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-29

PROJECT NUMBER: P1.0

PROJECT TITLE: Moose calf survival and nutrition in GMU 22D

PERIOD OF PERFORMANCE: March 15, 2018 – Dec. 30, 2020

REPORTING PERIOD: March 24, 2020 – Sept. 30, 2021

REPORT DUE DATE: Submit to Coordinator December 30th

PRINCIPAL INVESTIGATOR: Warren Hansen

COOPERATORS: None

This is the final report for a multi-year project. This template is applicable to both:

- the final closeout report of a multi-year grant; or
- the final closeout report of a multi-year *project* within the annual operating grant, summarizing all accomplishments for all objectives.

Authorities: 2 CFR 200.328
2 CFR 200.301
50 CFR 80.90

I. SUMMARY OF WORK COMPLETED ON PROJECT

The nutritional status of moose (Alces alces) is an important biological component to understand for the management of populations. Weights of 10-month-old calves, and age specific parturition and twinning rates are used as an indicator of population health and nutritional limitation. Typically, it is assumed that forage available in winter and winter severity drive 10-month-old weights. Alternatively, dam condition and summer weather could contribute to variation in 10-month-old calf weights. To better understand the potential drivers of 10-month-old calf weight we captured, weighed, and collared 5-month-old calves and recaptured them as 10-month-olds. Tracking weight from fall to spring may inform causes of limited growth of the moose population on the Seward Peninsula, Alaska. Four subsequent years of captures resulted in 329 captures representing 120 collared female calves. The average fall weight between 2017-2019 was 197 kg. Average spring weight between 2018-2020 was 181 kg, resulting in an average of

9.2% over-winter weight loss. These fall and spring weights correspond with some of the heaviest fall weights and lightest spring weights recorded in Alaska. Correlation between spring and fall weights was 0.59 (Multiple R2), with little variation of between study years (0.63, 0.62, 0.73). Average survival rate to 1 year of age (from capture at 5-months to 12-months) was 89%. Estimated survival to 2-years of age (5-months to 24-months) was 74%. Over- winter mortality for all winters was low with a total of four mortalities occurring between 2017 – 2021. One of these mortalities was attributed to starvation and the remaining three to wolves (Canis lupus). All other mortalities (22) occurred during other times of year and were attributed to grizzly bears (Ursus arctos). Recent data identified parturition rates of two and three-year-old cows to be high. Based on low browse removal rates, and the high estimated reproductive output, we surmise that forage is not currently limiting the abundance in this population. This along with high amounts of overwinter weight loss implies that winter severity plays a large role in the relative body condition of this population. The landscape potential for maintaining higher densities appears possible. Nutrition and subadult survival appear to be adequate. A potential limiting factor in this population may be survival of the neonate to 5-month-old age class. Neonatal mortality rates may provide further insight to predator driven mortality limiting this population. The interaction between summer conditions, overwinter conditions and the resulting 10-month-old weights is complex. Further investigation is needed to understand how climatic variables influence summer weight gain and winter weight loss and how these weights influence lifetime productivity.

Objective 1: Evaluate nutritional condition of moose in GMU 22D across summer and winter periods

Accomplishments: We evaluated the nutritional condition of this moose populations through measurements of calf weights, twinning and parturition rates. We weighed over 300 moose and monitored these collared cohorts of calves for age at first parturition and measured twinning rates. These activities all fell withing the expected budget for the project.

Objective 2: Evaluate cause and mortality rates of marked moose.

Accomplishments: Our objective was to monitor the radio collared moose once per month for mortalities. Throughout this 3-year study we detected 26 mortalities out of 126 collared female moose. This monitoring schedule met our research needs to identify how and when mortalities are taking place in this population and if our measured mortality rates might be cause for limitation to population growth. We have been largely successful at adhering to the monthly monitoring schedule due to the availability of local aviation staff and ability to capitalize on windows of good weather. This study identified that mortality of collared cows is low and not a likely contributor to population limitations. We have also identified grizzly bears as the primary predator and that the bulk of mortalities occur in the spring.

This activity fell within the expected budget for the project.

Objective 3: Evaluate nutritional quality of summer and winter forage species.

Accomplishments: Winter browse samples and summer browse samples are currently stored in ADF&G freezer space in Palmer. Samples have been sent to the moose physiology lab in Palmer to assay for digestible protein. The samples are currently in-queue, but an apparent low staffing and backlog of samples has kept our sample from being assayed at this time This activity has thus far fallen within the expected budget for the project. We are currently unable to make any inferences about the nutritional quality of winter and summer forage until these samples are assayed.

Objective 4: Evaluate age at first parturition.

Accomplishments: When each cohort reached the age of 2 years we started monitoring for parturition and measured twinning rates for each cohort. Age specific parturition and twinning rates in this population are high. The 3-year age specific parturition rate is 79% with a twinning rate of 27%. Within this project we have met our goals in measuring partition and twinning and this activity fell within the expected budget for the project.

Objective 5: Evaluate stress physiology utility of hoof tissue.

Accomplishments: We successfully sampled cortisol from the hooves of captured moose. This is the first time to our knowledge that cortisol has been extracted from the hooves of moose. We detected no significant variation of cortisol from the gradient of the hoof when sampled in the fall. We found no correlation with fall hoof cortisol with fall weight or spring cortisol concentration and overwinter weight loss. There was a weak correlation with spring hoof cortisol and spring weights ($p=0.005$, $R^2=0.09$). These accomplishments met our objectives for measuring cortisol in the study. This activity fell within the expected budget for the project.

II. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

1. There have been no Significant Developments to report on this project.

III. PUBLICATIONS

There have been no publications from this project to date. This data has been presented to the 2021 North American Moose Conference and is intended to be published in the Journal Alces.

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

Over the past half century GMU 22D has experienced a significant rise and subsequent fall in moose abundance. In GMU 22D the population peaked in the mid-1980s with moose densities greater than 1 moose/sq. mi. The population declined to a low density of 0.5 moose/sq. mi. during the 1990s due in part to three consecutive hard winters (Nelson 1995). By 2006 the population in GMU 22D had increased to 0.91 moose/sq. mi. but subsequently decreased again to 0.57 moose/sq. mi. in 2014, which is an average annual decline of 13% (Persons 2006, Gorn 2014). The reasons this population is currently experiencing a decline in addition to never fully recovering from the collapse in the 1990s remain unclear.

Reacting to the current declines in moose abundance the Alaska Board of Game (BOG) adopted regulations eliminating non-resident hunting opportunity in GMU 22D beginning in the 2017-2018 regulatory year. In addition to declines in abundance, bull to cow ratios are lower than optimal and harvest is estimated to be less than 4% of the estimated abundance. Current harvestable surplus of moose in GMU 22 is 314 moose with 45 of those moose coming from GMU 22D (Pers. Com. Dunker 2017). The harvest objective for GMU 22 is 300 to 680 moose and the amount reasonably necessary for subsistence (ANS) is 250 to 300 moose (AAC 92.110, 99.016)(ADF&G 2015).

Short yearling weights were collected by area biologists from 2007 through 2010 to find a possible reason for the population decline in GMU 22D, short yearling weights were collected by area biologists from the unit from 2007– 2010 and averaged 175 kg (n=74) (Gorn 2014). While these weights were associated with two of the deepest snow years on record, average short yearling weights less than 175 kg indicate populations that may be approaching or surpassing resource limits in interior Alaska (Boertje et al. 2007). Preliminary results from a twinning survey and browse removal study conducted in 2017 may not only support that the population is nutritionally limited, but also that winter browse availability may not be the limiting factor.

At this point, it is unclear why this population declined in abundance over the past 10 years. One hypothesis is that the population experienced resource limitation and has declined in abundance due to poor nutritional condition (Boertje et al. 2007) which is expressed through depressed twinning rates, reproductive pause and increased mortality from predation. Nutritional limitation may be seasonal and is not necessarily a result of density dependent competition for winter browse. An alternative hypothesis is that this population has been unable to grow beyond low densities due to predators regulating both birth and death rates at equilibrium (Gasaway et al. 1992). In 1982 an 8-year study collaring cow moose began in GMU 22D that resulted in an estimated calf mortality of 50% occurring between June and November but with causes of death unknown (Grauvogel 1982).

Both hypotheses may be valid but we are unable to determine if either mechanism explains the realized declines in abundance without further study. This research plan is intended to explore both the predator limitation and resource limitation hypotheses. The combination of an over-winter calf mortality study and a browse nutrition study will begin to elucidate the complex interactions between predators, prey and resource limitation. Because moose are large, long-lived animals, lag effects on body condition are certainly possible. It is notable that the effect of snow depth on calf weights in GMU 22 from 2006 through 2010 appeared to lag, potentially implying that the nutritional condition of the dam was partially driving variation in spring calf weights. This suggestion would be consistent with findings in previous studies that concluded variation in spring weights is largely explained by body condition entering the winter (Griffith 2011). The proposed study may be the initiation of a potentially long-term project as alternative hypotheses are evaluated and the study is adapted. This study will closely examine the potential for seasonal limitations to production and survival as a result of winter conditions experienced as well as the potential for using a marked sample of cows to evaluate the role of summer foraging conditions on nutritional condition. The GMU 22 population of moose may exhibit a different dynamic with respect to resource limitation than what has been exhibited by interior Alaskan moose populations with longer growing seasons, and a longer history of presence on the landscape.

Prepared by: Warren Hansen

Date: 12/1/2021