

ALASKA DEPARTMENT OF FISH AND GAME

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MOOSE NUTRITION AND PHYSIOLOGY STUDIES

By

Charles C. Schwartz

Progress Report  
Federal Aid in Wildlife Restoration  
Project W-22-5, Job 1.28R

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(Printed December 1986)

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## PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Mike Hubbert, Institute of Arctic Biology,  
University of Alaska, Fairbanks

Project No.: W-22-5 Project Title: Big Game Investigations

Job No.: 1.28R Job Title: Moose Nutrition and  
Physiology Studies

Period Covered: 1 July 1985-30 June 1986

### BACKGROUND

Digestive physiology studies were initiated in 1979 (Franzmann and Schwartz 1979). Major goals and procedures have been outlined in previous progress reports.

### RESULTS

Studies conducted during this report period include an evaluation of the energy requirements of moose calves (Alces alces) during winter. Data from these studies have been compiled and are being analyzed for the final report. Additional data collected under this job since 1979 are also being analyzed for the final report.

A final report summarizing the work conducted under this project is being prepared. The report will be prepared in sections, with a written manuscript covering each topic. The report will contain 2 main sections, one dealing with with adult moose, the second with calves. Under the adult section the following topics will be covered: (1) protein requirements, (2) maintenance energy estimates, (3) fat dynamics, (4) browse digestion, (5) weight dynamics, (6) seasonal intake rates, (7) a Ph.D. thesis entitled "Effects of dietary quality and quantity on energy partitioning in moose," and (8) a summary of these studies and how they relate to the overall objective of estimating carrying capacity. The section on calves will cover last winter's experiments on energy requirements of calves. The report will summarize all the work related to the nutritional carrying capacity model, the field test, and the model's potential application. Several segments of the above listed work have been completed. The abstracts from these are listed in Appendix A.

#### LITERATURE CITED

Fränzmänn, A. W., and C. C. Schwartz. 1979. Moose Research Center report. Alaska. Dep. Fish and Game. Fed. Aid in Wildl. Rest. Proj. W-17-11. Jobs 1.14R and 1.21R. Juneau. 23pp.

APPENDIX A. Abstracts of manuscripts prepared for the final report.

PROTEIN DIGESTION IN MOOSE

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Abstract: Protein digestion trials were conducted with 4 moose (Alces alces) fed isocaloric diets varying in crude protein from 8 to 16%. The maintenance requirement for nitrogen was  $0.627 \pm 0.073 \text{g/kgBW}^{0.75}/\text{day}$ . This represented a minimum dietary crude protein content of  $6.8 \pm 0.8\%$ . Each additional unit of ingested nitrogen resulted in  $0.346 \pm 0.140$  units increase in retained body nitrogen and  $0.561 \pm 0.140$  units increase in urinary nitrogen loss. Metabolic fecal nitrogen was  $0.457\text{g}/100\text{g}$  dry matter consumed. J. Wildl. Manage. 00(0):000-000.

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FOOD PASSAGE RATE IN MOOSE

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Abstract: Four tame moose (Alces alces) were used to measure dry matter digestion and rates of passage of 3 diets: a pelleted ration, a mixture of pellets and winter-clipped aspen (Populus tremuloides), and a mixture of winter-clipped aspen, willow (Salix spp.), and paper birch (Betula papyrifera). Dry matter digestion was greatest for the pellets (64.3%) followed by the pellet-aspen mix (60.5%) and the mixed browse (42.0%). Time of 1st appearance, rumen turnover time, and total mean retention time for both the solid and liquid phases of digesta were longest for the mixed browse diet. There was a significant correlation ( $r = 0.97$ ,  $P < 0.05$ ) between the movement of the solid and liquid components of digestion.

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ENERGY REQUIREMENTS FOR WINTER MAINTENANCE OF ADULT MOOSE

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Abstract: Nine adult moose (*Alces alces*) were assigned to 1 of 3 experiments in 2 separate trials. During trial 1, moose were fed a pelleted diet at ad libitum, or at 85% and 70% of ad libitum. During trial 2, moose were fed, at ad libitum intake, 1 of 3 pelleted diets containing a digestible energy content of 2.4, 2.1, and 1.8 kcal/g dry matter. Regression equations of digestible energy intake (g/kgBW<sup>0.75</sup>/d) with monthly body weight change (kg/d) provided the basis for estimating maintenance energy requirements. Our best estimate of energy required for maintenance was 148 and 131 kcal/kgBW<sup>0.75</sup>/d of digestible and metabolizable energy. This estimate of metabolizable energy was close to an independent estimate of 134.6 kcal/kgBW<sup>0.75</sup>/d calculated from information available in the literature. The relationship of heat production and metabolizable energy intake provided an estimate of predicted fasting metabolism of 72.7 kcal/kgBW<sup>0.75</sup>/d, which is discussed.

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## SEASONAL WEIGHT DYNAMICS OF MOOSE

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Abstract: Total body weight data for moose are presented and discussed. Information from 6 animals (3 males and 3 females) over a 5-year period was analyzed and fitted to standard growth equations. Changes in weight were dynamic seasonally with periods of weight loss and gain different for males and females. Males obtained maximum weights in late August just prior to the rut. They lost between 11-19% of their body weight during the breeding season, which represented the greatest weight loss at any season. Weight loss from pre-rut maximums to post-winter lows ranged from 7-23% and were dependent upon the combined weight loss during the rut and subsequent winter losses. Weight gains from winter lows to pre-rut maximums ranged from 33-41%. Females reached maximum weight in midwinter, much later than males, while minimum weights occurred shortly after parturition. Average weight loss ranged from 15-19%. Weight gains from lows to highs ranged from 25-43%. Females giving birth to single and twin calves lost an average of 34.8 and 63.0 kg, respectively. Mathematical fits (derived with a Brody equation) of maximum weights for males and females are presented. Data would not fit sinusoidal equations; reasons for the lack of fit are presented. Comparisons are made with other published weight data for moose.

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ESTIMATES OF DIGESTIBILITY OF BIRCH, WILLOW AND ASPEN USING MOOSE

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Abstract: Trials were conducted with tame moose (Alces alces) to estimate intake and digestibility of (1) a mixed diet of 70:20:10 aspen (Populus tremuloides): paper birch (Betula papyrifera): willow (Salix spp.), (2) a diet mixture of 30% aspen and 70% pelleted ration, and (3 and 4) mixed diets of 33:33:33 paper birch:willow:aspen browse during winter. Moose would not consume the mixed diet of 70:20:10, and the trial was terminated after 1 week. Reasons for refusal are discussed. Dry matter intake (DMI) of the aspen and pelleted ration was  $58.9 \pm 2.7 \text{ g/kgBW}^{0.75}/\text{d}$  with an estimate of dry matter digestion of the aspen of  $40.9 \pm 8.5\%$ . There was a high degree of error associated with this estimate. DMI and DMD for the mixed browse diets ranged from 20.7-45.1  $\text{g/kgBW}^{0.75}/\text{d}$ , and 28.1-44.3% respectively. Digestible and metabolizable energy represented 37.0 and 27.8% of gross energy intake. Intake of energy was below levels required for winter maintenance.

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