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: 12.0

PROJECT TITLE: Identifying metrics for evaluating nutritional stress in muskox.

PERIOD OF PERFORMANCE: 3/24/2020 – 9/30/2021

PERFORMANCE YEAR: March 24, 2020 – September 30, 2021; year 3 of a 4-year grant

PRINCIPAL INVESTIGATOR: Brynn Parr, WBIII

COOPERATORS:

Authorities: 2 CFR 200.328
2 CFR 200.301
50 CFR 80.90

I. PROGRESS ON PROJECT OBJECTIVES DURING PERFORMANCE YEAR

OBJECTIVE 1: Investigate field and analytical techniques used to date to evaluate nutritional condition of muskox and all allied species.

ACCOMPLISHMENTS: We conducted a thorough a literature review of field and analytical techniques used to date to evaluate nutritional condition of muskox and all allied species.

OBJECTIVE 2: Evaluate pregnancy and parturition-based indicators to nutritional condition and establish baseline values for populations with high productivity and reproductive potential.

ACCOMPLISHMENTS: We asked hunters to provide the pregnancy status (i.e. presence/ absence of a fetus and lactation status) from female muskoxen harvested during the 2020 and 2021 spring hunting seasons.

Pregnancy status provided by hunters revealed 88% of sampled females in 2020 were pregnant and 33% were lactating; 25% of sampled muskox were both lactating and pregnant. In 2021, pregnancy status provided by hunters revealed 80% of sampled females were pregnant and 50% were lactating; none of the sampled muskox were both lactating and pregnant

OBJECTIVE 3: Evaluate forage and diet-based indicators to nutritional condition and establish baseline values for populations with high productivity and reproductive potential.

ACCOMPLISHMENTS: We asked hunters to provide fecal samples, livers, femurs, and fat measurements from muskoxen harvested during the 2020 and 2021 hunting seasons.

We received 21 fecal samples, 23 livers, 13 femurs, and 19 fat depth measurements from the 2020 hunt and 12 fecal samples, 12 livers, 7 long bones, and 10 fat depth measurements from the 2021 hunt during this reporting period.

2020 results: Fecal samples were submitted to Jonah Ventures in Boulder, CO for plant and fungus eDNA testing. Of plants consumed by muskox, 61% of plants were moss, 36.5% of plants were shrubs, 2% of plants were sedges/grasses, and the remaining 1% was a mixture of forbs and rushes. Of the fungi consumed by muskox, 89% belonged to the Ascomycota phylum and 10% belonged to the Basidiomycota phylum; very little fungi found in lichen was present in the muskox diet (0.363% of all fungal results), indicating muskox were not feeding on lichen in mid- to late-winter. Liver samples were submitted to the Analytical Sciences Laboratory at the University of Idaho (Moscow, ID) to test for trace minerals. Average iron (133ppm) and zinc (38ppm) levels are lower than levels previously reported for wild populations in Alaska; however, these levels and average levels of all other trace minerals tested are within published ranges for healthy or increasing wild muskox populations in North America. Femur lengths were measured in our lab; female femurs averaged 11.7 inches and male femurs averaged 12.8 inches in length. We then cut femurs in half to extract bone marrow to test for percent water loss. Water loss in females averaged 8.2% and males lost an average of 8.9%. Overall back fat averaged 2.3cm, and overall rump fat averaged 3.1cm.

2021 results: Fecal samples were submitted to Jonah Ventures in Boulder, CO for plant and fungus eDNA testing. Results had not yet been received by the end of this reporting period. Liver samples were submitted to the Analytical Sciences Laboratory at the University of Idaho (Moscow, ID) to test for trace minerals. Average zinc levels declined to 30ppm, while average iron levels climbed to 143ppm. Both zinc and iron levels remain lower than levels previously reported for wild populations in Alaska. Femur lengths were measured in our lab. Female femurs averaged 11.7 inches, and no male femurs were submitted. We then cut femurs and long bones in half to extract bone marrow to test for percent water loss. Water loss in females averaged 6.7% and males lost an average of 5.4%. Overall back fat of both sexes combined averaged 2.1cm and overall rump fat averaged 2.2cm.

OBJECTIVE 4: Evaluate stress-based indicators to nutritional condition and establish baseline values for populations with high productivity and reproductive potential.

ACCOMPLISHMENTS: We asked hunters to provide hair samples from muskoxen harvested during the 2020 and 2021 hunting seasons that will be used to evaluate cortisol levels.

We received 22 hair samples from the 2020 hunt and 11 hair samples from the 2021 hunt during this reporting period. Hair samples are currently being stored in our lab in preparation for testing. Hairs will be cut, cleaned, and submitted to the stable isotope lab at the University of Alaska Fairbanks to determine the rate of growth. Results will allow us to next test cortisol levels at known periods of time for each hair sample. Stable isotope results from the 2019 hair samples were received during this reporting period. However, we did not see obvious oscillations in stable nitrogen isotopes as previously reported by Mosbacher et al. 2016. We are investigating patterns in stable carbon isotopes and the C:N ratios to look for isotope patterns that are associated with hair growth rates.

OBJECTIVE 5: Engage advisory committees and BOG to explore incremental adjustments to stocking density on Nunivak Island.

ACCOMPLISHMENTS: Due to Covid-19, we were unable to travel to Mekoryuk or Toksook Bay in person to speak with hunters directly. However, we spoke with the transporters in Mekoryuk over the phone to ask for their assistance collecting samples for the last year of this study. We also provided a letter to all the Nunivak and Nelson Island hunters that highlighted the project, desired outcomes, and requested samples; this letter was mailed with a complete sampling kit to all hunters.

II. SUMMARY OF WORK COMPLETED ON PROJECT TO DATE.

Year 3 of a 4-year project.

We have collected samples from 67 individual muskox over the past three year, including 56 fecal samples, 59 liver samples, 33 femur samples, 56 hair samples, 54 paired (back and rump) fat measurements, and pregnancy status for 35 muskox cows.

Fecal samples were sent to Jonah Ventures in Boulder, CO, to test for fecal eDNA; results indicated muskox consume large amounts of moss but very little lichen during the mid- to late-winter period. Liver samples were submitted to the Analytical Sciences Laboratory at the University of Idaho in Moscow, ID, to test for trace minerals. Results were comparable to other healthy wild muskox populations across North America. Femurs were sampled in an ADF&G laboratory to test for percent water loss; both sexes have had fatty marrow indicating they were in good health in mid- to late-winter. Initial lab validations indicate that both cortisol (a stress-related hormone) and progesterone (a pregnancy-related hormone) are found in muskox hair at

levels that can be measured. Hair sample results from 2019 have not yet allowed us to determine a standard growth rate, therefore further research is ongoing.

III. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

We requested and received approval to extend the project end date to June 30, 2022.

IV. PUBLICATIONS

No publications have resulted from this project to date.

V. RECOMMENDATIONS FOR THIS PROJECT

This project will continue for one more year.

Prepared by: Brynn Parr

Date: 11/30/2021