PRELIMINARY OBSERVATIONS REGARDING MEAN APRIL TEMPERATURE AS A POSSIBLE PREDICTOR OF TICK-INDUCED HAIR-LOSS ON MOOSE IN SOUTH CENTRAL ONTARIO, CANADA.

Mike L. Wilton[1] and Dale L. Garner[2]

[1]Ontario Ministry of Natural Resources, Whitney, Ontario, Canada K0J 2M0; [2]Faculty of Environmental and Forest Biology, College of Environmental Science and Forestry, State University of New York, Syracuse, New York, U.S.A. 13210

ABSTRACT: Concern over the apparent unpredictability of moose (*Alces alces*) die-offs related to winter tick (*Dermacentor albipictus*) induced hair-loss prompted this investigation. Comparison of data from 1984 to 1993 implies that tick-induced winter hair-loss severity and spring moose mortality may be directly related to mean April temperature of the previous year or years.

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The presence and implications of winter tick (*Dermacentor albipictus*) on moose (*Alces alces*) have been well documented. Irritation caused by winter ticks can lead to self grooming by moose with resultant hair-loss (i.e., alopecia) (McLaughlin and Addison 1986, Samuel 1989, 1990). McLaughlin and Addison (1986) found that moose with extensive premature hair-loss had less pericardial and abdominal visceral fat than moose with little or no hair-loss. Furthermore, in Alberta, epizootics of winter tick have been associated with deaths of moose during at least 12 winters since 1930 (Glines and Samuel 1989).

It appears likely that adult ticks drop off moose from mid-March through April (Addison *et al.* 1989) with peak disengagement occurring in late March (Drew and Samuel 1989, Welch *et al.* 1991) Larval ticks ascend vegetation during the fall with peak attachment to moose thought to occur during the peak moose breeding season which occurs between mid-September and mid-October (Drew and Samuel 1985, Wilton 1992).

Since ticks may be off moose from April through mid-October, it is during this time that the ticks would be vulnerable to weather induced mortality. We suggest that mean April temperature may directly affect winter tick abundance the following year, thus influencing premature hair-loss and possible mortality in moose.

STUDY AREA AND METHODS

Algonquin Park, situated in south central Ontario between Georgian Bay and the Ottawa River Valley (Fig. 1), is colder than surrounding areas because of its higher elevation. Mean daily April temperatures (i.e., the average of the daily maximum and daily minimum temperatures) for the years 1983-92 were obtained via the Ontario Climate Centre of Environment Canada, Toronto, Ontario, from the Dwight Meterological Station (D.M.S.) which is located immediately outside western Algonquin Park (Fig. 1).

Two surveys are conducted annually in an effort to monitor tick-induced hair-loss on moose in Algonquin Park:

Aerial Survey

As close to March 20th as flying conditions permit, a helicopter survey is conducted during which hair-loss is "mapped" on as many moose as can be encountered. Moose are grouped subjectively into one of 5 hair-loss severity categories (i.e., nil, light, moderate, severe, very severe) following Samuel and Barker (1979).

Categories are assigned severity class values from 1-5 in ascending order. Animal

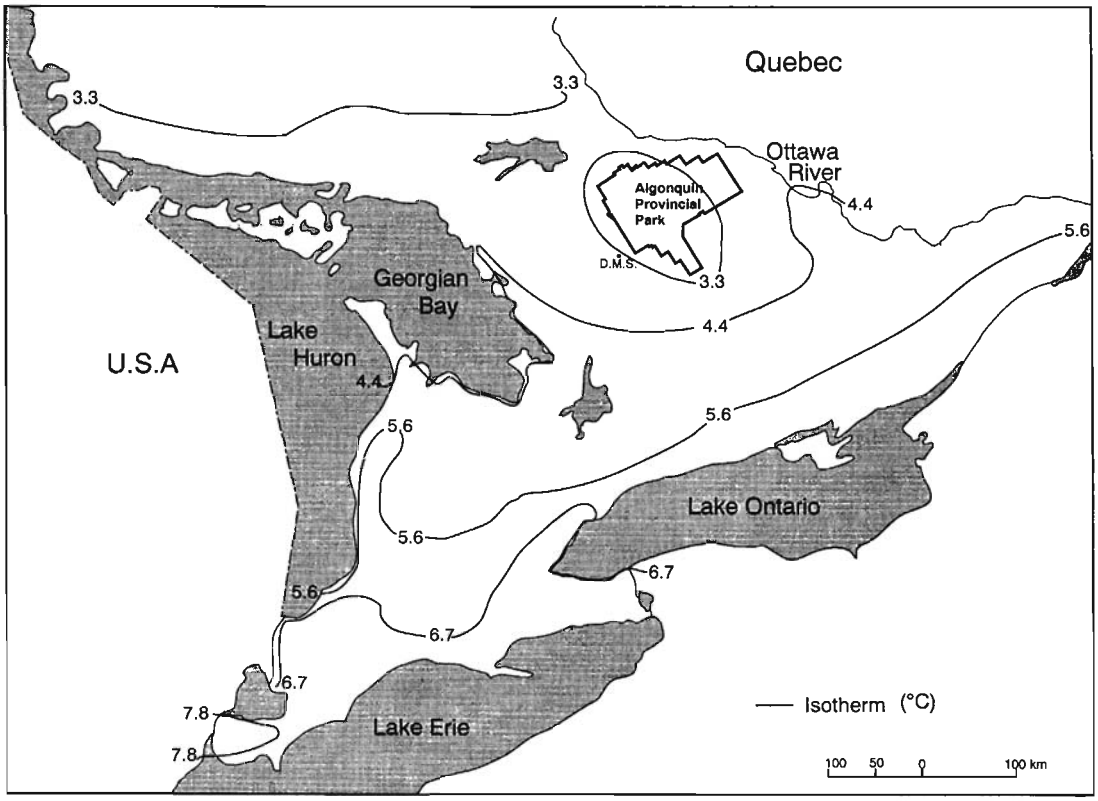

Fig. 1. Southern Ontario showing Algonquin Provincial Park and isotherms representing 30 year (1931-60) mean daily temperatures (C) for April (from Brown *et al.* 1980).

frequency (f) in each severity class is then multiplied by the appropriate factor (1-5) and the sum is divided by the total number of animals encountered (i.e., sample size; n) on the aerial survey, to yield a hair-loss severity index (H.S.I.) as per the following equation -

$$\text{H.S.I.} = \frac{\sum[(\text{Severity Class})\ (f \text{ of Severity Class})]}{n}$$

Sample sizes from 1984-93 aerial surveys were 53, 47, N/A, 40, N/A, 43, 33, 52, 75 and 85, respectively.

Carcass Survey

Since 1988, in the early spring a letter is sent to all staff members requesting that they map the location and describe in detail all moose carcasses encountered during the spring and early summer periods. As many carcasses as possible are re-visited in an effort to ascertain which deaths may have been related to winter tick (Garner and Wilton 1993).

A multiple regression was performed to test the relationship between hair-loss in moose and number of carcasses found in the current year, and mean April temperature of the previous year.

RESULTS

While no statistically significant ($p>0.05$) relationships were established between hair-loss, moose mortality and mean April temperature, the trends are notable (Fig. 2). Years showing a higher H.S.I. generally coincide with years following higher mean April temperatures and years exhibiting lower H.S.I. generally coincide with years following lower mean April temperatures. Similarly, years of higher carcass occurrence generally coincide with years of higher H.S.I. while years of lower carcass occurrence generally coincide with years of lower H.S.I. These results imply

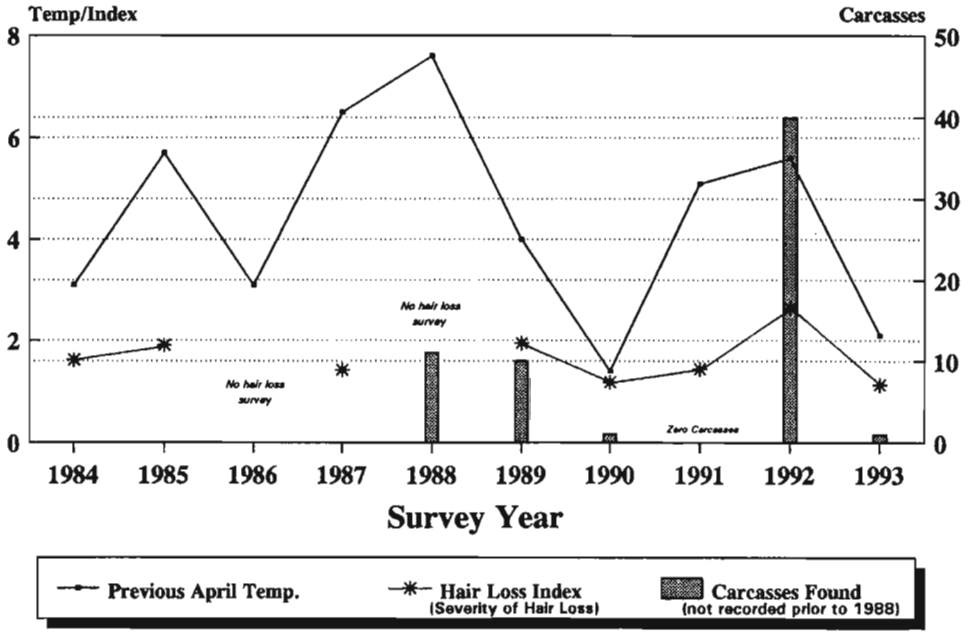

Fig. 2. Relationship between Hair-loss Severity Index (H.S.I.), moose carcasses found, and previous mean April temperature.

a link between mean April temperature, winter tick-induced hair-loss and apparent tick-related mortality in moose the following year.

DISCUSSION

Drew and Samuel (1986) found that survival of engorged (disengaged) females was greatly influenced by snowmelt. Samuel and Welch (1991) found under experimental conditions that survival of unattached larval tick aggregations was greatly influenced by snow, low temperatures and high winds in late October and November. It is likely however, that under natural conditions, larvae would be attached to their host by this time thus avoiding mortality.

Zarnke *et al.* (1990) suggested that a combination of low spring and fall temperatures together with late spring snow-melt and early snows in the fall may limit the spread of winter tick to certain parts of Alaska. Our work indicates that winter tick survival through April may be linked to a critical mean temperature between 3 and 4C (i.e., above this temperature survival is good, below survival is poor). The long term average 3.3C isotherm for southern Ontario (Fig. 1) encompasses portions of Algonquin Park implying that improved tick survival can generally be expected in some areas (i.e., the eastern portion).

It is suspected that the link between mean April temperature, tick-induced hair-loss and apparent tick-related mortality in moose is far more subtle and complex than our data indicate. Continued data collection and a more comprehensive analysis may eventually yield a more accurate predictor of this condition.

DEDICATION

This paper is dedicated to Mrs. Ida Cousintine who operates the Dwight Meteorological Station and to all other worthy individuals who gather weather data so faithfully.

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