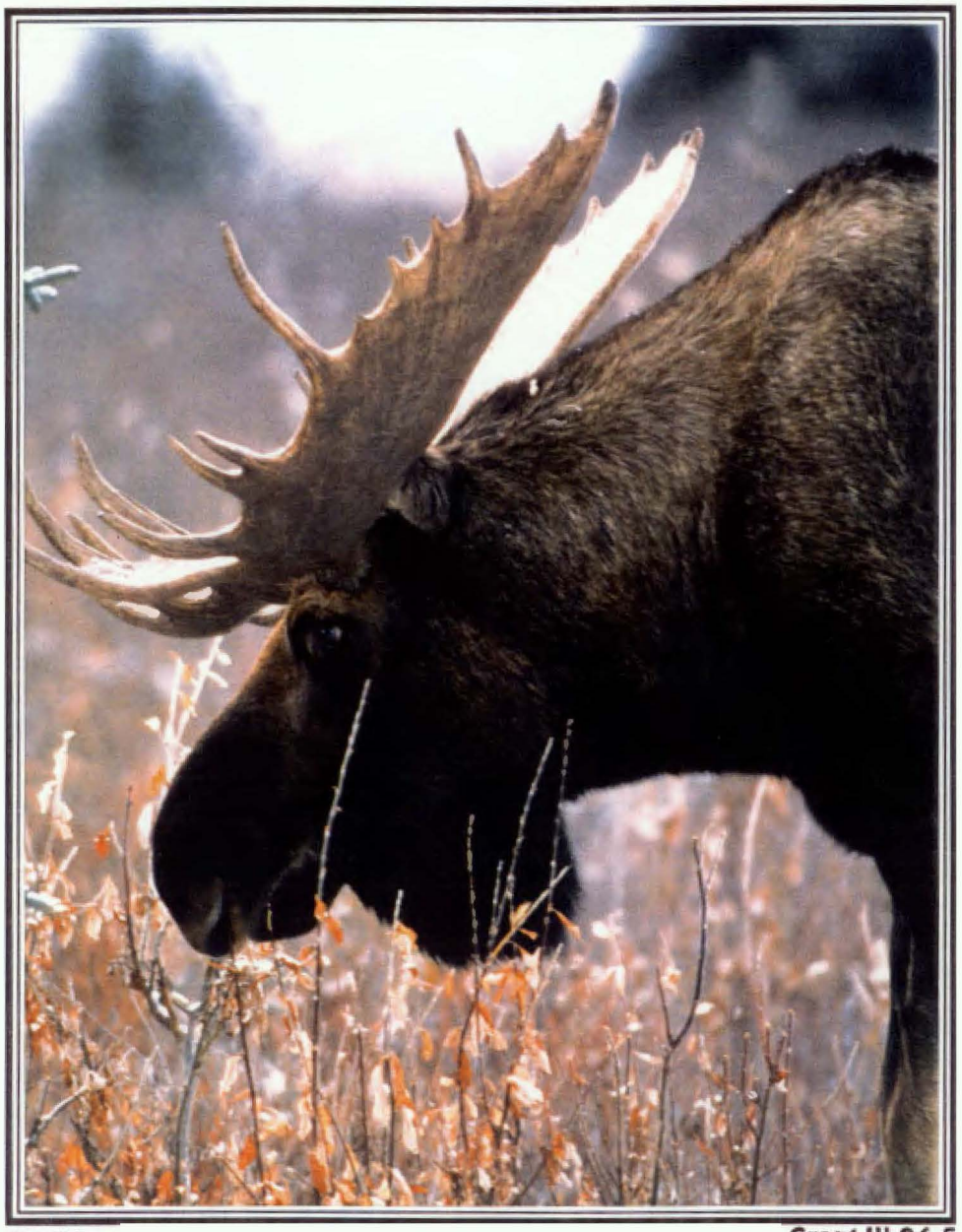
Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Research Progress Report
1 July 1996-30 June 1997

Interrelationship of Forage and Moose in Game Management Unit 13

William B Collins



Ken Whitten

Grant W-24-5
Study 1.50
July 1997

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
Frank Rue, Commissioner

DIVISION OF WILDLIFE CONSERVATION
Wayne L. Regelin, Director

Free copies of this report and other Division of Wildlife Conservation publications are available to the public. Please direct requests to our publications specialist:

Mary V Hicks
Publications Specialist II
ADF&G, Wildlife Conservation
P.O. Box 25526
Juneau, AK 99802
(907) 465-4176

Mary V Hicks@fishgame.state.ak.us

RESEARCH PROGRESS REPORT

STATE: Alaska STUDY NO.: 1.50

GRANT NO.: W-24-5

STUDY TITLE: Interrelationship of Forage and Moose in Game Management Unit 13

AUTHOR: William B Collins

PERIOD: 1 July 1996-30 June 1997

SUMMARY

Willow treatments within exclosures in Tyone Creek and Oshetna River drainages were clipped at 30, 60 and 90 percent to simulate light, medium and heavy rates of utilization by moose. Diameter, length and weight characteristics of feltleaf willow were determined outside exclosures. Percent winter browse utilization outside exclosures was 31.5% and 28.7%, respectively, for Oshetna River and Tyone Creek floodplains.

Key words: *Alces alces*, browse utilization, feltleaf willow.

CONTENTS

BACKGROUND

The Alaska State Board of Game has selected human consumptive use as the priority for wildlife management in Game Management Unit 13 (GMU-13). In accordance with this priority, the Alaska Department of Fish and Game (ADF&G) must determine what biological potential may exist for increasing the productivity and/or harvest of game species, including moose. Management biologists question if Unit 13 moose are limited by forage resources, predation, or a combination of both.

Availability of nutrients to moose is one aspect of ecological carrying capacity that must be determined before these questions can be answered. Nutrient availability is affected by forage productivity and availability relative to weather conditions and utilization histories. Assessment of these factors will be useful in development or modification of strategies to manage harvest and habitat for the welfare of Unit 13 moose.

According to Bishop and Rausch (1974), range condition has operated as a limiting factor to the moose population in Unit 13 in the past. Ballard et al. (1991) believed the degree of this limitation was unclear but recognized the significance of severe winters and their influence on forage availability as probable causes of declines in Unit 13 moose productivity. They also recognized the significance of habitat decline resulting from fire suppression and subsequent vegetation succession.

Effects of foraging by moose can change the quantity and quality of food available to them (Moen et al. 1990, Wolff and Zasada 1979, Molvar et al. 1993, Danell et. al. 1994, McKendrick et al. 1980), causing decreases in moose reproduction (Franzmann and Schwartz 1985, Boer 1992) and increased mortality. Forage-moose relationships are complicated by factors of snow accumulation in winter (Bishop and Rausch 1974, Schwab and Pitt 1991, Coady 1974, Telfer 1970 and 1978) and amount of solar radiation in summer (Bo and Hjeljord

1991). Ecological carrying capacity for moose is also affected by frequency and intensity of fire (Spencer and Hakala 1964, Wolff and Zasada 1979).

OBJECTIVES

To identify relationships of moose browse availability and quality to utilization histories, I will test the following null hypotheses:

H1. Productivity of principle winter browse species in Unit 13A is not limited by previous levels of utilization by moose (tested at 4 levels of utilization).

H2. Crude protein and digestible energy of current annual growth are not affected by point of origin within the shrub.

H3. Winter nutrient consumption rates are not limited by utilization in prior years.

PROCEDURES

SEASONAL DIETS

Winter diets of moose are being determined in early, mid, and late winter by backtracking moose and counting freshly browsed twigs at feeding sites. This will allow determination of forage species, plant parts, foraging rates, and diet mixing (Hobbs and Spowart 1984). Quantities of browse produced and percent utilization are being determined from twig counts in spring (Shafer 1965).

DIET QUALITY

Principal foods (>5% of diet) and composite diets will be analyzed for digestible energy and digestible protein (Robbins 1983). Late winter collections of browse will be used in nutritional analyses.

WINTER BROWSE AVAILABILITY

Twig counts and shrub density estimates will be used to determine availability of winter browse species and associated nutrients in 3 principal vegetation types used by Unit 13 moose in winter: riparian tall willow, hillside diamond willow, and black spruce-willow communities. Availability is being determined by height strata for stems less than 4 cm diameter at 1.5 m above ground (dbh), but only up to 2.5 m height for stems greater than 4 cm dbh.

Effects of browsing and clipping on feltleaf willow will be evaluated in terms of shrub survival, total current annual growth (CAG), distribution/availability of CAG, and browse quality. Feltleaf willow will be evaluated in this manner because it is the principal source of browse in severe winters when deep snow covers diamond willow in upland sites. As such, these plants are most likely to be overbrowsed and most indicative of "carrying capacity." Significance of leaf dimensions, leaf weight, and numbers of flowering stalks and seeds (Cook 1977) will also be investigated to determine their value as indicators of willow vigor.

Interpretation of browsing effects requires knowledge of browsing histories of individual shrubs (Shepherd 1971). Within the principal study area, browsing histories will be approximated through interpretation of shrub structures (numbers and chronological positions of previous browsing points) and supported by interpretation of historical moose trend-count data. Browsing effects will also be determined through clipping treatments, since histories of clipped plants are more certain. Four exclosures (600 m^2) were constructed within riparian willow stands to protect clipping treatments from browsing interference by moose and caribou.

Inside each exclosure, 4 treatment levels of utilization (none, light, moderate, and heavy) are being imposed. "Heavy" clipping treatments are intended to simulate 90% utilization, or approximately 15% more than what Wolff and Zasada (1979) suggested represents the carrying capacity of feltleaf willow. "Light" and "moderate" levels of clipping approximate 30% and 60% utilization, respectively. Actual utilization as occurs outside the proposed exclosures will be treated as inference covariates in analysis of shrub responses. Shrub response will be analyzed annually following repeated measures, randomized block design, blocking on site (exclosure) in each vegetation type.

RESULTS

SEASONAL DIETS

Early through midwinter snow accumulation was light, and during that time moose remained widely distributed, foraging primarily in upland diamond willow communities. Snow depth was less than 40 cm most of winter, but in March it increased to 55 to 60 cm, covering upland willows. This late winter increase in snow depth resulted in average overall winter severity (Testa 1997) but only a short-lived dietary shift to feltleaf willow. Feltleaf willow is the most highly preferred of willow species, but evidently its palatability and productivity are not significant enough to concentrate moose in narrow riparian zones, unless availability of other browse is reduced by snow accumulation.

DIET QUALITY

Collected browse has not yet been analyzed for digestible energy or digestible protein.

BROWSING EFFECTS

In late March 1997 clipping treatments were imposed in all exclosures. In winter 1998 we will measure responses and repeat clipping.

Percent of terminal feltleaf willow twigs browsed in winter 1994-1995 in the Tyone and Oshetna drainages were 76.2% and 82.0%, respectively, but only 12.0% and 13.0% in winter 1995-1996, and 28.7% and 31.5% in winter 1996-1997 (Table 1). Winter 1994-1995 was one of deep snow accumulation which concentrated moose in riparian zones, whereas snow accumulation in winter 1995-1996 never restricted moose distribution, and snow in winter 1996-1997 was only marginally restrictive during March. Availability of browse in the Nelchina study area appparently was not a limiting factor to moose in the past 2 winters.

RECOMMENDATIONS

We should conduct twig counts and shrub density estimates for estimating browse and nutrient availability during winters when moose distribution is restricted by snow. Clipping treatments in exclosures should be maintained for the next 3 years to determine effects on shrub productivity and browse availability.

LITERATURE CITED

Ballard, W. B., J. S. Whitman, and D. J. Reed. 1991. Population dynamics of moose in south-central Alaska. Wildl. Monogr. 55. 49 p.

Bishop, R. H. and R. A. Rausch. 1974. Moose population fluctuations in Alaska, 1950-1972. Naturaliste Can. 101:559-593.

Bo, S. and O. Hjeljord. 1991. Do continental moose ranges improve during cloudy summers? Can. J. Zool. 69:1875-1879.

Boer, A. H. 1992. Fecundity of North American moose (*Alces alces*): A review. Alces Supplement 1:1-10.

Coady, J. W. 1974. Influence of snow on behavior of moose. Naturaliste Can. 101:417-436.

Cook, C. W. 1977. Effects of season and intensity of use on desert vegetation. Utah Agricultural Experiment Station Bull. 483. 57 p.

Danell, K., R. Bergstrom, and L. Edenius. 1994. Effects of large mammalian browsers on architecture, biomass, and nutrients of woody plants. J. Mammal. 75:833-844.

Franzmann, A. W. and C. C. Schwartz. 1985. Moose twinning rates: a possible condition assessment. J. Wildl. Manage. 49:394-396.

Jenkins, K. J., P. J. Happe, and R. G. Wright. 1990. Evaluating above-snow browse availability using nonlinear regressions. Wildl. Soc. Bull. 18:49-55.

McKendrick, J. D., G. O. Batzli, K. R. Everett, and J. C. Swanson. 1980. Some effects of mammalian herbivores and fertilization on tundra soils and vegetation. Arctic and Alpine Res. 12:565-578.

Moen, R., J. Pastor, and Y. Cohen. 1990. Effects of beaver and moose on the vegetation of Isle Royale National Park. Alces 26:51-63.

Molvar, E. R., R. T. Bowyer and V. Van Ballenberghe. 1993. Moose herbivory, browse quality and nutrient cycling in an Alaskan treeline community. Oecologia 94:472-479.

Risenhoover, K. L. 1986. Winter foraging strategies of moose in subarctic and boreal forest habitats. Ph.D. Thesis, Michigan Technological Univ., Houghton. 108 p.

Robbins, C. T. 1983. Wildlife feeding and nutrition. Academic Press, New York, N. Y. 343 p.

Schwab, F. E. and M. D. Pitt. 1991. Moose selection of cover types related to operative temperature, forage, and snow depth. Can. J. Zool. 69:3071-3077.

Shafer, E. L. 1965. The twig-count method for measuring hardwood deer browse. J. Wildl. Manage. 27:428-437.

Shepherd, H. R. 1971. Effects of clipping on key browse species in southwestern Colorado. Colorado Div. Game, Fish and Parks Tech. Pub. No. 28. 104 p.

Spencer, D. L., and J. B. Hakala. 1964. Moose and fire on the Kenai. Proc., 3rd Ann. Tall timbers Fire Ecol. Conf.

Telfer, E. S. 1970. Winter habitat selection by moose and white-tailed deer. J. Wildl. Manage. 34:553-559.

—— 1978. Cervid distribution, browse and snow cover in Alberta. J. Wildl. Manage. 42:352-361.

Testa, J. W. 1997. Population dynamics of moose and predators in Game Management Unit 13. Alaska Dep of Fish and Game. Federal Aid in Wildl. Restor. Project W-24-5, Study 1.49. Juneau.

Thomas, D. L. and E. J. Taylor. 1990. Study designs and tests for comparing resource use and availability. J. Wildl. Manage. 54:322-330.

Van Ballenberghe, V, D. G. Miquelle, and J. G. MacCracken. 1989. Heavy utilization of woody plants by moose during summer at Denali National Park. Alces 25:31-35.

Wolff, J. O., and J. C. Zasada. 1979. Moose habitat and forest succession on the Tanana River floodplain and Yukon-Tanana uplands. Proc. N. Am. Moose Conf. Workshop 15:213-244.

Prepared by:

William B. Collins
Wildlife Biologist III

Approved by:

Wayne L. Regelin
Wayne L. Regelin, Director
Division of Wildlife Conservation

Submitted by:

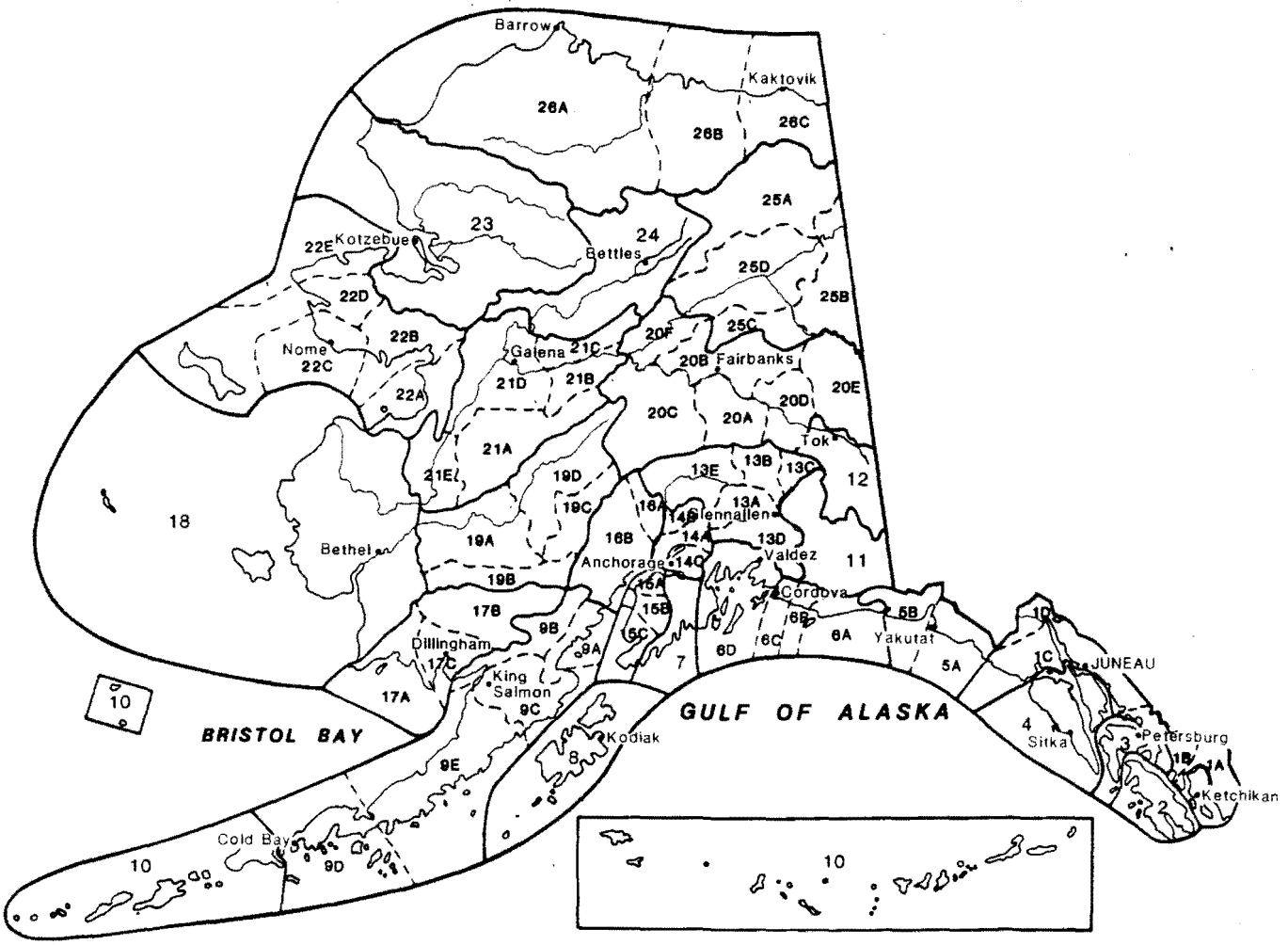
Charles Schwartz
Research Coordinator

Steven R. Peterson, Senior Staff Biologist
Division of Wildlife Conservation

Table 1. Percent utilization of feltleaf willow by moose. Standard deviations are in parenthesis.

	Oshetna River			Tyone Creek		
Twig height	1994	1995	1996	1994	1995	1996
0.5 - 1.5	n.d.	9.3(11.1)	9.7(10.0)	n.d.	4.3(4.5)	5.2(5.0)
1.5 - 2.5	n.d.	10.5(3.4)	11.2(4.6)	n.d.	5.0(4.2)	6.6(6.5)
Terminal	82.0(22.2)	13.0(11.6)	31.5(13.8)	76.2(16.2)	12.0(12.8)	28.7(10.2)

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.

Ken Whitten