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-SW-2020

PROJECT NUMBER: 1.33

PROJECT TITLE: Tracking reproduction, movement, and diet in caribou and moose

PERIOD OF PERFORMANCE: July 1, 2019 - June 30, 2021

PERFORMANCE YEAR: July 1, 2019 - June 30, 2020; year 1- of a 2-year grant

REPORT DUE DATE: August 28, 2020

PRINCIPAL INVESTIGATOR: Mandy Keogh

COOPERATORS: Matthew Wooller and Audrey Rowe, University of Alaska Fairbanks

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Authorities: 2 CFR 200.328
2 CFR 200.301
50 CFR 80.90

I. PROGRESS ON PROJECT OBJECTIVES DURING PERFORMANCE YEAR

OBJECTIVE 1: Determine the strontium and oxygen signatures in caribou teeth

1a. Transfer caribou jaws with teeth collected in 2018 to UAF.

1b. Participate in hunter check stations with ADF&G staff to collect addition samples (e.g. jaws with teeth) from the forty-mile caribou herd.

1c. Use established methods for Sr and O isotope analysis on up to 30 teeth from forty-mile herd caribou harvested in 2018.

1d. Analyze isotope data (Objective 1c) and apply spatial statistics to investigate caribou movement.

ACCOMPLISHMENTS: 1a Caribou jaws from individuals in the forty-mile caribou herd (2018) were successfully transferred from ADFG to Wooller et UAF. 1b. Covid 19 prevented UAF graduate student Audrey Rowe from participating in the hunter check station during this reporting period. Future plans are being made for her to participate. 1 c. We analyzed isotope ratios of three molars in all forty-mile herd caribou mandibles from 2018 that included molars (many mandibles had only incisors present). Eighteen of the mandibles supplied had molars, for a total of 54 teeth analyzed. Five additional mandibles from collared caribou from the forty-mile herd that died in various other years were received and analyzed as well, totaling 15 additional teeth analyzed. 1d. We have

begun applying spatial modeling methods based on UAF's recently peer reviewed protocols (Funck in revision; Bataille et al. 2020) to determine likely movement patterns of the caribou across the landscape. Hunter check stations were not run this year due to COVID-19, so Objective 1b could not be met this year.

Additonaly the UAF team is investigating whether cementum layers in some of the caribou teeth that have been analyzed already for their enamel also hold an isotopic record of caribou movement. A potential significant advantage of cementum would be a lifetime record of movement as compared to enamel (approximately the first 2 years of life). Preliminary analyses indicate that strontium is at a high enough concentration in the cementum to allow analyses using laser ablation.

References cited:

J. Funck*, C. Bataille, M. Cameron*, J. Rassic, **M.J. Wooller**, (In Revision). Building a bio-available strontium isotope 'rode'-map for Eastern Beringia. Journal of Quaternary Research.

Bataille, C.P., Crowley, B.E., Wooller, M.J., Bowen, G.J., 2020. Advances in global bioavailable strontium isoscapes. Palaeogeogr. Palaeoclimatol. Palaeoecol. 555, 109849. https://doi.org/10.1016/j.palaeo.2020.109849

OBJECTIVE 2: Determine nutrient and hormone concentrations in hair and hoof samples from male caribou from the forty-mile herd.

2a. Clean and process hair samples for C and N isotope analysis from the forty-mile herd of male caribou (2017=20; 2018=20).

2b. Submit hair samples (N=40) to the Alaska Stable Isotope Facility (ASIF), UAF for C and N stable isotope analysis.

2c. Sample 5 hooves (8 samples along each hoof) and submit samples to the ASIF for C and N stable isotope analysis to assess temporal pattern found in caribou hooves.

2d. Based on the results from Objective 2c, collect tissue from ~4 points along the length of each hoof (N=30) and submit samples to the ASIF for C and N stable isotope analysis.

2e. Based on the results from Objective 2c, collect tissue from ~4 points along the length of each male caribou hoof (N=30). Extract and quantify cortisol and testosterone hormones from hoof samples.

ACCOMPLISHMENTS: We transferred 76 caribou legs from the 40-mile herd collected during 2017-2018. We collected dark brown hair from the top of the foot and for 34 animals we also collected light colored hair from around the hooves. All hair samples were cleaned, subdivided for stable isotope analysis and hormones. Hair samples were submitted to the Alaska stable isotope facility at the University of Alaska Fairbanks and $\delta^{13}C$ and $\delta^{15}N$ values have been received. Subsamples of hair for hormones were weighted (~20 mg), powdered, steroid hormones extracted, and cortisol and testosterone

measured using previously validated enzyme immune-assay kits (Arbor Assay, Ann Arbor, MI). To date, 34 of the legs have been processed for collecting hoof tissue, briefly, hooves were cleaned with 100% methanol and 4 sections of hoof tissue was removed using U/V shaped stitching groover starting 1 cm below the coronary growth band. Previously we proposed collecting 8 sections but given the length of the hooves, we were only able to collect 4 at 1 cm intervals. Hoof samples were washed 3 times with 100% methanol and subdivided with one set of samples being submitted to the Alaska stable isotope facility at the University of Alaska for $\delta^{13}C$ and $\delta^{15}N$ values. The second set of hoof samples were cut, weighed (~20mg), steroid hormones extracted, and cortisol and testosterone measured using previously validated enzyme immune-assay kits (Arbor Assay, Ann Arbor, MI). We are currently collecting and processing the remaining hoof samples.

OBJECTIVE 3: Determine nutrient and hormone concentrations in hair and hoof samples from female caribou and moose.

3a. Collect 8 samples along 10 hooves (5 caribou, 5 moose) and submit samples to the ASIF for C and N stable isotope analysis.

3b. Extract and measure hormones from hair and hoof samples collected from breeding female moose housed at the Kenai Moose Research Center. 8 females have ~12 samples each representing periods of non-pregnancy and pregnancy within each female.

3c. Extract and measure hormones from hair and hoof samples.

3d. Based on the results from Objective 3a, extract and quantify cortisol and progesterone hormones from 4 points along each hoof.

3e: Compare progesterone patterns between females with known and unknown calving histories.

ACCOMPLISHMENTS: We received hair and hoof samples from the Moose Research Center in Kenai, AK, and hoof samples from Region V moose. To date, hoof samples have been cleaned, cut, weighed (~20mg), steroid hormones extracted, and cortisol and progesterone measured in MRC moose using previously validated enzyme immune-assay kits (Arbor Assay, Ann Arbor, MI). We have also measured cortisol in Region V moose hoof samples. We have started processing MRC hair samples, segmenting individual hairs for hormone concentrations. Of relevance to these objectives is the publication of a new publication from the UAF collaborators on the use of C and N isotopes on tail hairs (also keratin as in hoofs) of free ranging bison in Alaska to track nutritional stress (Funck et al. 2020).

References cited:

Funck, C. Bataille, T. Seaton, J. Rassic, **M.J. Wooller**, (2020). Stable isotopic signatures in modern wood bison (*Bison athabascae*) hairs as telltale biomarkers of nutritional stress. Canadian Journal of Ecology. 98(8): 505-514, https://doi.org/10.1139/cjz-2019-0185

II. SUMMARY OF WORK COMPLETED ON PROJECT TO DATE.

This report summarizes accomplishments in Year 1 of a 2-year project. As part of the project we have analyzed samples from caribou and moose for markers of diet, migration, and steroid hormones.

III. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

There have been no Significant Development Reports (SDR) or amendments submitted during this performance year.

IV. PUBLICATIONS

There have been no publications thus far during this performance year.

V. RECOMMENDATIONS FOR THIS PROJECT

Project will continue 1 more year.

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Date: 08/23/2020