FEDERAL AID
INTERIM PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

Alaska Department of Fish and Game
State Wildlife Grant

Grant Number: **W-33** **Segment Number:** 9

Project Number: 1.63

Project Title: Evaluation and testing of techniques for ungulate management

Project Duration: July 1, 2005 – June 30, 2011

Report Period: July 1, 2010 – June 30, 2011

Report Due Date: September 1, 2011

PRINCIPAL INVESTIGATORS: Tom Lohuis, John Crouse and Stacy Crouse

WORK LOCATION: Moose Research Center

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

The Kenai Moose Research Center (MRC) location, facilities and captive animals provide unique conditions for developing and testing techniques applicable to ungulate management. This study has been continuously active since 1969 when the MRC became functional. Most findings from these studies have been published as articles in scientific journals, book chapters, proceedings and popular articles. As allocation issues intensify, the evaluation of new tools and the development of new techniques will be required to reveal mechanisms underlying complex population dynamics.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

In the past 3 decades, a wide variety of drugs have been used to immobilize moose. The most effective combinations have been opioid anesthetics paired with a tranquilizer to smooth induction and recovery. Carfentanil citrate, a synthetic opiate, used in combination with xylazine hydrochloride, an alpha-adrenergic tranquilizer, has worked well to immobilize moose. Recent studies, however, have implicated xylazine, when used in combination with carfentanil, in producing exacerbated mortality risk through induction of aspiration pneumonia. New experimental immobilization drugs are now available but have yet to be thoroughly evaluated in moose.

Acceptable non-lethal means to temporarily restrain or modify the behavior of distressed or aggressive wildlife are needed. The application of electro-muscular disruption devices (EMDDs) to incapacitate domestic animals and humans has been thoroughly demonstrated. The use of TASER® electronic control devices on bears and moose has been reported, but no current data exists to support the use of any EMDD to routinely restrain or haze wildlife.

Annual and seasonal variation in the nutritional condition of female moose is an important indicator of a population's reproductive potential. Moose use body stores of nutrients during winter when forage alone cannot meet their requirements. Ultrasonography can be used to quantify changes in body fat, but the contribution of nitrogen (N) from body protein is difficult to measure and has been little studied in moose. N stores likely play an important role, particularly during late-winter, when fat stores are near exhaustion and N demands for fetal growth are greatest. Methods that can discriminate between dietary and endogenous contributions of N are needed.

Dr. Spalinger (Department of Biology, University of Alaska Anchorage) and his collaborators Dr. Tom Hanley (US Forest Service, Pacific Northwest Experiment Station, Juneau, AK) and Dr. Kenrick Mock (Department of Mathematics and Computer Sciences, University of Alaska Anchorage) are developing web-based applications for the determination of carrying capacity of habitats to support large herbivores, based on nutritional needs of the animals, and the availability and nutritional quality of their foods. The moose system includes linked databases of understory biomass and forage-specific nutritional data for a variety of habitats and forages, but would benefit from additional site-specific data.

Detecting births and enumerating the number of viable calves is germane to determining moose population productivity. Locating parturient females and observing calves is problematic in habitats that conceal moose or make surveillance difficult. Intravaginal telemetry devices (VIT) have been used to locate and facilitate capture of other cervid neonates, but have not been previously deployed in moose.

In 1990 a portion of the facility was modified to provide for a small number of caribou. The original objective of these studies was to examine the extent to which nutritional factors influenced reproduction in caribou and how that relationship might have contributed to the decline of the Southern Alaska Peninsula caribou herd. Initial work demonstrated a strong linear relationship between ingesta-free body fat and maximum subcutaneous rump fat thickness, but further samples were needed to validate the predictive equations.

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: Kenai Moose Research Center (MRC) maintenance and operations.
We held and cared for 20-25 moose and 0-9 caribou. We hand-raised and accustomed 4 female and 1 male moose calves to the presence and handling by humans. We constructed a 0.5 mile long by 30 feet wide fenced alleyway across the northeast portion of Pen 2 to direct the movement of animals between enclosures and from Pen 3 to our animal holding, processing and weighing facilities. Shrubs and trees have been removed from 8000 linear feet of enclosure fence. Conifers have been thinned around existing structures and fire suppression equipment (gasoline powered water pump, hose and sprinklers) has been purchased and is on-site. We replaced the insulation and pest-proofed beneath the floor and in the attic space of the Lab building. We replaced the

porches of each of the residence cabins. We removed the aged and failing exterior log sealant from each of the residence cabins and refinished the cabins with a two-part sealant that will protect them from further deterioration. We replaced the propane gas cooking range/oven in each of the residence cabins. A 3,200 square feet uninsulated steel shop building was constructed by the Kenai National Wildlife Refuge and electrical, gas, and water lines were purchased and put in place by MRC staff. The building is to replace the log structure enclosing the existing well, shower, and shop space which was deemed unfeasible to maintain by the Kenai National Wildlife Refuge. Before the building can meet its intended use, however, electrical fixtures, plumbing and insulation are necessary.

OBJECTIVE 2: Drug testing.

We evaluated the combination of medetomidine and ketamine to immobilize a single male moose. We evaluated the combination of butorphanol, azaperone and medetomidine (BAM) to immobilize 11 moose. Neither of the combinations was satisfactory to immobilize moose. Under the influence of medetomidine and ketamine, the male moose would not remain recumbent. We were able to titer a dose that could achieve recumbence in moose using BAM; however, the induction time was longer than acceptable. In addition, the depth of anesthesia and the level of muscle relaxation were so great that respiratory depression and hypoxia resulted. We cannot recommend the use of medetomidine and ketamine or BAM to immobilize moose at this time. We do recommend further evaluation of Thiafentanil, a newer synthetic opioid, which has achieved satisfactory results without the use of a tranquilizer in other subspecies of moose.

We evaluated moose (2 females/2 males) physical response and physiologic effects of TASER® electronic control devices in contrast to standard powder-charged chemical immobilization darts. Temporary incapacitation and the desired flight response were achieved with the TASER®. Increased levels of some physiologic indicators of stress were observed using the TASER®, but no long-term effects were determined. There was no increased risk of capture myopathy and no mortalities resulted from use of the TASER®. When properly applied by trained personnel, the TASER® is suitable for hazing wildlife when the alternatives put the animal's welfare or people at risk of injury or death.

OBJECTIVE 3: Moose nutrition, physiology and reproductive studies.

We collected samples of blood, urine and feces from 6 female moose over 2 consecutive winters once each month from November through June to evaluate whether an isotopic approach (the natural abundance of $\delta^{15}N$ of N-bearing metabolites) could be used to monitor N losses in relation to tissue change and diet contribution. Measurements of body composition by water dilution were made mid-winter and again within 1 week following the average birth date of calves. Animals were weighed on a walk-on scale once each month and the depth of subcutaneous fat over the rump was measured by ultrasound. Diet composition was measured by direct observation of each female during an 8-12 hour period (hours of daylight) 2 days each month. The $\delta^{15}N$ of N-bearing metabolites in urine and blood was enriched over the $\delta^{15}N$ of the diet which suggests high contributions from body N. Ingested plant secondary compounds, bound to sugars and

excreted in the urine, made extraction of urinary creatine problematic. This is an important aspect when applying this method for browsers because 1) it becomes necessary to rely on a blood sample to determine $\delta^{15}N$ of the body and 2) detoxification of plant secondary compounds with sugars implies an additional source of N loss not previously considered.

We developed and evaluated techniques to estimate food acquisition rates (grams dry matter/minute) of foraging moose. Food acquisition rates were combined with time-activity budgets to reconstruct diets and to estimate total nutrient intake (digestible energy and protein). Our nutritional database will expand the plant availability for Kenai-Forest locations from 6 to 18. Despite extensive research effort, it remains difficult to estimate diet composition and intake of free-ranging moose. This severely constrains our ability to understand how the nutrient intake of animals can be related to their requirements. The relative proportion of primary dietary components can be described through microscopic examination of undigested plant fibers and plant chemistry residues in feces. But there is an increasing awareness of the importance of understanding the foraging strategy of moose in the development of intensive management systems to meet population goals. Short-term foraging strategies that include plant selection, bite rate and bite size can be examined through direct observation of animals. Acquisition rates can be further combined with plant nutrient content, time spent foraging and location to estimate long-term nutrient intake. The approach is extremely time consuming, relies on the animals being easily observable and the animals behavior being unaltered by the presence of a human observer. New techniques will have to be developed to further understand moose foraging strategy in order to manage their foraging environment in both space and time.

The appropriate size of VIT for moose was determined from measurements of intact uteri collected from adult females (n = 8) killed by hunters or collision with highway vehicles. We developed techniques specific to moose, successfully deployed 13 VITs and evaluated the use of VITS in our captive moose population. VITs were an effective method for locating parturition sites and determining timing of most events. In addition, VITs could be used to quantify non-predation perinatal losses. The radio signal being transmitted from the VIT is attenuated by the body of the moose while in place. We recommend that VITs deployed in animals in non-captive populations always be deployed with a second VHF transmitter (i.e., female fitted with a radio-collar) to allow simultaneous location of the VIT and female and increase the distance at which the female can be located.

OBJECTIVE 4: Caribou nutrition, physiology and reproductive studies.

Problems related to personnel changes, inexperience with caribou husbandry and poor survival of caribou in captivity resulted in little progress toward objectives. Over time we collected baseline information on parameters of calving in nutritionally unrestricted caribou, improved facilities and vaccination schedules and developed predictive equations of total body fat using ultrasonographic fat measurements. Collaborative work with Dr. Parker (Institute of Natural Resources and Environmental Studies, University of Northern British Columbia) and Dr. Barboza (Department of Biology and Wildlife,

University of Alaska Fairbanks) investigated the effects of decreasing diet quality on protein conservation in female caribou. Data have been presented elsewhere (Stephenson et al. 1999 and Parker et al. 2005). The caribou studies were concluded in 2007 and no caribou remain at the facility.

OBJECTIVE 5: Preparation of reports and technical publications.
Annual research performance reports and Institutional Animal Care and Use (IACUC) documents were submitted. "Nutrient intake of a southeast Alaska moose population in relation to forage availability and its influence on nutritional condition," by S.G. Crouse, K.S. White, J.A. Crouse and N.L. Barten was presented as a poster at the 2006 annual meeting of The Wildlife Society in Anchorage, AK. "Using VHF transmitters to detect moose birthing events," by J.A. Crouse and B.W. Dale was presented at the 2007 annual meeting of the Alaska Chapter of the Wildlife Society in Anchorage, AK.

IV. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD

JOB/ACTIVITY 1B: Cabin repair and upgrades.
We replaced the insulation and pest-proofed beneath the floor and in the attic space of the Lab building. We replaced the porches of each of the residence cabins. We removed the aged and failing exterior log sealant from each of the residence cabins and refinished the cabins with a two-part sealant that will protect them from further deterioration. We replaced an inoperative gas cooking range/oven in one of the residence cabins.

JOB/ACTIVITY 3C: Using stable isotopes as indicators of protein balance in female moose.
We used 4 non-pregnant females and 1 pregnant female from the captive herd at the MRC. Animals were held together outdoors in 2.5km^2 enclosure (Pen 3) foraging on natural brows with access to water or snow. Each female was observed twice each month from November through April to quantify intake rates and determine which plants and plant parts were being eaten (~150 hours of foraging observations). Plants and plant parts consumed by moose were collected each month and stored frozen for analysis of nutrient, isotopic and alkane composition. In addition, diet composition of each female will be measured by microscopic examination of plant fibers in feces and the analysis of plant-wax markers (alkanes) in feces. Spontaneous feces and urine samples were collected from each animal 3 times per month (72 samples). Once each month February through April and June, blood was sampled (12 samples) and animals were weighed using a walk-on scale. The depth of subcutaneous fat over the rump (an index of total body fat) was measured at each weighing. Animals were sedated for intravenous administration of deuterium oxide (D2O) and sodium bromide (NaBr) for measurement of body composition by water dilution in February and again in June. Blood samples were collected 4h, 24h, and 72h after dosing with D2O and NaBr.

JOB/ACTIVITY 5: Preparation of reports and technical publications.
Laboratory analyses to determine $\delta^{15}N$ of moose blood and excreta samples were completed and the data were summarized.

V. PUBLICATIONS

None.

VI. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

We collaborated with Dr. Kimberlee Beckmen (ADF&G staff veterinarian) to determine trace mineral, serum phosphorus and vitamin D levels in moose calves. Blood samples were collected from 11 calves (6 female and 5 male). One orphan female calf (non-MRC stock) and 2 male calves taken from MRC moose were euthanized and shipped to either Dr. Beckmen or Alaska Veterinary Pathology Services for further pathologic and histopathologic findings.

The quality and quantity of forage available to moose within the enclosures has declined as a result of succession and browsing by moose. The capacity for the MRC to overwinter moose in a healthy condition is compromised and further degrading. We wrote a vegetation management plan and are working with the Kenai National Wildlife Refuge Fire Management Staff (Refuge Staff) to use various techniques to return and maintain at least 35% of each enclosure in deciduous woody vegetation less than 15 years old. We paid to transport a bulldozer, hydro-axe, and feller/buncher to the MRC which Refuge staff used during March and April 2009 to prepare three 40 acre blocks for burning and remove 9 acres of mature hardwoods. We identified areas suitable for mechanical treatment and Refuge Staff used a feller/buncher mounted on a Bobcat T-300 to remove and pile 17.5 acres of woodland-spruce (~ 25 years old and $\geq$ 8in DBH) in Pen 1. An additional 33 acres of aspen-birch saplings (~ 23 years old and $\leq$ 8in DBH) were knocked down and mulched using a hydro-axe in Pen 2.

VII. RECOMMENDATIONS FOR THIS PROJECT

This study has produced numerous findings and publications that are helpful to ungulate researchers and managers. We recommend continuation of this study so that new drugs and research and management techniques can be evaluated in a timely and efficient manner. We have initiated vegetation management prescriptions within the enclosures to enhance the forage intake of captive moose, but without committed effort to meet our goals the ability to maintain animals will be compromised.

Prepared by: John Crouse

Date: September 14, 2011