

MOOSE

I. Management History

In the 1700s when New England was beginning to be settled, the Vermont landscape was 95% forest. As forest dwellers, abundant moose populations roamed freely. Early town records and explorers' accounts indicate that the animal was widely distributed throughout Vermont. The French Canadians and Abenaki Indians who raided Deerfield, Massachusetts, in 1704 cached meat from 20 moose at a site on the Connecticut River near Brattleboro to provide food for their return march home to Canada (Williams 1707). An Abenaki hunter who lived near Crystal Lake in Barton also told of killing 27 moose and many beaver in that vicinity in the winter of 1783-1784 (Collins 1903).

Native Americans and European colonists killed moose opportunistically throughout the year for food. As Vermont's population grew the unregulated hunting of moose played a part in their disappearance from the state by the nineteenth century. Probably of far greater importance, however, was the loss of moose habitat when the native forests were converted to agricultural lands. This land conversion (forest into fields) began in about 1800 and peaked by 1880 after which only 37% of Vermont remained forested. By the late nineteenth century Vermont's remaining woodlands were concentrated along the higher elevations of the Green Mountains and in Essex County. Moose had become so rare that when a young bull was shot in March 1899, at Wenlock (now Ferdinand) in Essex County, newspaper reports called it "a strange animal" and "the last moose in Vermont."

During the twentieth century, hill farms went out of business on a vast scale. Forests gradually covered hard-won fields, and moose began to reappear in Vermont. By the 1960s, 25 moose were thought to exist in Essex County. By 1980, forests covered 80% of the land area of the state, and moose numbers had increased to a point where they were regularly seen in Essex County. Moose were also observed in neighboring counties. The absence of predation on moose by mountain lions and wolves, as well as by humans allowed rapid population growth. By 1990,



WAYNE LAROCHE

moose were abundant enough to support a limited, regulated hunt. The size and age structure of the moose population approximated populations in areas of North America where regulated hunting was routine.

Modern moose management began in Vermont in 1992 with the adoption of the state's first plan that used biological data derived from studies conducted in the state and the results from studies conducted on moose in nearby states and provinces of Canada. Public opinion was solicited via a series of public meetings held throughout the state during 1991 and 1992.

Vermont's first modern moose season was a three-day hunt held in 1993 in wildlife management unit (WMU) E in which 30 permits were issued and 25 moose were taken. In 1995 the season was expanded to include a second area, D2, and the season was lengthened to four days including a weekend. WMU E was subdivided into two parts prior to the 1996 season in order to distribute the moose harvest more uniformly across this area. In the new units E1 and E2, some of the hunters were issued antlerless-only licenses in order to achieve an equal adult sex ratio in the harvest and to take cows to stabilize the size of the herd by reducing the number of young moose entering the population in those WMUs. Antlerless-only permits have been issued in these units every year since 1996. Four additional units were opened to moose hunting in 1997.

No changes were made in the 1998 moose season because the Department was in the midst of drafting a new ten-year Moose Management Plan. Public comment concerning the new plan was obtained via mail and telephone surveys, open houses, public meetings, and written comments. To expand public benefits, the final plan called for further expansion of the area open for moose hunting whenever appropriate. Continued growth of the moose herd has resulted in expansion of moose hunting into a total of 17 WMUs, with 78% of the state open to regulated moose hunting.

By the early 2000s, the moose population in WMU E was causing significant damage to forest regeneration. Estimated moose densities were nearly double the target levels set in 1996, yielding population densities of about 1.75 moose per square mile.

Moose densities well over 3 per square mile in WMU E were overbrowsing forest regeneration, not only to their own detriment, but also to the detriment of other wildlife species that utilize low growing trees and shrubs for food and cover. Landowners, especially large industrial forestland owners whose livelihood and investment depends on a healthy and growing forest, were especially anxious to see moose densities reduced.

Large increases in permit numbers issued in units E and D2 were prescribed for the 2004 season (Table 3.1) in an attempt to move toward the goal of returning the moose density in these areas to their 1996 and 1999 levels, respectively. By this time, moose had approached the biological carrying capacity of the habitat.

Today, moose hunting in Vermont is regulated by a special license that limits the permit holder to a specific WMU. A moose harvest objective is determined each year for each WMU, and a specific

Table 3.1 Vermont Moose Season Results 1993 - 2008

YEAR	PERMITS ISSUED	MOOSE HARVESTED	% HUNTER SUCCESS	UNITS OPEN
1993 ¹	30	25	83	E
1994	40	28	70	E
1995 ²	75	61	81	D2, E
1996 ³	100	78	78	D2, E1, E2
1997	165	100	61	Above plus C, D1, H1 & H2
1998	165	97	59	
1999	200	120	60	Above plus G, I & J1
2000	215	137	64	
2001	229	155	68	
2002	365	221	61	Above plus B, J2, L, M1 & P
2003 ⁴	440	298	68	Above plus O1
2004	833	539	65	
2005 ⁵	1,046	640	61	Above plus Q
2006	1,115	648	58	
2007 ⁶	1,251	592	47	Above plus M2
2008	1,251	605	48	
Totals	7,520	4,344	58	

¹ 3-day, mid-week season.

² Season lengthened to 4 days and opening day moved to Saturday.

³ Antlerless-only permits issued for the first time. WMU E split into subunits E1 and E2.

⁴ Season lengthened to 6 days.

⁵ Season split into two 6-day periods; antlerless permit holders in D2, E1 & E2 hunt 2nd week.

⁶ Second season lengthened to 9 days.

number of licenses are issued to achieve target harvests. The license allows a party of up to two hunters, and an optional guide, to take a single moose during a season held in mid- to late-October. Hunters are selected by random draw from a large pool of applicants who apply prior to the license drawing. Licenses are either-sex or limited to cows and calves as necessary to achieve area-specific population goals (Table 3.1)



GINNY GARRISON

1998-2007 Plan Accomplishments

Vermont's second moose management plan was adopted in 1998 and incorporated biological data on the herd gathered between 1980 and 1997 along with public input. The results of the public input revealed that Vermonters generally wanted to see more moose statewide while wanting to stabilize populations in the Essex County area. Vermonters desired the benefits of a healthy moose population, but they also expressed serious concerns regarding moose/vehicle collisions and the upward trend in human conflicts with moose.

The ten-year moose management plan adopted in 1998 was designed to address the interests and concerns of the public and strive for a healthy, expanding moose population in balance with its habitat. The objectives and accomplishments of that plan are summarized below.

► **Objective 1. To maintain a healthy, viable moose population in Vermont.**

Vermont's statewide moose population was estimated at 2,100 animals in 1997. This objective included six strategies:

Strategy 1.1 Maintain a minimum fall population of at least 500 moose.

❖ **Action:** The Department estimated that the state-wide moose population following the 2007 moose hunt was about 4,000 animals. This number more than met the minimum objective of 500, but in the Northeast Kingdom region of the state the moose population grew at a rate that was unsustainable ecologically.

Strategy 1.2 Maintain an adult sex ratio of 40 – 60 bulls per 100 adults.

❖ **Action:** Harvest and mortality reports provide the information on the sex ratio

and age structure of Vermont's moose population. This data suggested that the adult male to female sex ratio was very close to a normal, 50:50.

Strategy 1.3 Maintain an adult age-class distribution of at least 25% greater than age four.

❖ **Action:** The Department kept track of nonhunting, or "incidental," mortalities occurring within the moose's "biological year" to determine an age-class distribution. The biological year (BY) for moose begins June 1, at the time of the annual birth pulse of calves, and ends May 31 of the following year. Figure 3.1 illustrates the age structure of Vermont's moose population over a five year period. Although the graph has a normal shape or curve, the percentage of younger moose, age classes one through three, declined from 71% in the early 1990s to 58%. This is likely due to the decrease in reproductive rate noted earlier resulting from increased moose density. Forty-two percent of these moose were more than four years of age.

❖ **Strategy 1.4 Continue to monitor various biological indices, such as carcass weight, beam diameter, ovulation rate, and occurrence of parasites.**

❖ **Action:** The Department monitored the health of the moose herd throughout the state and found the physical condition of the animals was deteriorating. Biologists found that over the previous nine years Vermont's cow moose ovulation rates had dropped dramatically (Fig. 3.2). Other indicators of the moose herd's health were the decline in the dressed carcass weight of yearling bulls and the smaller beam diameter for yearlings (Fig 3.3 and 3.4). These trends strongly indicated that the moose herd was exceeding its BCC in some parts of the state, most notably in WMUs E1 and E2. Biologists also watched for diseases and health related issues caused from two common parasites, the winter tick and the roundworm. There were, however, no apparent health effects from either of these parasites during this period.

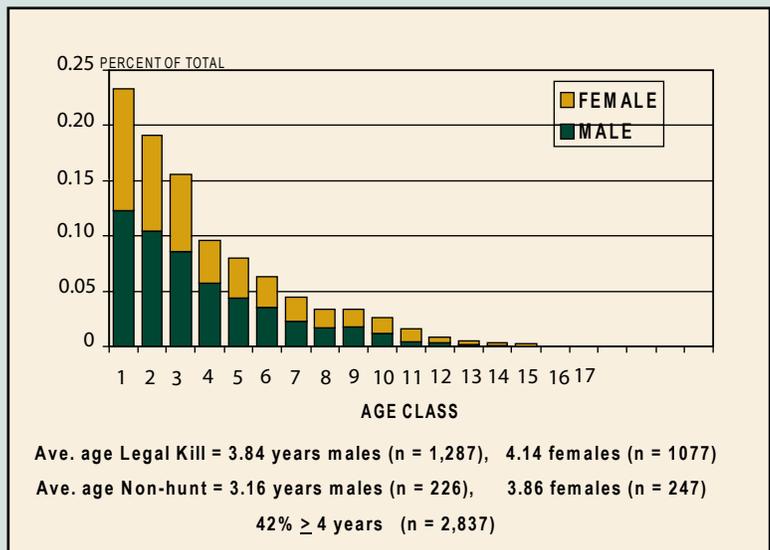


Figure 3.1 VT moose ages for legal and non-hunting mortalities for calendar years 2003 – 2007.

1998-2007 Plan Accomplishments (continued)

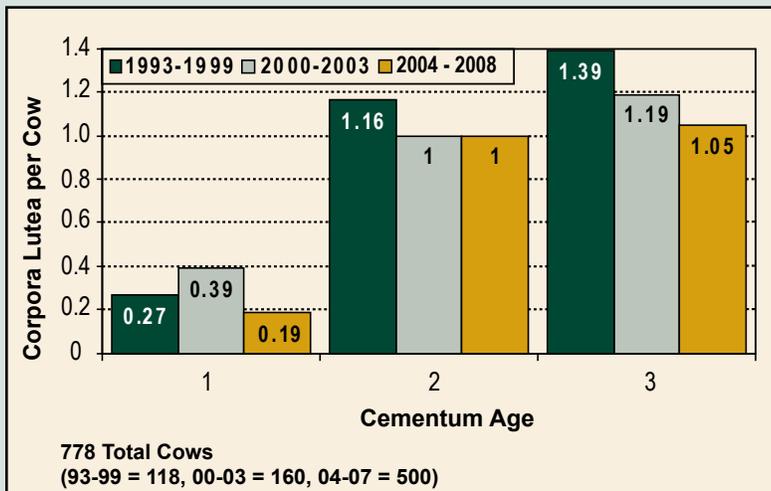


Figure 3.2 Comparison of ovulation rates for legally harvested cows from three time periods

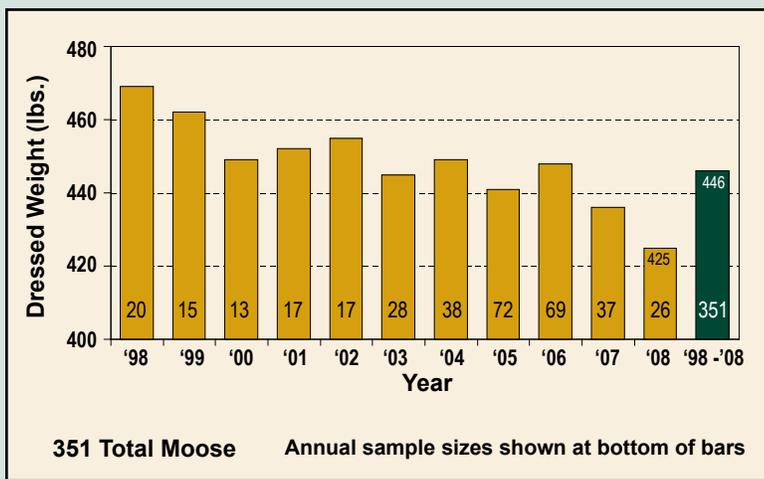


Figure 3.3 Yearling male carcass weight from Vermont moose harvests.

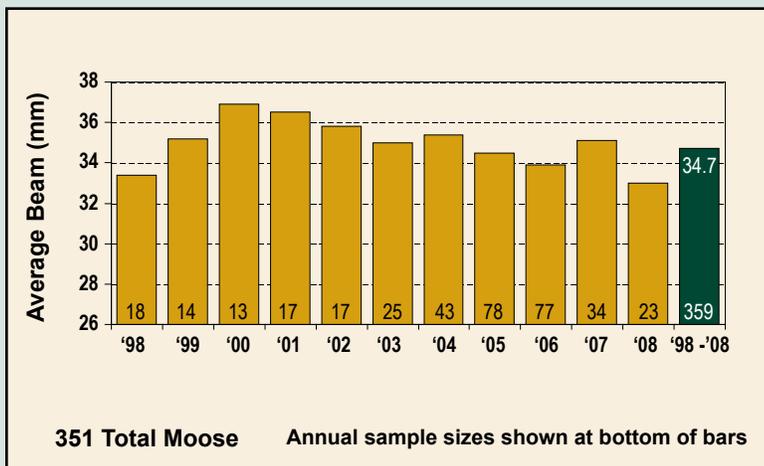


Figure 3.4 Yearling beam diameter from Vermont moose harvests.

Strategy 1.5 Develop a model to assess relative moose habitat suitability at the WMU or regional level throughout the state.

❖ **Action:** The Department assisted a graduate student at the University of Vermont (UVM) who modified a moose habitat suitability index (HSI) model that was used to evaluate moose habitat in WMUs E and I (Koitzsch 2000). The HSI values (1.0 equals ideal habitat) were estimated to be 0.64 and 0.34 for WMUs E and I, respectively. The Department expanded use of this model and sought funding and partnerships with research institutions to perform this work.

Strategy 1.6 Consider implementing field studies to investigate and monitor moose browsing in selected WMUs.

❖ **Action:** With the assistance of staff biologists, a UVM graduate student investigated the incidence of moose bark stripping on mountain ash throughout the state (Scharf and Hirth 2000). This study found that one third of mountain ash trees in northern regions were wounded by moose bark stripping. Also, forest inventories conducted on 85,000 acres of private timber lands in Essex County indicated 25% of the plots were browsed, 68% of which were heavily browsed.

➤ **Objective 2.** To provide for the controlled growth of Vermont's statewide moose population in all WMUs except for the Northeast Kingdom region where population stabilization is desired.

Strategy 2.1 Continue to utilize annual, mid-October, regulated moose hunts to stabilize the moose population in WMUs E1, E2, and D2 at 1996 levels.

❖ **Action:** The 1998 moose plan called for stabilization of the moose populations in the

1998-2007 Plan Accomplishments (continued)

Northeast Kingdom region. Density goals were about 1,000 moose in WMU E and 400 in WMU D2. Improved moose estimation methods revealed that the number of permits was still too few to achieve the objectives. Data gathered by the Department produced estimates of moose densities above the goals and continued evidence that moose were overbrowsing their range in the Northeast Kingdom.

Permit numbers for this region continued to increase during the plan period, partly in response to declining hunter success rate which made it necessary to issue more permits in order to meet harvest objectives, and partly in response to the need to expedite population reductions to protect forest habitat.

Strategy 2.2 *Continue to utilize regulated moose hunts to slow rate of growth of the moose population in WMUs C, D1, H1 and H2.*

❖ **Action:** Moose hunting first occurred in WMUs C, D1, H1, and H2 in 1997. The combined population estimate for these units had remained relatively stable since 2001 at about 700 moose.

Strategy 2.3 *Utilize regulated moose hunts to slow rate-of-growth of the moose population in WMUs G, J1, and I beginning in 1999.*

❖ **Action:** Moose hunting was initiated in WMUs G, J1, and I in 1999. The estimated moose population for these units increased from 290 (2001) to 370 (2004) and has since been successfully reduced to an estimated current population of 300 moose.

► **Objective 3. To maximize benefits from Vermont's moose population within acceptable social and biological limits.**

The Department continued to work toward balancing an abundant moose population and sustainable habitat with protection of the forest and prevention of conflicts with humans. During this planning period, the Department employed several strategies. These strategies involved regulating hunting, working with landowners to open access to hunting, and promoting habitat management through public outreach, education, and activities.

Strategy 3.1 *Continue with annual moose hunts in WMUs C, D1, D2, E1, E2, H1, and H2*

Strategy 3.2 *Open WMUs G, J1, and I to limited hunting beginning in 1999.*

Strategy 3.3 *Annually evaluate the potential for regulated moose hunting opportunities in other WMUs.*

❖ **Action:** All three of these strategies from the 1998 moose plan were implemented through regulation.

Strategy 3.4 *Coordinate with large property owners to find ways to enhance moose hunter access.*

❖ **Action:** The Department worked with large industrial forest landowners in the Northeast Kingdom to facilitate the opening of gates during the moose season and with the Vermont Horse Council and the Vermont Department of Forests, Parks & Recreation to facilitate the use of draft horses to haul moose carcasses out of roadless areas.

Strategy 3.5 *Promote the "Hunters Sharing the Harvest" program to moose hunters as a*

way of providing moose meat to needy households throughout Vermont.

❖ **Action:** The Department annually provided a 50-page guidebook to each moose hunting permit holder that included a description of the "Hunters Sharing the Harvest Program" and listed some examples of local food shelves that could store and distribute moose venison to their patrons. (There is currently no organized program or system to track donations.)

Strategy 3.6 *Cooperate with natural resource professionals and landowner organizations in dissemination of moose habitat management guidelines.*

❖ **Action:** In 1995, the Department, in cooperation with the Vermont Department of Forests, Parks & Recreation, published a booklet entitled: "A Landowner's Guide - Wildlife Habitat Management for Vermont Woodlands" (Regan and Anderson 1995). This publication, which includes a chapter on moose habitat, was made available to state biologists, private consulting foresters, and landowners through forest management workshops.

Strategy 3.7 *Develop and implement educational displays explaining Vermont's moose management for use at fairs, outdoor shows, and moose check stations.*

❖ **Action:** In 2001 the Department produced five sets of a seven-panel poster-board display covering many aspects of moose life history and management. These sets have since been used annually at moose weighing stations and in other outreach venues.

Strategy 3.8 *Construct at least two moose observation towers*

1998-2007 Plan Accomplishments (continued)

with parking areas near state highways in the Northeast Kingdom region, contingent on funding partnerships with the private business sector, regional chambers of commerce, and/or governmental tourism agencies.

❖ **Action:** The Department began work in 2006 on siting and designing a moose viewing tower off State Highway 105 in the Essex County town of Ferdinand.

Strategy 3.9 *Cooperate with a private interest in the publication of a "Vermont Moose Watcher's Guide."*

❖ **Action:** A professional wildlife photographer and author from Maine published the "Moose Watchers Handbook" in 2001, which included directions to popular moose viewing sites in Maine, New Hampshire, and Vermont (Silliker Jr. 2001).

► **Objective 4. To minimize negative interactions between humans and moose.**

Strategy 4.1 *Utilize annual limited-entry moose hunts to either stabilize or slow the growth rate of regional moose populations as noted above under Objective 2.*

❖ **Action:** The number of nonhunting moose mortalities steadily increased through the early part of the past ten years. Nonhunting moose mortalities during the last several years have seemed to decrease in the face of increased numbers of permits. Many of these mortalities (41%) occurred in the Northeast Kingdom units of D2, E1, and E2.

Strategy 4.2 *Develop and implement a policy for Department response to "nuisance" moose by 2000.*

❖ **Action:** To address damage caused by moose to livestock fencing, maple sap tubing, and

Christmas tree plantations, a Commissioner's rule was enacted in 1996 that under certain conditions allows a landowner suffering property damage to shoot the moose. To try to avoid this situation, the Department assisted the United States Department of Agriculture, Wildlife Services office in Berlin, Vermont, in developing an informational brochure describing possible ways to curb moose damage.

The Department also developed a protocol for sick or diseased moose that posed a potential hazard to public safety. These situations can arise when sick moose wander into urban areas, farmyards, or busy highways. A Department protocol for dealing with all "nuisance" moose still needs to be completed in the next planning period.

Strategy 4.3 *Continue to cooperate with the Vermont Agency of Transportation (VTrans) to erect warning signs at traditional moose highway crossings.*

Strategy 4.4 *Cooperate with the VTrans in implementing at least three roadside brush-clearing projects to improve visibility at the most dangerous moose crossings, where feasible.*

❖ **Action:** The Department worked with VTrans to evaluate several methods of reducing moose/vehicle collisions. VTrans considered the advice of the Department for the placement of moose crossing signs and the clearing of roadside brush adjacent to frequently used road-side salt licks in order to enhance the ability of approaching motorists to detect moose

Strategy 4.5 *Continue with annual press releases to remind motorists of moose hazards and explore potential for including a warning message with helpful driving tips concerning deer and moose collisions in the Department of Motor Vehicle's Driver's Manual and in all new vehicle registrations or renewals.*

❖ **Action:** The Department issued biannual press releases to newspapers and broadcast media each year to advise motorists during times of the year when movement of moose poses the greatest hazard to motorists. The Department also partnered with the Vermont Frost Heaves PBA basketball team to raise driver awareness concerning the hazard of moose on highways.



TOM MERRIFIELD

II. 2010-2020 Moose Management Issues, Goals, and Strategies

The overall goal of moose management in Vermont is to manage Vermont's moose to sustain healthy, viable populations consistent with biological, social, and economic considerations, and provide maximum hunting opportunities.

ISSUE 1. Regional Population Goals

GOAL: To maintain regional populations of healthy moose at or below cultural carrying capacity.

The Department uses several approaches in estimating moose populations — surveys, mortality data, and aerial censuses. Two annual hunter surveys (one for deer hunters and one for moose hunters), annual moose hunter success rates, and nonhunting mortality records provide the basis for the Department's moose permit allocation recommendations. Observations and knowledge provided by state game wardens, foresters, biologists, and landowners are also considered when making decisions and recommendations.

Since 1999, Vermont has conducted deer and moose hunter surveys that provide a measure of relative moose density trends by WMU across the entire state. The deer hunter survey asks hunters to identify and record the number of bulls, cows, calves, or moose of unknown sex or age that are observed. The moose hunter survey requests hunters to report any preseason scouting activities. Hunters are asked to record the number of scouting trips they took; the number of hours they spent scouting; and the number of moose they saw during these trips. The numbers are standardized to determine the average number of moose sighted per hundred hours scouting.

Moose hunter success rate is calculated as the percentage of all permit holders that harvested and registered a moose. Success rates are calculated annually for each WMU that is open to hunting. The current year hunter success rate is compared to the previous year to assess changes at the WMU level, considering number and type of permits issued. Hunter success can be affected by individual hunters' effort (time spent afield), weather conditions during the hunt, moose behavior, population levels, and the accessibility of moose to hunters (for example, the distribution of roads and trails in moose habitat).

The moose sighting rate from deer hunter surveys in WMU E has declined during the past four years, thus, the estimated moose density has also declined. The population density estimate for November 2008 was 2.59 moose per square mile, an estimated 1,526 moose. With the current permit quota, the target density for WMU E should be achieved following the 2010 hunting season. Moose sighting rates for D2, after remaining fairly stable for several years, finally decreased in November 2008. Using a rolling three-year average for deer hunter survey moose sighting rate data, the moose density in D2 is currently estimated to be 1.16 moose per square mile. It is possible that by maintaining the current permit quota of 340 for one more year that the D2 population may closely approach the target density of one moose per square mile. Permit numbers have been steadily increased in these units from 30 in 1998 to 110 in 2009. The combined population estimate for these units has remained relatively stable since 2001 at about 700 moose.

The Department maintains a statewide database of all reported nonhunting moose deaths. Nonhunting mortality data is collected and reported on a biological year basis that begins on June 1, after most of the moose calves have been born, and ends on May 31. Summaries of nonhunting moose mortalities are prepared each year and assessed prior to development of season recommendations. This information also helps us assess changes in moose numbers through time.

New Hampshire conducts aerial censuses using forward-looking infrared (FLIR) cameras that enhance the ability to observe moose on the ground and has developed a model that provides more accurate estimates of moose populations. Although potential differences in topography, road access, hunter behavior, and other factors could influence moose sighting rates between northern New Hampshire and northeastern Vermont which could affect the applicability of this model in Vermont, the Department has found the model to be useful in estimating moose densities in the state. The Department is seeking to conduct its own aerial FLIR count of moose in Vermont to verify that the New Hampshire model provides accurate estimates in Vermont. Flights are scheduled for December 2009.

Moose hunting has expanded into several additional WMUs since 1999 as populations have grown large enough to sustain hunting (see Table 3.1, page 41). As moose have become more abundant, public

attitudes toward the moose herd have changed over the nine-year period (1996-2007) as well. Results from the 2007 statewide telephone survey indicated, with some regional variations, that overall Vermonters (54%) want to see the moose population remain the same, 19% want to see it increased, and 10% want to see it decreased. Analyses of the data, with the 17% “don’t know/ no opinion” responses removed, is shown in Table 3.2.

Table 3.2 Public opinion on desired regional moose population size by region of residence, in percent (sample size in parenthesis).

Region*	Decrease	Remain the Same	Increase
Northeast Kingdom (99)	31 (31)	54 (53)	15 (15)
Greater Chittenden (268)	9 (24)	69 (184)	22 (60)
Central Vermont (243)	11 (26)	64 (156)	25 (61)
Southern Vermont (246)	10 (25)	66 (161)	24 (60)

*Northeast Kingdom: Caledonia, Essex and Orleans Counties
 Greater Chittenden: Franklin, Chittenden and Grand Isle Counties
 Central Vermont: Addison, Lamoille, Washington and Orange Counties
 Southern Vermont: Rutland, Bennington, Windsor and Windham Counties

With this public feedback in mind, the Department proposes to maintain regional moose numbers at their current levels in most areas of the state, with the exception of the Northeast Kingdom region, where moose numbers need to be reduced to a level below biological carrying capacity, and in a few WMUs where an increase in moose populations may be acceptable (WMUs I, L, P, and Q, and perhaps others). The Department will solicit more public input on this issue prior to setting final objectives on moose herd numbers for WMUs. Web-based questionnaires will be used early in this management plan cycle to solicit public input.

Based on November 2008 population estimates for each WMU (Fig. 3.5.), the Department will make adjustments in two units. The Department proposes continuing with a population target of 1,000 moose in WMU E (1.75 moose per square mile), but to readjust the target for WMU D2 from 400 to 600 moose. This new objective for WMU D2 equates to one moose per square mile, which should be well

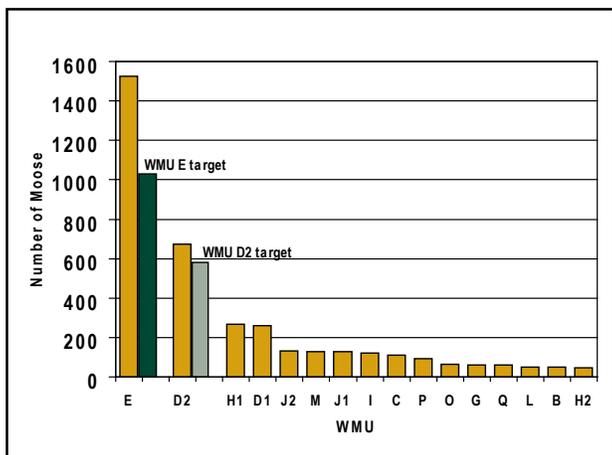


Fig. 3.5 Estimated moose population by WMU from sighting rates of 2006 -2008 November deer seasons.

below biological carrying capacity. This change is proposed because areas of current overbrowsing in D2 are limited, whereas historically higher moose densities (1.4 moose per square mile, 800 total) created overbrowsing. With the growing importance of moose hunting in this region, 600 moose may be an acceptable population level to area residents.

Management Strategies

- 1.1 Maintain a statewide fall post-hunt population of between 3,000 and 5,000 moose.
- 1.2 Maintain a sex ratio of between 40 to 50 bulls per 100 adults (moose of at least age-class one).
- 1.3 Maintain an adult age-class distribution of at least 25% of at least age-class four.
- 1.4 Maintain an average ovulation rate of more than 1.15 for cows age class of at least three.
- 1.5 Assess relative moose habitat condition of individual WMUs or regions of the state using forest inventory data and a GIS-based Habitat Suitability Index Model.
- 1.6 Reduce and maintain WMU E moose densities to 1.75 moose per square mile (approximately 1,000 moose post-hunt).
- 1.7 Reduce and maintain WMU D2 moose densities to 1.0 moose per square mile (approximately 600 moose post-hunt).
- 1.8 Allow slow population growth in WMUs I, L, P and Q while not exceeding one moose per square mile.
- 1.9 Stabilize moose population in other WMUs at current levels.

ISSUE 2. Moose / Human Conflicts

GOAL: To minimize motor vehicle/moose collisions and other forms of damage caused by moose.

As the moose population has expanded, so have the negative interactions with humans. Damage to fences and maple sugaring equipment are common problems. More and more moose are finding their way into developed neighborhoods or becoming habituated to humans. Both situations are rarely resolved without significant public disturbance and usually result with the moose's demise.

Vehicle collisions are the most serious human/moose encounters. Although deer collisions are far more common and often result in costly damage to vehicles, they rarely result in serious human injury. Moose collisions, on the other hand, often result in serious human injury or even death. The Department is continually looking for ways to reduce the number of motor vehicle collisions with moose. Currently, there are approximately 77 signed crossing areas statewide. Many of these signs carry a 40 mph speed advisory per the Department's recommendation.

The number of nonhunting moose mortalities steadily increased through the early part of this decade. Nonhunting moose mortalities during the last several years have decreased slightly (Fig. 3.6) with increased numbers of permits. Many of these mortalities (41%) occurred in the Northeast Kingdom units of D2, E1, and E2.

The Department began drafting a protocol for dealing with moose that are not sick but pose a

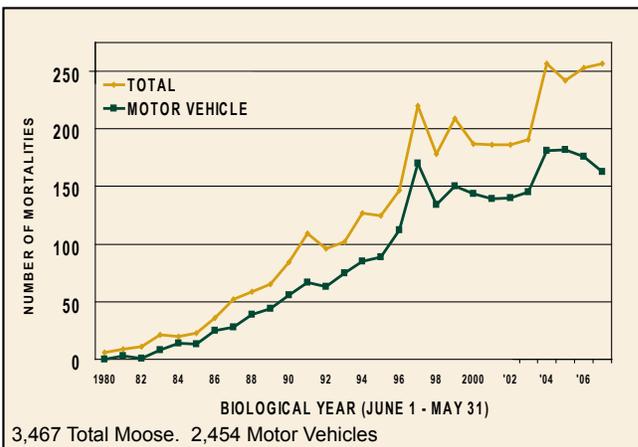


Fig. 3.6 VT non-hunting moose mortalities for biological years 1980 – 2007.

threat to public safety. When finalized, this protocol will conform to the Department's umbrella policy governing how it handles "nuisance" or "hazardous" wildlife in general (Regan 1998). Under the umbrella policy, humane treatment of animals is an important consideration. Euthanasia is recognized as sometimes being the only cost-effective and practical response.

Management Strategies

- 2.1 Develop and implement a policy for Department response to "nuisance" moose.
- 2.2 Continue to cooperate with the Vermont Agency of Transportation (VTRANS) to erect warning signs at traditional moose highway crossings.
- 2.3 Cooperate with VTRANS in implementing roadside brush-clearing projects to improve visibility at the most dangerous moose crossings, when feasible.
- 2.4 Cooperate with VTRANS to investigate the use of new technology that may help reduce moose/vehicle collisions.
- 2.5 Continue with annual press releases to remind motorists of moose hazards during seasons of increased moose movements.

ISSUE 3. Moose Hunting Opportunities

GOAL: To maximize quality moose hunting opportunity.

HUNTING SATISFACTION

Feedback the Department receives from various sources indicates a favorable satisfaction rate from moose hunters on the present structure and timing of hunting seasons. No major changes are being proposed in the current new plan.

Management Strategies

- 3.1 Provide quality moose hunting opportunity in all WMUs where feasible.
- 3.2 Coordinate with large property owners to enhance moose hunter access.
- 3.3 Provide information to hunters on how they can share moose meat with needy households throughout Vermont.
- 3.4 Conduct outreach efforts prior to any significant reduction in total permit numbers made in response to moose population changes.

3.5 Provide public opportunity to harvest moose for food and other utilitarian purposes.

MOOSE PERMIT LOTTERY

An average of 10,448 Vermonters have applied for a moose permit each year for the last five years. Beginning with the 2007 permit lottery, hunters who had applied the previous year but had not won a permit were awarded an extra chance, or “bonus point.” Unsuccessful applicants now accumulate a bonus point for each year they apply and fail to draw a permit. Each “point” adds another occurrence of their name into the lottery pool of applicant names increasing their odds of winning a permit. This recent change has helped satisfy those who have applied for many years without success and seems to have been favorably received by moose hunters. No further changes to the permitting process are currently being contemplated.

Vermont has issued a relatively high number of permits in recent years to reduce the moose population in the Northeast Kingdom. For the 2009 season, 1,230 permits were proposed statewide with 940 allocated to WMUs D2, E1, and E2 alone. Once population goals are reached in the Northeast Kingdom, the number of permits issued may be reduced.

Management Strategies

3.6 Maintain and improve hunter satisfaction by managing a preference point lottery system.

SPECIAL ARCHERY SEASON

Bow-hunting enthusiasts have encouraged the Department and the Fish and Wildlife Board to consider a special archery-only season for moose. Although bows can be used in the current moose season, some archers feel they might have more success in calling moose into close range if they were able to hunt during the peak of the rut and without competition from more mobile firearm hunters. Because of this interest, the Department included the following question in the 2007 telephone survey: “Currently, moose may be harvested during the season with rifles, handguns, muzzleloaders, bows, or shotguns. Do you support or oppose establishing an archery-only season for moose in Vermont in addition to the regular moose hunting season?”

This question was asked only of survey participants who were hunters. Of 252 respondents, 50% were opposed (39% strongly opposed and 11%



moderately opposed) and 39% were supportive (23% strongly and 16% moderately). Four percent neither supported nor opposed the idea while 7% answered “Don’t know.” The 39% of responding hunters corresponds closely with the proportion of Vermont hunters who bow hunt for deer, so it seems likely that most opponents are not archery hunters. Most of the respondents opposing an archery moose season were probably concerned that their chances of winning a moose permit in the regular season lottery would diminish. A similar opposition was expressed prior to the initial deer archery season in Vermont. Subsequently, many rifle hunters took up archery hunting, and the deer archery season became widely accepted. Archery deer season has subsequently added a significant recreational opportunity for Vermont’s deer hunters.

In reality, a limited archery season would have minimal impact on chances for a regular moose season hunter to win a lottery permit because permit numbers are based upon harvest objectives and the success rate of hunters. Archers are expected to have a lower success rate and would be expected to take a small portion of the target moose harvest.

The Fish and Wildlife Board received several petitions in the spring of 2008 for the establishment of a special archery season for moose. Consequently, the Department will propose a Board regulation to establish a short moose archery season, potentially beginning the first Saturday in October. The season might run for nine days with perhaps 50 permits issued via a lottery. Success rates will likely be less than 30%, so the archery moose harvest would be expected to take less than 20 moose statewide. This small harvest would have minimal biological impact on the moose population even if it was in addition to the regular permits set by harvest objective.

Management Strategies

3.7 Propose to implement a limited special archery-only moose hunting opportunity.

ISSUE 4. Moose Viewing

GOAL: Provide safe and quality moose viewing opportunity.

A public opinion survey found that nearly 57% of Vermont residents participated in viewing or photographing wildlife (Duda and Young 1996). White-tailed deer are the most viewed and photographed (89% of respondents). Due to their large size, interesting features, and historical scarcity, viewing moose remains a special thrill for most Vermonters. Moose can often be easily observed and photographed from vehicles while feeding along roadside salt licks or shallow wetlands. People frequently make special trips to the Northeast Kingdom and other areas to observe moose thereby contributing to the economy in rural areas of the state.

The Department answers many inquiries each year concerning when and where to observe moose. Efforts are underway to place a moose viewing tower at a favorite viewing spot east of Island Pond. This project should continue to move forward with completion expected by 2010.

Management Strategies

- 4.1 Construct at least one moose observation tower with a parking area near a state highway in the Northeast Kingdom region and investigate other locations in other regions.
- 4.2 Include moose in a guide to wildlife viewing sites on the Department's website.

ISSUE 5. Moose Habitat

GOAL: Maintain necessary habitat to support 3,000 to 5,000 moose on a sustained basis.

The moose is a northern forest species and uses different habitats during various seasons of the year. In general, moose prefer thick, brushy habitat for concealment and as sources of abundant food. Lowland softwood forests, beaver ponds, and other shallow bodies of water are favorite spring and summer habitats for moose. During the hot summer months, moose can suffer from overheating and must have access to dense shade or water for cooling. Moose also use ponds to escape biting insects and

predators. Moose frequent upland hardwood or mixed forests during the fall and winter. Younger age classes of these forest types provide abundant browse, especially in recently cutover areas. Managing habitats specifically for moose is difficult because this species has a large home range (4 to 10 square miles).

Moose are not as social as deer. Although it is not uncommon to encounter several moose together during the post-rut period, by late winter moose are usually either solitary or found in groups of two or three animals. These small individual groups of moose may each seek out middle-aged to mature softwood stands where they can escape deep snows and severe winter weather.

Moose habitat management is typically a by-product of areas where commercial logging has occurred and produced abundant browse. Forested landscapes that are actively managed therefore contribute to productive moose range. Clearcutting more than 50% of a moose home range within a few years, however, can result in an unfavorable balance of forest age classes which may cause moose populations to decline (Girard and Joyal 1984).

While clearcuts may provide plenty of food, moose prefer to remain close to cover. Thus, there is relatively less browsing within the interior of larger clearcuts, particularly during the winter, than within areas closer to forest shelter. The browse within clearcuts of ten acres or less in size maximizes browse availability to moose. Special habitats that may be critical to moose survival or productivity include late-winter concentration areas, aquatic feeding areas, and salt licks.

Logging practices in Vermont over the past few decades have generally had a favorable impact on moose, especially in the Northeast Kingdom. Timber harvesting in this region increased significantly during the 1980s. Hardwood browse became abundant even in many of the former softwood stands (Moulton et al. 1984).

Many large private forestlands throughout the state are currently enrolled in Vermont's Use Value Appraisal program and/or are under working forest easements. These legal instruments mandate sustained timber harvesting, which benefit moose. Most of the larger state forests and wildlife management areas also have active timber harvesting and habitat management plans designed to sustain a diversity of habitat conditions. Thus, the quality of forested moose habitats in Vermont should remain good

for many years. Exceptions may occur on the “wilderness” designated areas of federal lands, such as the Green Mountain National Forest, which tend to minimize the early successional forests favored as forage for moose. When possible, the Department will advocate for active management to provide for all seral stages of forest vegetation and adequate amounts of early successional habitat to provide for moose and other wildlife species that favor younger forests. In isolated cases, loss of small areas of older softwood trees might be detrimental to wintering moose. In the past, the Department has been able to obtain cooperation from industrial forestland owners in reserving some of these important winter moose habitats from timber harvest.

Vermont also has a wetlands protection law that often affords protection of these important habitats. Thus, natural and roadside salt licks are not likely to disappear in the foreseeable future. Increasing human development, however, is likely to continue to slowly erode moose habitat in Vermont. More important than actual loss of acres of moose habitat will be increases in human/moose conflicts expected as residential development and road systems extend into moose habitat.

Private landowners who wish to consider moose habitat in their land management plans can receive habitat management recommendations from the Department of Fish and Wildlife. A booklet entitled “A Landowner’s Guide, Wildlife Habitat Management for Vermont Woodlands” is scheduled to be updated and reprinted in 2010.

Management Strategies

- 5.1 Implement field studies to investigate, measure, and monitor the degree of moose and deer browsing within selected WMUs.
- 5.2 Provide natural resource professionals and landowners with moose habitat management guidelines.



ISSUE 6. Deer-Moose Competition and Forest Impacts

GOAL: Balance the nutritional needs of regional moose and deer populations with the need for adequate forest regeneration.

White-tailed deer and moose play a significant role in the ecology of Vermont’s forests. As herbivores (plant eaters), seed dispersers, and prey, they can have a large impact on other plants and animals in forest systems. The presence of these animals has profound implications for the structure and function of forested ecosystems. If deer and moose were to disappear from the forest system, a wide variety of changes would ripple through the forest.

Deer and moose feeding habits are a significant influence on the ecology of the forest. Deer have been estimated to eat between four and ten pounds of plant matter each day while moose may eat more than 40 pounds per day. In winter, both species prefer the twigs of many hardwood and softwood trees. In summer, deer focus their feeding on a variety of green herbaceous plants while in the fall, fruits, nuts, and seeds make up an important part of their diet. In summer, moose continue feeding on hardwood and softwood trees but also eat succulent, sodium rich, aquatic vegetation in or near swamps, bogs, and wet forest edges. Browsing by deer and moose is a natural and desirable aspect of Vermont’s forest ecology, but too many deer and/or moose in a given area can cause problems for forests and people.

As the moose population has increased, the question of how to determine carrying capacity for both species separately and in combination has become a challenge. The Department needs to develop new ways to assess forest habitat and its capacity to support both moose and deer while maintaining a healthy native forest. There is also a need to monitor changes in the forest at various scales across the state and through time.

Management Strategies

- 6.1 Develop a study to assess the carrying capacity for moose and deer on Vermont’s forestland.
- 6.2 Develop a decision making process that assists managers in determining the appropriate mix of moose and deer densities for a given WMU based on cultural and ecological factors.

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