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-R3-2020

PROJECT NUMBER: 4.45

PROJECT TITLE: Literature review and data assimilation of grizzly bear populations to understand sustainable rates of harvest

PERIOD OF PERFORMANCE: July 1, 2017 - June 30, 2020

PERFORMANCE YEAR: July 1, 2019 - June 30, 2020;

REPORT DUE DATE:

PRINCIPAL INVESTIGATOR: Kerry Nicholson

COOPERATORS: n/a

I. PROGRESS ON PROJECT OBJECTIVES DURING PERFORMANCE YEAR

OBJECTIVE 1: Compile and analyze available data on Interior and Arctic grizzly bear populations.

Job/Activity 1a: Estimate population parameters (e.g., reproduction, survival and mortality) for grizzly bears

ACCOMPLISHMENTS: Brown bear data collected by Harry Reynolds in sub-GMU 20A from 1981 through 2000 have been summarized and reported by Reynolds and Jay Ver Hoef. This data was again analyzed by John Merickel in 2017 in the frequentist framework. Both Ver Hoef and Merickel suggested analyzing the data in the Bayesian framework as this is more appropriate due to the amount of missing data. In 2019-2020, I began working with Meg Inokuma and we cleaned, organized, and reformatted the data to fit the Bayesian framework. We followed protocols similar to Brockman and Guttery 2019 and have produced overall population parameters. The results are presented in Appendix 1.

Job/Activity 1b: Determine feasibility of a harvest viability analysis where appropriate data are available to model growth rates and survival under various scenarios

ACCOMPLISHMENTS: No work was finalized on this aspect for this federal aid report. Predicting survival and population growth rates under various harvest scenarios is to be accomplished in a new Federal Aid report AKW-B-R3-2020 Project 4.46 Demographic and Numeric Consequences of Harvest Regulations on Grizzly Bear Populations. This objective is considered finalized.

OBJECTIVE 2: Survival and diet monitoring.
Job/Activity 2a: Grizzly bears that were collared in GMU 20A will be monitored for survival and reproductive information.

ACCOMPLISHMENTS: Bears that were radiocollared as part of this project were monitored for survival and reproductive information (Table 1).

Table 1. Productivity and adult and cub survival of 7 radio-collared grizzly bears in Unit 20A, Interior Alaska.

Bear ID	Sex	YEAR	# Times Tracked	# Times Seen	Status
100	F	2016	3	1	
		2017	7	3	
		2018	9	5	
		2019	3	2	
		2020	6	1	Alive as of June 10, 2020
101	F	2016	3	1	
		2017	7	3	
		2018	7	0	Shed collar
102	M	2016	3	3	
		2017	7	5	Hunter harvest
103	F	2016	3	3	
		2017	7	1	Killed by bear
104	F	2016	3	1	
		2017	7	6	
		2018	9	5	
		2019	2	2	
		2020	4	2	Alive as of June 10, 2020
105	M	2016	3	2	
		2017	0	0	Hunter harvest
107	F	2016	3	2	
		2017	7	4	
		2018	9	4	
		2019	4	3	
		2020	5	3	Alive as of June 10, 2020

Job/Activity 2b: Hunter harvested bears that are sealed in Region 3 will be sampled for stable isotope analysis to provide foundational information regarding bear diet, particularly in response to bait stations.

ACCOMPLISHMENTS: During the sealing (regulatory requirement) process, we continue to obtain tissue samples from hunter harvested bears. We have archived more than 250 grizzly bear samples and 400 black bear samples for future studies. Of those six hundred fifty samples, 220 have been processed for stable isotope diet analysis.

OBJECTIVE 3: Report findings and develop a research protocol proposal.

Job/Activity 3a: Develop and write a research proposal(s) and operational plan(s) for identified project(s) with possible major field components

ACCOMPLISHMENTS: Grizzly bear research by ADF&G in Interior and Eastern Arctic Alaska is not a high priority at this time. Therefore, this objective is not applicable and is considered completed.

II. SUMMARY OF WORK COMPLETED ON PROJECT TO DATE.

Objective 1 was accomplished. However, for job/activity 1a. the original intent from Reynolds and Ver Hoef was to assess survival before and after population reduction. We were unable to finish this analysis objective during this reporting time period. We recommend finishing this analysis and writing the final summarized report regarding the data from 1981-2000. It was determined that activity 1b would benefit from further in-depth analysis and was reorganized under a new Federal Aid project.

Objective 2, as there is no current intent for a research project to continue studying bears in 20A, this objective is finalized. Seven grizzlies were radiocollared under the auspices of this project. The remaining 3 collared bears will continue to provide survival and fecundity information under the standard survey and inventory management protocols for this GMU.

We have established protocols for sampling harvested bears for tissues that can be used in future research or management studies. A draft of the diet analysis report is projected to be completed this spring.

III. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

The intent was for this project to be finalized at the end of FY20. However, due primarily to unavailability of support staff, some of the statistical analyses were not completed.
The travel was intending to get met to the International Bear Association conference that was canceled due to COVID.
The budget for the supply was intending to buy an ATS receiver, but the contract pilot I ended up using for the aerial survey flights had his own receiver. Therefore, I did not think it was prudent to spend $3000 to purchase a receiver for a project that was ending.

IV. PUBLICATIONS

Appendix 1. Table results from survival analysis

Appendix 2. Draft abstract and figure of stable isotope analysis

V. RECOMMENDATIONS FOR THIS PROJECT

1. Monitoring of the 3 radiocollared bears from this project will continue under standard survey and inventory management objectives (AKW-G-R3-2020 Project 4.00).

2. Tissue samples will continue to be collected from some hunter harvested grizzly bears under standard survey and inventory management objectives (AKW-B-R3-2020 Project 4.00) and tissues will be archived until needed.

3. Complete the stable isotope analysis (Job/Activity 2b). with an expected report finding to be finished by the end of this calendar year. Preliminary results are presented in Appendix 2. A Significant Development Report or Amendment will be submitted to request funding to complete Job/Activity 2b.

Prepared by: Kerry Nicholson Wildlife Biologist III, Division of Wildlife Conservation, Alaska Department of Fish and Game **Date:** 10 September 2020

Appendix 1. Table results from survival analysis

Table 1. Estimated female vital rates and detection probabilities for the brown bear (*Ursus arctos*) population in Alaska Game Management Unit 20A from 1981- 2000.

Parameter	Posterior Mean	SD	95% Credible Interval
Sub-adult Detection Probability	0.91	0.04	0.83 – 0.94
AwoDO[a] Detection Probability	0.95	0.03	0.89 – 0.98
AwDO[b] Detection Probability	0.79	0.03	0.73 – 0.82
Cub-of-the-Year Survival	0.56	0.05	0.46 – 0.67
Yearling Cub Survival	0.98	0.01	0.95 – 0.99
Sub-adult Survival	0.89	0.03	0.82 – 0.94
AwoDO Survival	0.86	0.03	0.80 – 0.91
AwDO Survival	0.92	0.02	0.88 – 0.95
Sub-adult Natural Mortality	0.01	0.01	0.01 – 0.03
AwoDO Natural Mortality	0.01	0.01	0.01 – 0.03
AwDO Natural Mortality	0.02	0.01	0.01 – 0.04
Sub-adult Anthropogenic Mortality	0.09	0.03	0.04 – 0.15
AwoDO Anthropogenic Mortality	0.10	0.03	0.05 – 0.15
AwDO Anthropogenic Mortality	0.05	0.02	0.02 – 0.08
Sub-adult Unknown Mortality	0.01	0.01	0.01 – 0.03
AwoDO Unknown Mortality	0.03	0.01	0.01 – 0.06
AwDO Unkown Mortality	0.01	0.01	0.01 – 0.03
4yo to AwoDO	0.61	0.08	0.44 – 0.76
4yo to AwDO	0.28	0.08	0.13 – 0.44
AwoDO to AwoDO	0.32	0.04	0.24 – 0.40
AwoDO to AwCOY[c]	0.55	0.04	0.46 – 0.63
AwCOY to AwoDO	0.10	0.03	0.05 – 0.17
AwCOY to AwCOY	0.09	0.03	0.04 – 0.16
AwCOY to AwYRL[d]	0.73	0.04	0.64 – 0.81
AwYRL to AwoDO	0.78	0.05	0.68 – 0.86
AwYRL to AwCOY	0.14	0.04	0.07 – 0.24

(a) AwoDO = adult (5+ years old) without dependent offspring; (b) AwDO = adult (5+ years old) with
dependent offspring (cubs-of-the-year or yearling cubs); (c) AwCOY = adult (5+ years old) with a cub-of- the-year litter; (d) AwYRL = adult (5+ years old) with yearling litter.

Table 2. Population metrics for the brown bear (*Ursus arctos*) population in Alaska Game Management Unit 20A from 1981-2000, estimated from a deterministic matrix population model. COY = cubs-of-the-year.

Parameter	Posterior Mean	SD	95% Credible Interval
Population Growth Rate (λ)	0.981	0.016	0.948 – 1.009
Stable Age/Stage Distribution			
2 Year Olds	0.087	0.004	0.080 – 0.094
3 Year Olds	0.079	0.003	0.072 – 0.085
4 Year Olds	0.071	0.004	0.063 – 0.079
Adults without Cubs	0.325	0.020	0.287 – 0.366
Adults with COY	0.251	0.012	0.229 – 0.275
Adults with Yearlings	0.186	0.008	0.171 – 0.201
Reproductive Value			
2 Year Olds	0.128	0.008	0.111 – 0.143
3 Year Olds	0.141	0.005	0.131 – 0.150
4 Year Olds	0.156	0.002	0.152 – 0.159
Adults without Cubs	0.161	0.007	0.148 – 0.175
Adults with COY	0.197	0.006	0.186 – 0.208
Adults with Yearlings	0.217	0.003	0.211 – 0.224
Lifetime Reproductive Output	0.775	0.174	0.487 – 1.162
Generation Time	14.786	1.202	12.639– 17.541

Appendix 2. DRAFT abstract and figure for diet analysis report

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Grant V. Hilderbrand, National Park Service, Anchorage
Diana Lafferty, Wildlife Ecology and Conservation Science Lab, Department of Biology, Northern Michigan University, 1401 Presque Isle Ave, Marquette, MI 49855
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Comparison of population characteristics of black and grizzly bears inferred from two different hunting methods: Implications for bias in harvest metrics

Metrics obtained from harvested bears may not reflect the composition and characteristics of populations as a whole. These biases can be in part explained by behavioral differences in bears and by differences in harvest methods, hunter selectivity, and regulations. The use of bait stations provides opportunities for hunter selectivity with regards to size, sex, and quality. Bait stations or providing supplemental foods may alter the behavior of animals and attract subgroups of a population. Supplemental resources could therefore create an ecological trap that temporarily provides abundant high caloric food, but in an environment that has high risk of mortality. Managers of bear populations in Alaska need information about the relative vulnerability of sex and age classes to different harvest methods. To obtain a better understanding of the effect of harvest methodologies, we compared the sex-ratio, age structure, skull size, and diet of bears taken over bait to those harvested by spot and stalk methods. We also compared harvest metric across and species (black vs. grizzly bears) taken by each method. Finally, we compared harvest metrics for black bears taken before and after the change in harvest regulations that allowed grizzly bears to be hunted over bait. We observed differentiation between the core isotopic niche of grizzly and black bears taken from the same geographic location which is to be expected but we did not observe significant differences between the sexes. Composition of the harvest can be applied to adaptively manage bear populations. Understanding biases in the composition of harvest can reduce potential management conflicts and help maintain appropriate sex ratios and provide a diversity of hunting opportunities. However, this information should be paired with the unharvested population as they may yield further insight into the effects of harvest.

Figure. Carbon and Nitrogen signatures from the stable isotope analysis of muscle tissues from grizzly and black bears. Triangles are male, circles female, red are grizzly bears and blue are black bears from sealed hunter harvest throughout Interior Alaska, 2011-2018.