CONDITION ASSESSMENT OF ALASKAN MOOSE

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Abstract: The ultimate measure of a population's condition is its reproductive success; however, in some instances this information may not be available or easily obtained. Other methods to assess a population's condition may then be useful to game managers as sole or supplemental data. Condition assessments were made of Alaskan moose (*Alces alces gigas*) population using morphometric measurements (total length, chest girth, hind foot, and shoulder height), weight, antler growth, condition grading based on form and composition, and physiological parameters (blood and hair). Blood parameters which best reflected condition in Alaskan moose were calcium, phosphorus, total protein, hemoglobin, and packed cell volume. Hair mineral element determinations did not directly reflect condition of population but were useful in identifying potential trace element deficiencies which may influence reproductive success. Application of these various condition assessments to different Alaskan moose populations resulted in similar population condition ranking.

INTRODUCTION

Game managers have long sought methods to make general condition assessments of animals under their jurisdiction. Condition for this application may be defined as the physical composition, form, or stage of existence that an animal exemplifies at a certain time. The trained and experienced eye was a valid approach to condition assessment; however, today's need for more sophisticated management requires quantitative evidence in some form.

Many approaches have been used to assess condition of animals representing a population, and perhaps the best methods available are those measuring a population's reproductive success. This is the ultimate measure of a population's condition or well-being. Bishop and Rausch (1974) reviewed procedures for obtaining moose population composition and reproductive information. Timmermann (1974) reviewed moose censusing techniques and Simkin (1974) reviewed reproduction and productivity of moose.

This paper is concerned with condition assessment techniques of moose population other than those associated with censusing, reproduction, and productivity, and those associated with carcass data (VFA, fat deposition, et cetera). In many instances supplemental information relative to moose population condition is needed, and in some instances no reproductive or productivity data are available. The animal living in an environment functions as an indicator of the state of the environment and we use this concept to assist in making comparative environmental assessments.

PHYSICAL STATUS (MEASUREMENTS AND WEIGHTS)

Several methods are available to assess condition via physical status of moose. Morphometric measurements (total length, chest girth, hind foot, and shoulder height) comparisons were made between adult moose from several Alaskan populations (Franzmann et al. 1977). Significant differences ($P < 0.05$) were detected between populations. The Kenai Moose Research Centre (MRC) population consistently had the smallest measurements, while the Copper River delta population had the largest (Table 1). Outside MRC, Kenai Peninsula and Glennallen area populations ranked between MRC and Copper River populations. Measurements of interior Alaska moose by Coady (1973) in general ranked near the Copper River sample.

Weight was another physical attribute used to compare condition of 2 Alaskan moose populations (MRC and Kenai Peninsula). One-hundred-seventy live weights were obtained using a winch tripod device (Arneson and Franzmann 1975). Weight differences were compared on a monthly basis and Kenai Peninsula adult females were significantly heavier from June to December, but through winter differences were not detectable (Franzmann et al. 1977). Male moose comparisons were similar; however, smaller distribution and size of sample permitted only limited comparisons. Weights of interior Alaska moose reported by Coady (1973) during October and June were higher than either MRC or Kenai Peninsula moose during the same months. High ranges and standard deviations were experienced with moose weight data, and large samples would be necessary for meaningful comparisons. Live

Table 1. Rank of moose population condition based upon blood, morphometric, antler, and condition class parameters[a].

Condition related parameters	Rank				
	1[b]	2	3	4	5
Ca	Glennallen	Copper R.	Southcentral	Kenai Pen. (Homer)	MRC
P	Glennallen	Copper R.	Southcentral	Kenai Pen. (Homer)	MRC
TP	Glennallen	Southcentral	Copper R.	Kenai Pen. (Homer)	MRC
Hb	Copper R.	Glennallen	Kenai Pen. (Homer)	Southcentral	MRC
PCV	Copper R.	Glennallen	Kenai Pen. (Homer)	Southcentral	MRC
Total Length	Copper R.	Glennallen	Kenai Pen.	MRC	
Chest Girth	Copper R.	Glennallen	Kenai Pen.	MRC	
Hind Food	Copper R.	Glennallen	Kenai Pen.	MRC	
Shoulder Height	Copper R.	Glennallen	Kenai Pen.	MRC	
Antler	Copper R.	Alaska Pen.	Seward Pen.	Interior	Kenai Pen.
Weight	Interior	Kenai Pen.	MRC		
Condition Class	Copper R.	Glennallen	Kenai Pen.	MRC	

a Blood values from late winter/early spring (February, March and April).

b Highest values.

weights are difficult to obtain, and dressed weight data introduce other sources of variation. Additionally, comparisons would have to be on a same-month same-year basis.

PHYSICAL STATUS (CONDITION CLASSES)

A condition evaluation for moose handled at MRC was routinely made. Condition classes were established based upon the premise that animal form and composition are largely dictated by the interaction of the complexes of climate and nutrition (Ledger 1968). Condition classes were graded from 1 to 10 on the basis of the following criteria (adapted from Robinson 1960):

Class 10. A prime fat moose with thick firm rump fat by sight; well fleshed over back and loin; shoulders round and full.

Class 9. A choice fat moose with evidence of rump fat by feel; fleshed over back and loin; shoulders round and full.

Class 8. A good fat moose with slight evidence of rump fat by feel; bony structures of back and loin not prominent; shoulders well-fleshed.

Class 7. An "average" moose with no evidence of rump fat but well-fleshed; bony structures of back and loin evident by feel; shoulders with some angularity.

Class 6. A moderately fleshed moose beginning to demonstrate 1 of the following conditions: definition of neck from shoulders, upper fore leg (humerus and musculature) distinct from chest, or rib cage is prominent.

Class 5. A condition in which 2 characteristics listed in Class 6 are evident.

Class 4. A condition in which all 3 characteristics listed in Class 6 are evident.

Class 3. A condition in which the hide fits loosely about neck and shoulders; head is carried at a lower profile; walking and running postures appear normal.

Class 2. Signs of malnutrition are obvious; outline of scapula is evident; head and neck low and extended; moose walks normally, but trots and paces with difficulty and cannot canter.

Class 1. A point of no return; generalized appearance of weakness; moose walks with difficulty and can no longer trot, pace, or canter.

Class 0. A dead moose from malnutrition and/or accompanying circumstances.

The grading evaluation was particularly useful when done by the same individual(s) over a long period of time. This grading system was used at MRC to assist in determining which physiological parameters reflected animal condition.

ANTLER GROWTH

Antler growth may be used as a comparative condition index of moose. Gasaway (1975) compared antler growth and spread from several areas of Alaska and concluded that moose from the lower Copper River drainage and Alaska Peninsula grew the biggest antlers on the youngest moose. Moose from Kenai Peninsula, interior Alaska, south-central Alaska, and Seward Peninsula generally had smaller antlers at the same ages. Kenai Peninsula moose had the smallest and slowest growing antlers.

HAIR ELEMENT ANALYSIS

Comparisons of hair element analyses were made on a monthly basis from various regions in Alaska (Franzmann et al. 1977) and significant differences ($P < 0.01$) were detected. The relationship of these values to condition of the animals is not well understood; however, the values were used to compare with condition ranking of populations (Table 2).

BLOOD CHEMISTRY AND HEMATOLOGY

Franzmann et al. (1976) reported that blood calcium (Ca), phosphorus (P), total protein (TP), hemoglobin (Hb), and packed cell volume (PCV) reflected condition status in moose. Albumin, beta globulin, and glucose also reflected condition status, but were influenced by excitability and were of lesser value for application. These values must be used as comparisons between populations during same month and preferably the same year. Late winter (March and April) comparisons between Alaskan moose populations indicated significant differences between populations and a condition ranking was made (Table 1).

Table 2. Rank of moose populations based on hair mineral element parameters sampled late winter/early spring (February, March, and April).

Hair elements	Rank 1[a]	2	3	4	5	6
Ca	Glennallen	Southcentral	MRC	Homer	Interior	Copper R.
Mg	Southcentral	Glennallen	Homer	Copper R.	Interior	MRC
K	Interior	Glennallen	Homer	Copper R.	Southcentral	MRC
Na	Southcentral	Copper R.	Glennallen	Homer	MRC	Interior
Cu	Copper R.	Southcentral	Glennallen	Homer	Interior	MRC
Fe	MRC	Interior	Southcentral	Homer	Glennallen	Copper R.
Mn	Glennallen	Southcentral	MRC	Homer	Interior	Copper R.
Zn	Glennallen	Copper R.	Homer	MRC	Interior	Southcentral
Cd	Interior	Glennallen	Homer	Copper R.	Southcentral	MRC
Pb	Glennallen	MRC	Southcentral	Copper R.	Homer	MRC

a Highest values.

APPLICATION OF COMBINED CONDITION CRITERIA

Testing of these combined criteria on different populations was made using 2 populations which have been well studied and documented at the potential low and high extremes based on productivity data. MRC population represented the low and the Copper River population represented the high. Table 1 ranks these populations with other populations sampled (Glennallen, south-central, Kenai Peninsula) during late winter/early spring (February, March, and April) using blood, morphometric, antler, and condition class criteria. Table 2 ranks MRC and Copper River populations with other populations sampled (Glennallen, south-central, Homer, interior) also during late winter/early spring. The blood, morphometric, antler, and condition class ranking has a definite pattern; however, the hair element ranking lacks a clear pattern.

DISCUSSION

Applying the various condition related criteria to Alaskan moose populations provided a means to evaluate these criteria, particularly as they related to the low productivity of MRC and high productivity of the Copper River populations. Copper River population ranked highest for all morphometric, antler, and condition class criteria. Highest ranking of blood values from the Copper River population was shared with the Glennallen population. MRC population ranked lowest for all criteria.

Certain of these parameters have greater value in assessing moose population condition than others. Franzmann et al. (1976) considered PCV the most useful blood parameter for assessing condition since it reflected differences between nearly all condition class comparisons. Total protein rated next followed in order by P, Ca, and Hb. Moose measurements which had the highest correlation with body weight were considered the most useful parameters; however, all 4 measurements ranked population the same. Total length/weight correlation coefficient (r) was 0.94, chest girth r was 0.90, shoulder height r was 0.87, and hind foot r was 0.81 (Franzmann et al. 1977). Using the best blood parameter (PCV) and the best measurement parameters (total length and chest girth), moose population condition ranked the same (Table 1). (South-central measurements were not available.)

Ranking of moose populations using hair mineral element values provided no pattern relative to condition assessments as detected with other parameters (Table 2). Excess minerals may be stored or excreted and relative stored abundance would not necessarily relate to condition. Deficiencies in mineral levels as reflected by hair analysis could, however, influence condition. With an identified Cu deficiency syndrome on Kenai Peninsula (Flynn and Franzmann 1974), population ranking based on Cu levels proved interesting. MRC population ranked lowest and Copper River population ranked highest. This demonstrated the potential value in making population comparisons using hair element analyses. We may identify in certain populations ranking low in certain values a priority for investigating certain mineral elements. We cannot, however, relate hair element values to condition status at this time.

Quantitative condition assessment of moose populations provides a means for game managers to determine priorities for more intensive investigation. In Alaska, moose are widely distributed and in many instances little is known regarding the status of certain populations. Other populations, however, have been intensively studied and are regularly monitored. Obtaining condition related data from these populations provides a comparative standard to which comparisons with populations of unknown quality may be made. We will use MRC and Copper River populations in Alaska as the low and high standards when assessing other populations. The parameters we will use in order of preference are the blood profile (PCV, TP, P, Ca, and Hb), total length and chest girth measurements, condition class grading, antler growth, and weight. This ranking may vary with individuals in other areas as conditions dictate. Carcass information should be used when possible; however, this outlined procedure relates to obtaining data from live immobilized moose.

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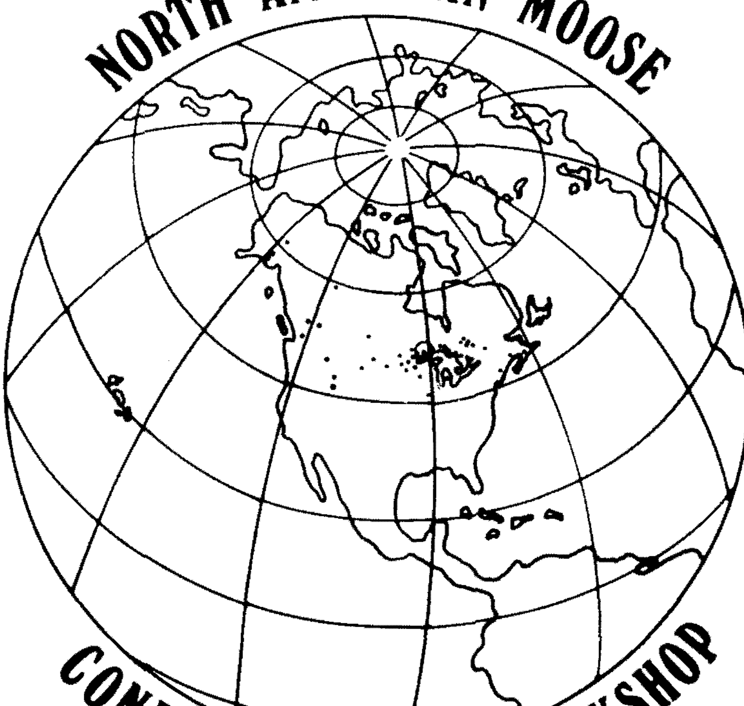
NORTH AMERICAN MOOSE



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