

THE STATUS AND MANAGEMENT OF MOOSE IN VERMONT

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ABSTRACT: Increasing moose populations in Vermont prompted the initiation of a study in 1980 to monitor distribution, population trends, and moose health and condition. The state moose population increased from estimates of 200 animals in 1980 to over 1500 in 1993. The major known mortality factors have been motor vehicle collisions (62%) and poaching (23%). In 1992, a 5-year moose management plan was adopted in response to increased public interest in moose. A major action of the plan was implementation of a limited hunt in only one management unit, with 30 either-sex permits issued via a lottery in 1993. Permit numbers are expected to be increased in the future to achieve a goal of population stabilization for the management unit, as desired by the public.

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Vermont's moose (*Alces alces*) population has grown substantially over the past decade. Consequently, public awareness and interest in moose has also increased. In response to these increases in herd size and public interest, the Vermont Department of Fish and Wildlife (VDFW) developed a 5-year moose management plan for the years 1992-1996. This paper summarizes the methods used to monitor Vermont's moose population and to assess public desires regarding moose, and presents the results of these studies along with the basic components of the management plan.

BACKGROUND

Historically, moose were plentiful throughout Vermont, and "in many places the early settlers depended upon their flesh for no inconsiderable part of the subsistence of their families" (Thompson 1853:p50). Following European colonization, the widespread clearing of forests and subsequent conversion to farmland eliminated much of Vermont's moose habitat. By 1870, over two-thirds of the State had been cleared for agricultural uses.

The loss of forest and unregulated hunting caused the near extirpation of moose from Vermont. By the 1850's, the small number of moose that remained were in Essex County

(Thompson 1853). Essex County lies in the extreme northeast corner of the state, and is Vermont's most heavily forested and rural county.

Management of Vermont moose began in 1896 when legislation afforded the species complete protection. Sightings of moose remained very low throughout the first half of the twentieth century (Foote 1946), but increased noticeably during the 1970s in northeastern Vermont (Garland 1980).

Improving habitat conditions and lower numbers of white-tailed deer (*Odocoileus virginianus*) have probably had the greatest impact on the recent growth of the moose herd. Forested habitats used by moose increased in Vermont during the twentieth century to the point where today over 76% of the state is forested (Brooks *et al.* 1987). With maturing and matured forests, timber harvesting has increased during the past two decades and consequently available moose browse has increased.

Wetland habitats preferred by moose also increased in this century, beginning with beaver (*Castor canadensis*) reintroductions from Maine in the 1930s (Foote 1946). Those restocking efforts, regrowth of the forest, and trapping regulations have resulted in the current widespread distribution of beaver ponds in Vermont.

The roundworm parasite of white-tailed deer (*Parelaphostrongylus tenuis*) has been implicated as causing moose population declines in other jurisdictions (Karns 1967, Prescott 1974, Kearney and Gilbert 1976). If it is a limiting factor, the decline of Vermont's deer herd from over 200,000 in the 1960s to 120,000 in the 1970s probably reduced the risk of *P. tenuis* infections in Vermont moose.

By 1980, the VDFW estimated the moose population at 200 animals (Garland 1980). Some northeastern Vermont sportsmen considered this a huntable population, and they petitioned the rule-making Fish and Wildlife Board to initiate a limited moose hunt. The Board requested that the VDFW "determine the status of moose in Vermont and recommend a management program on this animal by January 1, 1985" (Garland 1981).

The 1985 report indicated that, although Vermont's moose herd was growing slowly, it was not yet ready to sustain even limited harvest pressure. Concerns about ongoing incidental mortality (e.g., motor vehicle collisions, poaching, brainworm) and lack of older-aged moose were cited as reasons not to initiate hunting at that time (Willey 1985).

Throughout the remainder of the 1980s and into the early 1990s, the moose population in Vermont increased in number and distribution. In 1991 the VDFW advised the Fish and Wildlife Board and the Legislature that a limited moose hunt could be initiated. VDFW also advised that moose population goals per wildlife management units (WMU) be developed through a public participation process before initiating a hunt.

METHODS

Monitoring of Moose Population Parameters

Vermont's moose study was initially designed to investigate the distribution, population levels and trends, and health and condition of the moose population (Willey 1985). Cause and number of incidental mortalities,

age structure, sex ratio, distribution, and cow/calf ratios were monitored.

Moose sighting report cards have been used since 1980 by VDFW and other State and Federal field personnel to document moose distribution and productivity. All known incidental mortalities have been investigated by VDFW game wardens since 1980. Cause-of-death, sex, and age class were collected from each mortality when possible. Incidental mortalities were tabulated by biological year (June 1 - May 31) and linear regression equations for total mortality and mortality caused by motor vehicles only were calculated for use in a population model.

The pathology department at the Univ. of Connecticut, Storrs, conducted a microscopic examination for *P. tenuis* in 73 brains and 58 spinal cords sections collected from moose in 1987 and 1988.

Central incisors collected from incidental mortalities since 1985 have been used for age determination via cementum annulation (Sergeant and Pimlott 1959).

Public Involvement

Beginning in 1991, the VDFW involved the public-at-large in developing a moose management plan. A "scoping committee" composed of two legislators and five representatives of local and statewide conservation groups met in June 1991 to review and critique the planning process.

A moose brochure (VDFW 1991) was prepared and distributed throughout the state in August 1991. The brochure included facts about moose biology, current status of Vermont's moose population, moose issues of concern, and an invitation to the public to help plan the future of Vermont's moose.

A series of public involvement meetings was held statewide during September 1991 to update citizens on the current status of moose, identify the various benefits and problems associated with moose, and gather public input on desired regional moose population

levels.

Following the public meetings, a Citizen's Moose Advisory Committee (MAC) was organized to help review the public input and develop management strategies. The nine-member MAC included representatives of hunting and anti-hunting groups, environmental organizations, and forestry, agricultural, and business interests -- groups believed to be most interested in and/or most likely to be affected by the moose plan.

After considering the public input and the recommendations of the MAC, the Moose Management Team, composed of 4 VDFW biologists, drafted a 5-year Management Plan (Alexander *et al.* 1992a). The Draft Plan proposed management objectives and strategies that attempted to provide for the welfare of the moose population while addressing the interests and concerns of the public regarding moose.

The Draft Plan was distributed before holding nine more public meetings in late February and early March 1992 to receive public comment. All comments received at or following the meetings were considered in preparing the final draft of the plan.

RESULTS

Moose Population Monitoring

From 1980 through 1984, reports of moose sign, sightings, injuries or mortalities had been received for 117 townships (46% of all townships). By the end of 1992, this total had increased to 179 (71%).

From 1980 through 1992, 31 cows were observed with calves during the months of June through September. 49 calves were seen with these cows, for a ratio of 1.58 calves/cow with calves.

The number of reported annual incidental moose mortalities in Vermont has increased dramatically over the past decade. From June 1980 through May 1993, 586 moose mortalities were reported. The majority occurred in the northeastern region of the state;

40% from Essex County alone. When tabulated on a biological year (BY) basis, both total annual mortality and annual mortality caused by motor vehicles only displayed a linear trend (Fig. 1) with r^2 values of 0.93 and 0.96 respectively. The linear regression equations were used in a simple model which estimated the numbers of moose necessary to produce the observed increases in incidental mortality. The model predicted over 1500 moose present in Vermont after neonatal losses in June 1993.

Collisions with motor vehicles has been the leading cause of reported mortalities (62%), followed by poaching (23%), other or unknown (12%) and suspected brainworm (3%). Of the 73 brains and 58 spinal cords subjected to microscopic inspection for presence of *P. tenuis*, only one tested positive.

Sex was determined for 548 incidental mortalities. Of this total 278 were males and 270 females, for a sex ratio of 103 males: 100 females.

Age class was determined by cementum

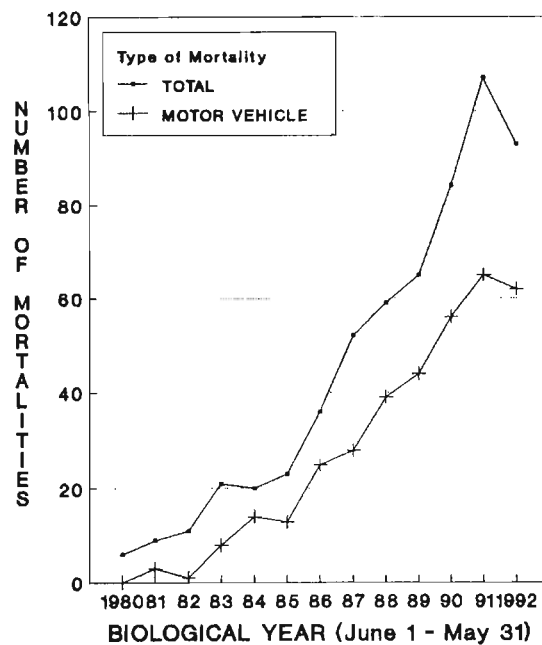


Fig. 1. Incidental moose mortalities (n=586) in Vermont, 1980-92.

annulation for 244 moose ≥ 1 year old (i.e., calves were excluded). Most mortalities were of young moose with 67% being ≤ 2 years old (Fig. 2). Average age has increased in recent years: average age of moose ≥ 1 year old from BY 1985-90 was 2.32 years (n=178) as compared to 3.45 years for BY 1991-92 (n=67).

**Public Involvement
Public Input Prior to the Draft Management Plan.--**

Over 300 persons attended the September 1991 meetings to identify benefits and problems associated with the growing moose population in Vermont. The benefits most frequently identified were economic boosts from tourism and future hunting expenditures followed by hunting (for its recreational and meat value), and opportunity to observe and photograph moose. The most important problems identified were the rapid rise in moose/vehicle collisions, various forms of property damage caused by moose, and competition between moose and deer.

VDFW also sought insight into the rela-

tive number of moose citizens desired for the various regions of the state. Meeting attendees completed a questionnaire on how many moose they desired statewide and in the so-called "Northeast Kingdom" (a region composed of Essex County and two adjacent counties). The majority of meeting attendees desired more moose statewide, however, the desires for the Northeast Kingdom were fairly equally divided between those who wanted more, the same, or less moose (Fig. 3). Essex County residents (where moose densities are highest) preferred more or the same number of moose statewide but fewer or the same number in the Northeast Kingdom (Fig. 4).

Some meeting attendees also provided written comments, primarily concerning moose hunting in Vermont. Nine persons opposed moose hunting, 3 felt additional population studies should be conducted before initiating a hunt, and 7 supported a limited hunt.

The VDFW also received 67 letters from

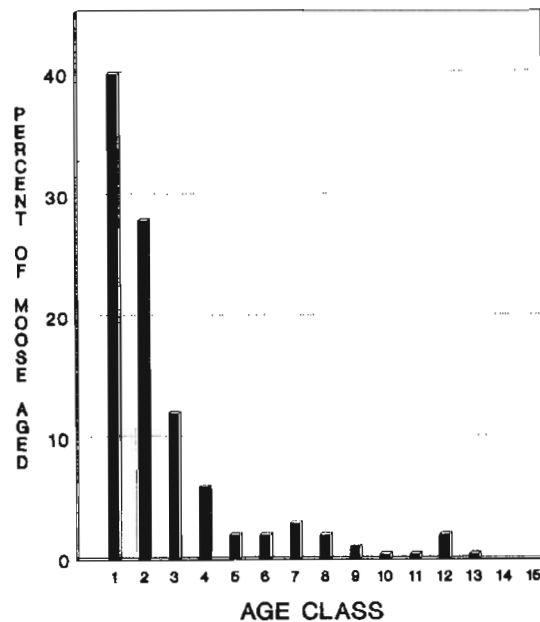


Fig. 2. Cementum ages of incidentally-killed moose (n=244) in Vermont, 1985-92.

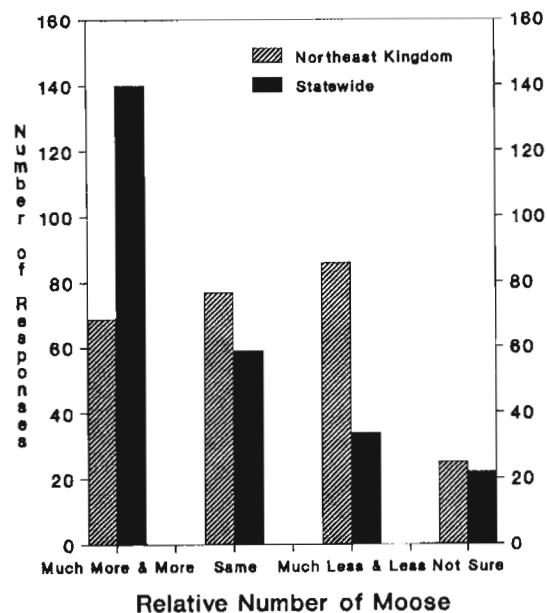


Fig. 3. Relative number of moose desired in Vermont by public meeting attendees (n=261), September 1991

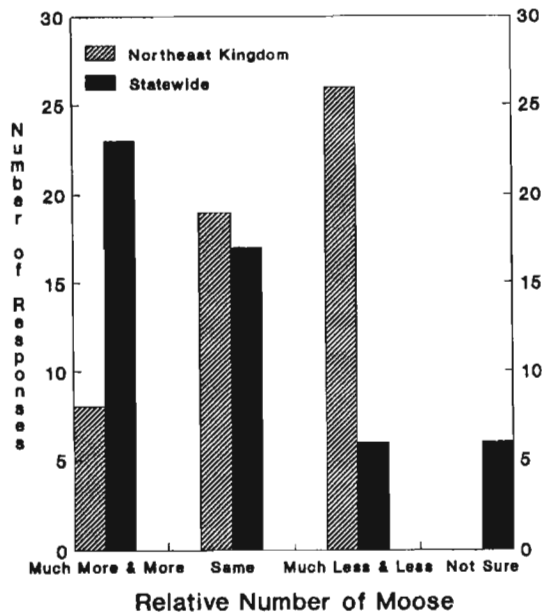


Fig. 4. Relative number of moose desired in Vermont by public meeting attendees from Essex County (n=54), September 1991.

non-attendees concerning moose management, about half of which came from people living in other states--some from as far away as the West Coast. Over 80 percent of these letters were from persons morally or otherwise opposed to hunting moose in Vermont.

The MAC met on 3 occasions from October to December 1991 and openly debated the management of Vermont's moose prior to submitting a list of final recommendations to the Moose Management Team. The committee stated that "It appears the maximum numbers of moose that can coexist compatibly with the local human population in Essex County has been reached or exceeded", and recommended that the "Department should establish moose management zones identifying areas where the moose population may: a. exceed cultural carrying capacity; b. exceed biological carrying capacity; c. be managed for growth; d. be managed for stability or reduction" (Alexander *et al.* 1992b).

Public Review of the Draft Management

Plan

Nearly 250 people attended the nine public meetings held in February/March 1992 to review the Draft Plan. Most of the verbal and written comments of attendees were strongly supportive of the Draft Plan. Written comments were received from 71 attendees. On the question of implementing a moose hunt, 76 percent of these respondents supported a season in 1992 or 1993, 11 percent felt a hunt should be delayed a few years or at least until the VDFW could obtain more accurate population information, 7 percent were opposed to a hunt, and 6 percent had no comment on hunting. One comment form was returned with a petition containing 114 signatures in support of a Vermont moose hunt.

DISCUSSION

Status of Vermont's Moose

Despite ongoing losses to motor vehicles, poaching, brainworm, etc., Vermont's moose population is increasing in number and distribution throughout the state. The 1993 statewide moose population estimate of over 1500 moose represents a 750% increase over the 1980 estimate of 200. The rate-of-increase (λ) as determined by these population estimates has averaged roughly 1.15 over the past 13 years. The λ for other growing moose populations with adequate food and exposed to little or no hunting ranged from 1.15 to 1.30 (VanBallenberghe 1983). At a λ of 1.15, the time required for a population to double in size is 5 years. If Vermont's moose herd continues to increase at its present rate it would number over 3,000 by 1998.

The observed calves/cows with calves ratio along with the high percentage of young animals in Vermont's moose population indicates a high reproductive rate. The observed ratio of calves/cow with calves (1.58), compares favorably with a 1982 estimate of 1.5 for New Hampshire (Willey 1985)--a neighboring state whose moose population also experienced substantial growth during the 1980s.

The average age of Vermont's moose population has increased markedly since 1984, when no moose were aged older than 4 years (Willey 1985). The average age remains lower than that of hunter-killed moose from other, generally more stable populations, likely because productivity is high and most samples are from road-killed moose which are often biased toward yearlings (Kris Bontaites, N.H. Fish and Game Dept., personal commun., Oosenbrug *et al.* 1986). The older age structure observed in recent years contributed to our decision that Vermont's moose population could support a limited hunting season without causing a population decline.

Public Desires

Results of the public involvement process indicate the public is acutely aware that moose/human conflicts exist (potential road hazard being the most serious one). However, the public also acknowledges the current and potential benefits of moose and, consequently, desires to have more moose statewide. For the Essex County area however, we received a clear mandate to arrest moose population growth.

Moose viewing opportunities are important to Vermonters, but so is hunting opportunity, and most of the meeting attendees believed that non-consumptive and consumptive uses were compatible. While anti-moose hunting sentiment is present in Vermont, it comes mainly from those morally opposed to any type of hunting (animal rightists), and is concentrated in the more urban areas. Indeed, virtually no opposition to moose hunting was expressed by Essex County residents.

Opponents to a Vermont moose hunt organized the "Protect the Moose" coalition in 1992 to lobby the Governor and Legislature to prevent implementation of a moose hunt. The coalition was led by Vermont representatives of People for the Ethical Treatment of Animals (PETA), Friends of Animals, and the Humane Society of the United States. The

coalition conducted press conferences, generated letter-writing campaigns, placed large advertisements in newspapers, and produced "fact sheets" for distribution to Vermont Legislators. There was little organized effort made by Vermont's sportsmen's groups nor the VDFW to counter the animal rightist's opposition to moose hunting.

MANAGEMENT IMPLICATIONS

The 1992-1996 Moose Management Plan

Vermont's moose management goal is "To manage Vermont's moose to sustain viable populations consistent with biological, social, and economic considerations" (Alexander *et al.* 1992b). Vermont's Moose Management Plan has the following 5 main objectives to reach the goal:

- 1) "To allow for the controlled growth of Vermont's statewide moose population in all Wildlife Management Units (WMUs) except for WMU 'E' where population stabilization is desired". WMU 'E' closely parallels the political boundaries of Essex County, and, at 1,565 km², occupies 7.6% of the State's total deer range of 20,584 km² (Garland 1969). A limited hunt is planned for October 1993 to work towards achieving this objective.
- 2) "To monitor moose population levels and biological and cultural carrying capacity in all WMUs to determine when and if population regulation may be necessary". We plan to assess cultural carrying capacity by conducting periodic public information-gathering meetings in selected WMUs. Methods of monitoring population levels will include a continuation of the monitoring of incidental mortalities. Two other methods we will consider are annual moose sighting surveys by deer and moose hunters and aerial census. Vermont's heavily forested and mountainous terrain would make a statistically-valid aerial census difficult to obtain (Gasaway *et al.* 1986, Kris Bontaites, NH Fish and Game Dept., per-



sonal commun.), but there may be promise in developing infra-red remote sensing technology (Gustafson 1993).

VDFW expects to always keep the moose population below biological carrying capacity (BCC) due to social considerations. However, BCC will be monitored by collecting age, corpora lutea counts, dressed carcass weight, and antler form and diameter from legally harvested moose. Additionally, reports of cow/calf sightings may provide some insight into whether moose populations remain below BCC.

- 3) "To maximize recreational benefits from Vermont's moose population within acceptable social and biological limits." In addition to the implementation of hunting, moose viewing opportunities will be explained via press releases, and selected roadside wetlands and salt-licks are to be included in the forthcoming "Vermont Watchable Wildlife Guide".
- 4) "To minimize negative interactions between humans and moose". VDFW will continue to work with the Vermont Agency of Transportation to erect warning signs at traditional moose highway crossings, publish educational materials to increase driver awareness, and investigate other methods to reduce moose/vehicle collisions.

Vermont currently has no highway where accident rates are high enough to justify the expense of roadside fencing, and draining of salt-licks would likely not be allowed under Vermont's water quality laws. Alternative road de-icers may be a future possibility, but most alternatives are not considered feasible at this time (David Ross, Vermont Agency of Transportation, personal commun.). Clearing back of roadside trees and shrubs to improve driver visibility, however, may be considered.

- 5) "Secure adequate funding for the Moose Management Program". In recent years, the VDFW has expended \$50,000 to

\$100,000 annually on moose management. These costs are incurred from collecting and processing biological data, collecting and transporting moose carcasses to a meat processor for salvage, selling moose meat to the public, handling nuisance moose, and investigating illegal kills. Costs are also incurred from conducting public involvement meetings, providing information to the media, presenting slide-shows, and preparing publications.

The costs for moose management activities have been borne by Vermont hunting license holders, at the expense of other VDFW programs. Therefore, VDFW plans to "secure passage of legislation authorizing the charging of moose hunting permit applications fees", in order to generate new revenues. We hope to maximize revenue by not charging a fee for the permit itself. With only a limited number of permits, we believe the real revenue-generator is the application. For example, Maine received 10 times as much revenue from the applications for the 1000 permits issued in 1992 as they did for the permits themselves (\$550,000 vs. \$50,000, Karen Morris, Maine Dept. Inland Fisheries & Wildl., personal commun.). Maine charges \$25 and \$200 for resident and non-resident permits respectively. We believe that thousands of more Vermont residents and non-residents will pay a \$10 application fee to vvy for a free moose hunting permit.

Postscript: The 1993 Hunt

A limited-entry, 3-day hunt was held in mid-October 1993, in WMU E only. Thirty permits were issued of which 10% (3) went to non-residents. Over 11,000 Vermont residents and 1300 non-residents entered a lottery to receive a permit. Each permit allowed the permittee or a designated subpermittee to take one moose of any sex or age. Twenty-five moose were taken for a success rate of 83%. Fourteen (56%) were adult bulls, 10 (40%)

were adult cows, and 1 (4%) was a male calf. The largest moose was a 385 kg (completely dressed) bull with a 129.5 cm antler spread. The average dressed weight for 6 yearling bulls was 230.9 kg.

The small numbers of permits represented an extremely conservative approach by VDFW to Vermont's first moose hunt. The fall 1993 moose population in WMU E was conservatively estimated at around 400 animals. In order to stabilize this population as called for by the management plan, 50-70 moose, half of which would have to be cows, would need to be removed (assuming all non-hunting mortality to be additive). This number was reduced approximately in half in order to err on the conservative side, even though we expected success rates to be around 75% and harvest to be biased toward bulls. We plan to increase permit numbers in successive years to achieve the goal of stabilization.

There was no application or permit fee for the 1993 moose hunt. A bill to create a fee structure for the moose season was introduced during the 1993 legislative session. The Protect the Moose coalition lobbied vigorously to defeat the bill, and although the bill passed the initial two readings, it was overturned on the final vote. VDFW plans to seek passage of a fee bill in future sessions.

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program. Several moose biologists from nearby jurisdictions have provided Vermont's moose study with invaluable consultation over the years. Special thanks to Kris Bontaites, New Hampshire Fish and Game Dept.; Kim Morris, Maine Dept. of Inland Fisheries and Wildlife; and Tim Timmermann, Ontario Ministry of Natural Resources, for their expert guidance. Vermont's moose study was funded in part by Federal Aid in Wildlife Restoration, project number W-34-R.

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