order shall accompany each application.

(d) Only one application per person shall be entered in the lottery. Any person who turns in an incorrect state of residency on an application shall be disqualified from the lottery process and shall not be eligible to receive a permit.

(e) Illegible applications and incomplete applications shall be returned and not considered. Corrected applications may be resubmitted.

- (f) No late entries shall be accepted.
- (g) Bonus points shall be accrued in accordance with RSA 208:1-a, II- a.
- (h) No person shall accrue more than one point in a given year's lottery.
- (i) A person's accrued points shall be lost if:
  - (1) The applicant fails to provide an eligible application for a given year's lottery;
  - (2) The applicant fails to provide notification of a license number or non-driver identification number change as specified in (x); or
  - (3) The successful applicant has paid the permit fee and does not return the permit by October 1 as specified in (u).
- (j) All applications shall be:
  - (1) Turned in to the department headquarters by 4:00 p.m. on the last Friday in May;
  - (2) Postmarked no later than midnight on the last Friday in May; or
  - (3) Submitted on-line as long as the transaction was started prior to 4pm EST on the last Friday in May.
- (k) Applications shall be assigned a number on a first come first served basis when received at the department headquarters. Self-addressed and stamped receipts shall be returned as notification that the application has been received.
  - (l) The lottery drawing shall be:
    - (1) Held after the season dates have been adopted by rules; and
    - (2) Conducted in the following manner:
      - a. Selection of winning numbers shall be done by computer selection of random numbers;
      - b. A total of 525 application numbers shall be drawn;
      - c. A total of 300 additional numbers shall be drawn as alternates;
      - d. The 525 moose permits shall be allocated as specified in Table 300.01 below:

Table 300.01 Moose Permit Allocation Table

Wildlife Management Unit	No. of Permits For Either Sex Moose	# of Permits Restricted To Antlerless Moose Only
A <sub>1</sub>	15	0
A <sub>2</sub>	75	20
B	50	0
C <sub>1</sub>	25	0
C <sub>2</sub>	40	0
D <sub>1</sub>	20	0
D <sub>2</sub>	25	0
E <sub>1</sub>	15	0
E <sub>2</sub>	5	0
E <sub>3</sub>	20	0
F	25	0
G	40	0
H <sub>1</sub>	10	0
H <sub>2-north</sub>	10	0
H <sub>2-south</sub>	5	0
I <sub>1</sub>	20	0
I <sub>2</sub>	30	0
J <sub>1</sub>	15	0
J <sub>2</sub>	25	0
K	15	0
L	10	0
M	10	0

e. Based on the order of computer selection, applicants shall be assigned a permit as follows:

**1. Applicants shall be assigned a permit for either sex moose in a wildlife management unit indicated on their application;**

2. If all permits for either sex moose in those wildlife management units are filled, applicants shall:

- (i) Be assigned to a permit for an antlerless moose provided their application indicates they are willing to hunt antlerless moose in one of the wildlife management units having these permits available; and
- (ii) Not be assigned a permit if their application indicates they are not willing to hunt antlerless moose; and

3. Once all of the initially drawn applicants have been considered for permits:

- (i) Alternates shall be used to fill the remaining permits; and
- (ii) Successful applicants shall be notified by mail within 10 working days; and

f. The percentage of nonresident numbers drawn shall not be greater than the percentage of nonresident hunting licenses sold during the previous calendar year, and nonresidents shall be randomly distributed throughout the wildlife management units.

(m) Alternates shall be chosen if a permittee chooses not to participate in the hunt and advises the department, in writing, of this decision. Alternates shall be selected in the order in which they were originally drawn in the lottery. Chosen alternates shall then be permittees. Alternates shall be assigned to the wildlife management unit which was assigned to the original permittee. These new permittees shall be notified by mail within 7 days after being selected.

(n) The permit fee shall be paid in full at Concord headquarters no later than the last working day in July. Late payments received via U.S. mail shall be accepted provided they were postmarked no later than midnight on the third Friday of July. Alternates shall be chosen for applicants failing to pay the fee by the prescribed date. Alternates selected shall then pay within 14 days after being notified.

(o) The permittee shall not be required to designate a subpermittee. However, if one is so designated, the permittee shall submit the information required in (p) below on the permittee and the subpermittee, if so designated, to the fish and game department so that it shall be received at fish and game headquarters in Concord by the last working day in July. If an alternate is chosen as a permittee, designation of subpermittee and accompanying information shall be submitted with the payment.

(p) The information required of permittees and subpermittees shall be as follows:

- (1) Complete name and mailing address;
- (2) Date of birth;
- (3) Telephone number; and
- (4) Signature.

(q) The permittee shall obtain a permit described in Fis 1102.21. There shall be no residency requirements for the subpermittee.

(r) The permittee shall complete a mandatory pre-hunt seminar conducted by fish and game department personnel during the months of August, September or October. Permittees who fail to complete the pre-hunt seminar shall not be issued permits.

(s) Subpermittees shall return a signed statement that they have read and understand the current year's New Hampshire moose rules. The statement shall be received at the Concord office no later than the last working day in July. Late statements received via U.S. mail shall be accepted provided they are postmarked no later than midnight on the third Friday in July.

(t) No person shall act as a subpermittee for more than one permittee.

(u) Once the fee for a moose permit has been paid, the permittee shall lose all accumulated points and not be eligible for the next 3 application periods, unless the permittee returns the permit prior to October 1 so that an alternate may be notified to participate in the moose hunt.

(v) No permittee shall sell or barter the subpermittee portion of their permit.

(w) No person shall possess more than one moose permit as a permittee.

(x) If a person's driver's license number or non-driver identification number changes due to re-issuance, the applicant shall notify the department in writing and provide the original number and the new number.

(y) The executive director shall waive restrictions in the moose lottery process to delay the issuance of a moose permit for 1 year due to medical problems or national emergency which prevents the permittee from participating in the moose hunt

(z) The executive director shall authorize permits, in addition to the permits in (1)(2) d., if the director determines that a department error resulted in the rejection of an application for a permit, provided the issuance will have no significant impact on the moose population and the application would have otherwise been successful based on its random number.

APPENDIX III. Calculation of Moose Carrying Capacity in the CT. Lakes Management Region.

INSERT ADOBE BROWSE REPORT HERE

**APPENDIX IV.**



**NEW HAMPSHIRE BIG GAME PLAN**  
**Moose Management Goals and Objectives**  
**2006-2015**

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## **Introduction**

This Big Game Plan represents the stated goals and objectives of the New Hampshire Fish and Game Department for deer, moose, black bear and wild turkey management for the period January 2006 through December 2015. Our ability to achieve these goals and objectives is influenced by a variety of factors including the availability of human and technical resources, the accuracy of the wildlife information we gather, the level of support we receive from our constituents, the decisions made by the Fish and Game Commission, health and available habitat and even weather variables that influence wildlife reproduction, survival, and hunting season harvest rates.

## **Authorities**

From a general perspective the Department, under statute RSA 207:58, is given guidance which states: “The legislature finds it is in the best interests of the state and its citizens to regulate, protect, restore, and conserve the wildlife resources of the state under a uniform scheme of management through the fish and game department. The general court further finds that it is in the best interest of the state and its citizens that the fish and game department recognize, preserve, and promote our special heritage of hunting, fishing, trapping, and wildlife viewing by providing opportunities to hunt, fish, trap, and view wildlife in accordance with title XVIII.”

Statutory authority for setting deer seasons is found in RSA 208:2 which states in part: “The executive director, after consulting with the commission, shall have the authority to open and close the seasons for the taking of wild deer, to fix the number and sex limitation for wild deer, and any other conditions governing the methods and manner of taking and reporting of the same, subject to ...”

Statutory authority for setting moose season is found in RSA 208:1-a which states in part: “No person shall hunt, take, or possess any moose or any part of the carcass of a moose taken in this state without first, obtaining a valid license for such activities from the department of fish and game. The executive director of fish and game, with the consent of the commission, may establish, by rules adopted under RSA 541-A, a hunting season for moose in any county of the state, or any portion thereof.”

Statutory authority for setting bear seasons is found in RSA 208:22 which states in part: “The executive director, with the consent of the commission, shall adopt rules, pursuant to RSA 541-A, relative to opening and closing the seasons for the taking of wild black bear, fixing the number of wild black bear that may be taken and any other conditions governing the methods and manner of taking and reporting of the same. The authority of the executive director as granted by this section may be exercised with reference to the state as a whole or for any specified county or part of a county.”

Statutory authority for setting turkey seasons is found in RSA 209:12-a which states in part: “The executive director shall adopt rules, pursuant to RSA 541-A, relative to: (a)Establishing seasons and bag limits, and issuing wild turkey permits. (b)Establishing registration stations and



registration agent fees for wild turkey. (c)Specifying the methods for taking and registering wild turkeys. (d)The enhancement, protections, and propagation of wild turkeys.”

## **Process**

New Hampshire’s wildlife resources are held in trust by the state for the benefit of our citizenry. Therefore, it is important that wildlife management plans incorporate public input and to the degree practicable are consistent with public desires. Our first big game management plan spanned the period 1997 through 2005. Information considered in the formulation of that plan included a comprehensive public survey, eight public listening sessions, questionnaires from attendees of three public hearings and results from two 1-day stakeholder meetings.

This Big Game Management Plan was formulated over the course of 10-months, by a group of approximately 30 key wildlife stakeholders identified by the Fish and Game Department and referred to as the Big Game Public Working Group (PWG) ([see appendix 1 for a list of Public Working Group members and their affiliations](#)). Baseline information used by the PWG included results from a comprehensive public survey of randomly selected New Hampshire citizens and the most comprehensive species assessment reports ever written by Fish and Game Department staff. The process entailed monthly daylong meetings during which staff presented species information and answered questions. The PWG then proceeded to identify and rank key management issues and to promulgate regional species goals and objectives. All PWG meetings were professionally facilitated. Upon completion of the draft plan, the PWG received and considered staff comments, considerations and concerns. The draft plan will be subject to 4 one and one-half hour open house sessions held in Concord and Lancaster. Following incorporation of public input, the final draft plan will be submitted to the Executive Director of the NH Fish and Game Department and the NH Fish and Game Commission for their final review and approval.

## **Implementation**

This plan will serve as the basis for deer, moose, bear and turkey management in New Hampshire for the next 10-years. Regional population objectives will serve as operational targets for Fish and Game biologists, as they strive to achieve desired population levels over the course of the 10-year period. It is important to note that strategies (e.g. the number of days of either-sex hunting for deer, the timing and length of bear seasons, the number of moose permits issued, and the turkey hunting season framework) will continue to be subject to public input through our biennial season-setting process as described in RSA 541-A. This process includes informal and ongoing dialogue with user groups and a very formal process which involves public hearings and the incorporation of verbal and written public comment. These strategies will be used to achieve our population objectives, as defined in this Big Game Plan. Readers should note that this approach is not new; we have been using the 1997-2005 plan for the past 7 years. Based on the statistical variability of the various indexes used to monitor population levels, it was determined that population levels at +/- 12.5% of the stated population objective would be considered “at goal”, and not require a management action intended to make a population adjustment. This will help to stabilize season structure once the population objectives are reached. This approach reduces annual or biennial adjustments which might be needed to affect small adjustment, and will improve hunter satisfaction. Our intent is to review hunting season

structure every two years through biennial season setting. However, if severe winter weather or other unpredictable events occur which require immediate action, seasons may be adjusted annually. In the worst case scenario, where conditions create a short-term vulnerability which is unacceptable, emergency closure will be implemented.

The primary advantage of long-term planning is that it provides consistency of mission. That is, it allows the Department to focus its limited resources on specific goals and objectives over an extended period of time. This approach preempts false starts, unscheduled reversals of direction, changes in data needs, and other unproductive resource expenditures that can result from unclear or changing management mandates. Generally speaking, big game management goals and objectives are best achieved through slow, steady, consistent movement. Thus, management plans serve the greater good by defining long-term goals and objectives, providing for management and data consistency, and minimizing resource waste.

### **Limitations**

Wildlife diversity, viability and abundance depends on diverse and abundant wildlife habitat. Protection and/or management of wildlife habitat benefits a myriad of species, including moose, deer, bear and turkey. Management of game populations at levels identified in this plan will protect and achieve diverse cultural, recreational, economic and ecological values for the significant benefit of New Hampshire's citizenry. The effects moose and deer can have on habitat structure, and thereby suitability for other species and uses, was a major topic of discussion during the objective setting component of those species plans. The population goals set for those species reflect the group's best effort to balance the economic and recreational value of higher populations with the resulting economic and ecological consequences.

According to the Society for the Protection of New Hampshire Forests, *“New Hampshire has been the fastest-growing state in New England – and in the entire nine-state Northeast region - for four straight decades.”* In addition *“New Hampshire has lost forest and cropland to development at a rate of more than 20,000 acres per year in the past five years”*.

Human population growth and development threatens New Hampshire's wildlife resources by diminishing and/or degrading our habitat base and in the case of big game species, by limiting (due to sprawl and fragmentation) our ability to effectively manage game populations. Thus, unbridled development threatens our ability to achieve the goals and objectives identified in this plan. While it is beyond the scope of this plan to resolve all the challenges posed by existing trends in New Hampshire's human population, it is important for us to acknowledge that these challenges are daunting, and that many of the wildlife goals, objectives and values we ascribe to in New Hampshire are imperiled by these trends. Despite and because of these challenges, the Fish and Game Department will continue to work in partnership with local, regional and statewide land conservation interests, by providing technical and financial assistance when possible, to protect significant wildlife habitat.

# MOOSE

As of 2005, the estimated statewide moose population was 6,400 animals. If all the population objectives in this plan are achieved (including the proposed reduction of up to 30% in the new Connecticut Lakes Region) approximately 6,100 moose will reside in New Hampshire. This represents a net state-wide reduction of approximately 5%. Because the proposed reduction in moose numbers in the Connecticut Lakes region will be implemented in incremental steps, achievement of that specific objective will occur earlier than the tail-end of this 10-year plan.

**Goal 1:** New Hampshire will regionally manage moose populations by balancing and incorporating social, economic, public safety and ecological factors, using the best available science.

Objectives: Population objectives are summarized in the following table.

**Table 1. Moose population objectives by management region expressed in terms of moose seen per 100 hunter hours from the deer hunter mail survey.**

REGION <sup>1</sup>	CURRENT LEVEL <sup>2</sup>	1997-2005 OBJECTIVE	2006-2015 OBJECTIVE	MANAGEMENT ACTION REQUIRED <sup>3</sup>
Conn. Lakes (A1, A2)	10.59	8.63	7.4 <sup>4</sup>	Decrease
<b>North</b> (B, C2, D1)	6.35		6.0	None
<b>White Mtn.</b> (C1, D2, E1, E2, E3, F)	2.39	3.94	3.0	Increase
<b>Central</b> (G, H1, I1, I2, J1, J2)	1.64	1.50	1.5	None
<b>South West</b> (H2, K)	0.95	1.34	1.3	Increase
<b>South East</b> (L, M)	0.60	0.50	0.5	Decrease

<sup>1</sup> - Note that in the 1997-2005 management plan, Units A1, A2, B, C2, and D1 were combined as the North region. [See Appendix 3 for moose units and regions.](#)

<sup>2</sup> - A 3-year average of moose observation rates is used as the index to moose populations. This “Current Level” is the average of 2002-2004 moose observation rates.

<sup>3</sup> - If the “Current Level” is  $\pm 12.5\%$  of the 2006-2015 objective no management action is required, others are as indicated.

<sup>4</sup> - This represents the full 30% reduction, see objective 1-1 below.

Objective 1-1: In the Connecticut Lakes Region (WMUs A1 and A2), reduce the population by up to 30% by 2015 to obtain a population density of 7.4 moose seen per 100 hunter hours. It is felt that a population reduction would help reduce browse impacts without significantly impacting viewing or hunting opportunities. The reduction should occur in 10% increments at three-year intervals. It is anticipated that implementation of the Connecticut Lakes Timber Company Stewardship Plan will result in enhanced moose habitat carrying capacity in the region. Implementation of the Stewardship Plan and its affect on moose habitat will be monitored at each 3-year interval to help assess subsequent moose population objectives in this region. At each 3-year interval, public input will also be sought to assist moose management decision-making.

Objective 1-2: In the North Region (WMUs B, C2 and D1), maintain the moose population at a density of 6.0 moose seen per 100 hunter hours. This moose population will maintain satisfactory viewing and hunting opportunities without impacting regeneration or causing an increase in vehicle collision rates.

Objective 1-3: In the White Mountains region (WMUs C1, E, F and D2), reduce the population density objective to 3.0 moose seen per 100 hunter hours. This reduction will help reduce vehicle collision rates without causing a serious reduction in viewing or hunting opportunities.

Objective 1-4: In the Central region (WMUs H1, I1, I2, J1, J2 and G), retain the current objective of keeping the moose density at 1.5 moose seen per 100 hunter hours. The current density provides good hunting and viewing opportunities without causing high vehicle collision rates or browse levels.

Objective 1-5: In the Southwest region (WMUs H2 and K), meet the 1995 objective of increasing the moose population to 1.3 moose seen per 100 hunter hours. It's anticipated that this population increase will increase viewing and hunting opportunities without adversely impacting vehicle collision rates. Brain worm and relatively high ambient temperatures may complicate efforts to reach this objective.

Objective 1-6: In the Southeast region (WMUs L and M), maintain the moose density at 0.5 moose seen per 100 hunter hours. The high human population densities in this region are considered to be incompatible with a higher moose population due to increased opportunities for human/moose interactions.

Objective 1-7: The New Hampshire Fish and Game Department will Cooperatively work with the Department of Transportation, the Department of Safety, local law enforcement interests and other organizations, on laws, road design and educational programs designed to reduce wildlife/vehicle collisions.

**Goal 2:** New Hampshire residents and visitors will understand, appreciate and value moose in New Hampshire.

Objective 2-1: The New Hampshire Fish and Game Department will continue to use the educational and communication tools at its disposal to encourage people to drive safely in moose country, to view moose safely and to value and live with moose.

Objective 2-2: The New Hampshire Fish and Game Department will seek to educate and inform the motoring public about the risks, causes, and avoidance of moose/vehicle collisions to make our roads safer for wildlife and people.

**Goal 3:** New Hampshire residents and visitors will understand the role of Moose in New Hampshire's ecosystems.

Objective 3-1: The New Hampshire Fish and Game Department will continue to use the educational and communication tools at its disposal to help people learn how to: live with moose, view moose safely, drive safely in moose country, and value, protect and manage moose habitat.

**Goal 4:** The New Hampshire Fish and Game Department will work alone and in partnership with state, federal, and public and private partners to minimize the loss of critical moose habitat and to conserve, protect and enhance moose habitat on state, federal and private lands, through education and through the expenditure of technical and financial resources.

Objective 4-1: Identify critical moose habitat to facilitate protection and to educate landowners and other land stewards.

Objective 4-2: Promote use of the Department GIS Coarse Filter habitat identification capabilities.

Objective 4-3: Assist local, state, federal and private conservation groups and organizations to protect, conserve and manage critical moose habitat.

## Planning Document APPENDIX 1.

### Public Working Group Members For The 2004/2005 Big Game Planning Effort

1. Roscoe Blaisdell	NH Antler and Skull Club
2. Meade Cadot	Harris Center For Environmental Education
3. Bill Carney	Outdoor Writer/NHF&G Commissioner
4. Billy Dodd	Hunting Enthusiast
5. Bob Elwell	Farm Bureau
6. Rick Evans	NH Timberland Owners Ass./Forester
7. Carol Foss	NH Audubon/Ecologist
8. Suzanne Fournier	Speaking For Animals
9. Senator Gallus	New Hampshire State Senator
10. Raymond Grace	Granite State Bow Hunters
11. Rick Graham	NH Bear Hunters Association
12. Paul Karczmarczyk	Ruffed Grouse Society Regional Biologist
13. Ken Kreis, Sr	NH Wildlife Federation
14. Susan Mansfield	Graduate Student - Antioch
15. John McConnell	USDA Wildlife Services
16. Rep. McKinney	New Hampshire State Legislator
17. Buck Mercier	Registered Hunting Guide
18. Tom Morrow	CT Lakes Timber Company
19. Jim Morse	Retail Sporting Goods Store
20. Jim Neal	NH Farm Bureau/Deer Farmer
21. Glenn Normandeau	NHF&G Commissioner
22. Barry Parrish	USF&WS Refuge Biologist
23. Robert Phillipson, Jr.	NHF&G Commissioner
24. Robert Potter	Private Landowner/Conservationist
25. Scott Rolfe	NH DRED Forester
26. Bruce Schwegler	Private Landowner/Conservationist
27. Fred Shepard	NH Trappers Association
28. Kathy Starke	White Mountain National Forest Biologist
29. Matt Tarr	UNH Extension Forester
30. Edith Tucker	Reporter – Coos County Democrat
31. Keith Weaver	USF&WS Refuge Biologist
32. Charlie Williams	NH Chapter, National Wild Turkey Fed.
33. Scot Williamson	Wildlife Management Institute

Planning Document APPENDIX 3.

**N.H. MOOSE  
Management Regions**

