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

Alaska Department of Fish and Game
Wildlife Restoration Grant

GRANT NUMBER: AKW-B-R2-2020 Amendment #1

PROJECT NUMBER: P1.63

PROJECT TITLE: Evaluation and testing of techniques for ungulate management and operation of the Kenai Moose Research Center

PERIOD OF PERFORMANCE: July 1, 2019 to June 30, 2021.

REPORT DUE DATE: Submit to Coordinator August 24, 2018; due to FAC Sept 1, 2018

PRINCIPAL INVESTIGATORS: John Crouse and Dan Thompson

COOPERATORS: Kenai National Wildlife Refuge, Dr. Perry Barboza, Texas A&M University and PhD candidate Bridgett Benedict. Dr. Garrett Street, Mississippi State University and PhD candidate Jane Detinger. Drs. Alina Evans and Ane Eriksen, Inland University of Applied Sciences, Norway, and PhD candidate Theresa Kirchner. Dr. Alina Evans, Inland University of Applied Sciences, Norway and DVM student Jennifer Høy-Petersen. Thomas McDonough and Sue Rodman, ADF&G. Dr. Gui Verocai, Texas A&M University.

I. PROGRESS ON PROJECT OBJECTIVES DURING PERIOD OF PERFORMANCE

OBJECTIVE 1: Operate and maintain the MRC.

ACCOMPLISHMENTS: We maintained 15 adult moose during the last reporting period including 3 males (4-11 years old) and 12 females (1-19 years old). The females were held within Pens 2 and 3; separate from the males in Pen 1 throughout the year. The males were fed 13% Reindeer Ration (20-30 kg/animal/week) 1 November through late-April to supplement their intake of native vegetation. The females were fed 13% Reindeer Ration (20-30 kg/animal/week) 1 January through late-April to supplement their intake of native vegetation.

Fence and enclosure maintenance included installation of steel fence posts and braces to support 4 new gate panels to improve access between Pens 2 and 3. We also purchased materials and constructed a roofed chute to enclose a scale platform which can be used to weigh calves and adults.

Following antler hardening and shedding of the velvet, we dosed all 3 males on September 10th with 800 mg medroxyprogesterone acetate (MPA) delivered by 4cc

powder-charged dart to reduce aggression during the rut. We typically observe our males fighting to establish dominance during the rut and injuries are not uncommon. As well, interactions between our captive males and wild males on opposing sides of our perimeter fences cause a substantial amount of damage to the structures. Following dosing with MPA, we did not observe any significant clashes among our males, we did not detect or find any rut pits within the bull pen, and we did not have any issues with our captive bulls fighting with wild bulls through the fences. In addition, the males continued eating and did not lose body condition characteristic of the rut.

In early November, our oldest bull, Rocky (11 years), was not bearing weight on his right rear leg. He was immobilized and it was determined that one of the claws of his hoof was badly infected. Rocky was immobilized 18 times between November 3rd and April 7th to clean and address the infected claw. Dr. Cherise Neu inspected the claw on February 9th using a portable x-ray and determined the bone (3rd phalanx) was involved. We were advised to observe how healing progressed for the next 3-4 weeks and after that time decide to amputate the claw, euthanize the animal, or continue treatment. Following positive observations, the wound was flushed with betadine and a topical antiseptic cream was applied daily from April 7th – April 30th while the animal stood at the feed bunk. The tissue has since healed with no sign of drainage and Rocky exhibits no signs of discomfort and walks normally.

We weighed and chemically immobilized female moose to measure rump fat and loin muscle thickness, collect blood and feces in December and April to monitor resource allocation to fat and lean mass and to determine pregnancy status. The males were chemically immobilized concurrently with the females during December when all animals were provided vitamin and mineral supplementation and clostridium vaccination.

Blood samples from December 2020 revealed 5 unexpected pregnancies; the result of a yearling male that we were unable to move out of the female pen before mid-October. Because only 3 females had survived from our 2019 calf-rearing efforts, we decided to hand-raise up to 4 female calves and at least 1 male calf born to our females. We purchased vaginal implant transmitters (ATS, 3970) and deployed them in the pregnant females during April to aid in parturition surveillance.

We monitored VIT signals once daily, in the morning (Monday – Friday), from time of deployment in April until we detected a birth. Following observation of the first birth, we monitored VIT signals twice daily, once in the morning and again in the evening (Sunday – Saturday). Once a birth event had been detected via change in VIT pulse rate, personnel radio-tracked to the site and directly observed the number and sex of the calf(s). Calves were allowed to remain with the cow undisturbed for a minimum of 24 hours post-birth to allow passive transfer of immunity through the ingestion of colostrum while nursing. We removed all calves from their mothers at approximately 24-36 hours old, determined mass, marked with a VHF radio-collar, and collected blood for health screening. In addition, all calves were given an oral vaccine (Calf-Guard®, Zoetis) as an aid in preventing diarrhea, a selenium - tocopherol injection (BO-SE®, Intervet/Merck Animal Heath) as an aid in the prevention of white muscle disease, and a Vitamin AD

injection (Sparhawk Laboratories, Inc.) as a supplemental nutritive source of vitamins A and D.

Births occurred 19 May through 5 June and 7 calves were born (2 females:5 males). Average mass of calves was 16.1 kg. Following removal, we began bottle-feeding 2 females and 2 males. Two male calves were transferred to the Alaska Zoo for out of state placement and the last male calf was euthanized after there were no placement options available. We also accepted 2 female calves as orphans from Division of Wildlife Conservation personnel on the Kenai Peninsula. One of the orphaned calves died within 4 days after failing to thrive and the second, that was in poor condition upon arrival, was euthanized after 2 days at the MRC.

At 4-5 days old, each of our bottle-fed calves developed diarrhea. Feal samples were collected from 2 calves and sent to Washington Animal Disease Diagnostic Laboratory (WADDL) for testing. Mixed normal enteric flora were present, no salmonella were identified, and the clostridium and e. coli isolates were virulence genotyped. No parasites were detected, and the samples were negative for coronavirus, cryptosporidium, and rotavirus by PCR. The clostridium were identified as perfringens Genotype A, which is almost invariably present in the intestines of most mammals as normal flora. The e. coli isolate from 1 calf was virulence factor positive for the intimin (eaeA) gene associated with enterohemorrhagic (attaching and effacing) e. coli and negative for shiga toxins (stx1 and stx2). The e. coli isolated in the sample of the second calf as virulence factor negative. The results suggest that the cause of the diarrhea was unknown, however, calves were treated with trimethoprim sulfate (TMS) for 5 days and the cases resolved.

OBJECTIVE 2: Determine costs and consequences of insect harassment for moose.

ACCOMPLISHMENTS: We immobilized non-pregnant females (n=7) during mid-May to collect blood and baseline tissue samples prior to significant biting insect emergence and the appearance of sores. Skin tissue was acquired from the hind leg by punch biopsy (6-8 mm). May samples will be compared to those collected in July to determine serological and histological changes.

PhD candidate, Bridgett Benedict, arrived in mid-May and began collecting insects using a variety of traps at 4 locations within the moose enclosures. Bi-weekly trapping sessions will persist through mid-August to examine insect phenology as influenced by variations in climate and habitat.

Each week, insects on moose (n=10) were collected with a sweep net, saliva was collected using an absorbent swab, feces was collected, and thermal images were taken of the lower hind legs where the sores appear. Salivary cortisol and fecal glucocorticoid concentrations will be determined as biological markers of stress. The spatial heat distribution within the sores will be examined, with higher temperatures signaling potential inflammation or infection.

ADF&G Area Management staff were able to secure skin samples from moose killed in moose-vehicle collisions (n=9) on Kenai Peninsula roads in addition to tissue samples collected from MRC animals. The area of skin removed from each of the roadkill animals included multiple sores (versus a small biopsy from a single sore on captive animals).

We continued sampling wild-caught moose on the Kenai Peninsula to determine the spatial distribution of *Setaria* sp. Samples from November 2020 (n=30) and March 2021 (n=70) suggest low infection rates of adults this year, however, *Setaria* infections in calves (n=38) were still nearly 90%. We also investigated the relationship between Modified Knott's Test results obtained from fresh versus frozen blood samples. Blood samples were shipped fresh to Dr. Verocai's lab for initial determination, frozen, and then retested. Detection was 100% and the absolute counts were lower, but positively related to counts made on fresh samples. These results suggest we can categorize negative, low, medium, and high infections using archived blood samples that have been stored frozen. This would allow for retrospective analysis of samples over years with varying climatic conditions and perhaps identify indicators associated with high infection rates (e.g., hot summers).

OBJECTIVE 3: Quantify moose behavior and energetics using bio-loggers.

ACCOMPLISHMENTS: During October 2020, we deployed Vectronics GPS collars with advanced accelerometers and magnetometers on 9 of our adult female moose and completed 54 hours of direct observation to record activities. During early May 2021, we again deployed Vectronics GPS collars with advanced accelerometers and magnetometers collars on all adult female moose (n = 12). During May and June, PhD candidate Jane Detinger and MRC staff completed more than 250 hours of direct observation to record activities. Observation and sensor data will be used to develop a classification system to identify behaviors.

Following deployment of the Vectronics collars in October, we were unable to download the GPS and sensor data. All 12 collars eventually had to be returned (01/26/2021) to the manufacturer in Germany to address hardware/software issues and retrieve the data. The collars were not returned to us until 05/03/2021.

The deployment of implantable heart rate loggers (Star-Oddi LTD, Iceland) was delayed until mid-July because the loggers did not arrive until late-June. Our intention was to implant the loggers during immobilizations in May concurrent with VITs, however, production delays prevented the manufacturer from getting them to us in time.

OBJECTIVE 4: Determine reproductive phenology in moose.

ACCOMPLISHMENTS: During May immobilizations, we deployed vaginal implant transmitters (VITs) with temperature loggers to record body temperature in the 7 non-pregnant female moose and delayed deployment in the 5 females that gave birth until mid-July. Fecal samples will be collected daily from each moose (n=12) from mid-August to mid-October to determine progesterone concentrations and the timing of estrus.

Body temperature and progesterone profiles will be examined to determine if change in body temperature can be used as a marker of estrus timing.

II. SUMMARY OF WORK COMPLETED ON PROJECT TO DATE.

We studied hoof growth of moose during August 2018 – August 2019 and collected keratin samples of hair and hoof to determine progesterone and cortisol concentrations. Hair and hooves could be collected from hunter-killed animals and these tissues could provide information on previous pregnancy (females only) and seasonal stressors. Progesterone and cortisol were measurable in all hoof and hair samples. Annual hoof growth was different between front and rear hooves (5.58 cm versus 4.17 cm). Growth rates were highest during summer (April – August) and lower hoof wear (abrasion) was observed during winter. There was not an increase in progesterone in the recently grown hair (basal segment) collected from the known pregnant moose. The timing of molt and the reproductive cycle of moose may preclude using hair to assess reproductive state in female moose. Progesterone concentrations were elevated in a band of hoof growth deposited between April and August following pregnancy that resulted from breeding during the previous October. The potential for using progesterone concentrations of hooves to provide retrospective information regarding pregnancy in female moose may be possible.

III. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

Our permanent technician position has been vacant since January 2021. We have been able to get assistance periodically from other ADF&G staff and hired a short-term nonpermanent technician to assist with raising calves from mid-May to mid-September 2021. We recruited for our

permanent technician position during April but did not make a hire and are currently recruiting for the position again.

IV. PUBLICATIONS

Thompson, D. P., Crouse, J. A., McDonough, T. J., Barboza, P. S., Jaques, S. (2020). Acute thermal and stress response in moose to chemical immobilization. Journal of Wildlife Management, 84(6), 1051–1062.

Thompson, D.P., Crouse, J.A., Barboza, P.S., Spathelf, M.O., Herberg, A.M., Parker, S.D., Morris, M.A. (2021). Behaviour influences thermoregulation of boreal moose during the warm season. Conservation Physiology. 9(1): coaa130.

Cook R.C., Crouse J.A., Cook J.G., Stephenson T.R. (2021). Evaluating indices of nutritional condition for caribou (Rangifer tarandus): which are the most valuable and why? Canadian Journal of Zoology. 99(7):596-613.

V. RECOMMENDATIONS FOR THIS PROJECT

We are 1 year behind schedule on the completion of the projects reported here because of delays associated with the ongoing COVID-19 pandemic. All hardware have now been obtained from the manufactures and collaborators and their graduate students were allowed to travel to Alaska this summer. Work on these projects should continue through at least June 2022.

Prepared by: John Crouse

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