FEDERAL AID ANNUAL RESEARCH PERFORMANCE REPORT

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-20 **SEGMENT NUMBER:** 5

PROJECT NUMBER: 4.40

PROJECT TITLE: Grizzly bear use of the North Slope oil fields and surrounding region

PROJECT DURATION: 1 July 2008–30 June 2017

REPORT DUE DATE: 1 September 2017

PARTNER: Funding for a radio-telemetry flight to locate dens in FY17 was by grants from ConocoPhillips-Alaska, Inc., Caelus Energy Alaska, LLC, and Repsol E&P, USA.

PRINCIPAL INVESTIGATOR: Richard T. Shideler, ADF&G

COOPERATORS: Kerry Nicholson, ADF&G, Nils Pedersen & Todd Brinkman (UAF)

WORK LOCATION: Game Management Units 26A and 26B, oil field region

I. SUMMARY OF WORK COMPLETED THIS SEGMENT ON JOBS IDENTIFIED IN ANNUAL WORK PLAN

N.B.: Due to the decline in funding for this project over the past several FY the FY17 workplan was oriented toward ending all field work on this project. This would have included removal of all radio collars, removal of all hair snare sites, and cessation of ground inspections of den sites. However, late in FY17 funding became available and jobs originally scheduled to end in FY17 are being continued into or re-scheduled for FY18.

OBJECTIVE 1: Continue the den detection research with the goal of developing a management program using a combination of tested detection methods applied to the highest probability denning habitat. This will allow industry to optimize detection of denning grizzly bears and avoid them during winter exploration, transportation, and maintenance activities.

JOB/ACTIVITY 1A: Develop a grizzly bear den habitat selection model.

Problems with the scale of available Digital Elevation Models (DEM) continued to thwart our objective to develop a habitat selection model and map. In FY16 we had anticipated being able to compare results from high-resolution digital aerial photogrammetry ("Structure from Motion" technique) obtained for us by Dr. Matthew Nolan of the University of Alaska Fairbanks with a LiDAR-based DEM of the same area provided by Armstrong Energy, LLC (formerly by Repsol E & P, USA ["Repsol"]). Unfortunately, legal issues stalled acquisition of the DEM until late FY17 when those issues were resolved. We received the DEM, and have initiated analysis.

In FY16 the Department had purchased high-resolution digital imagery hardware and software for censusing caribou. An anticipated additional function for that system was to use the SfM technique to acquire fine-scale digital imagery that could be converted to a DEM. We expected to survey a test section of the study area with known and inspected dens using Department aircraft in August 2016. However, the expected hardware delivery date was delayed until winter; therefore, no SfM data were acquired. Both hardware and software have been received and successfully tested on caribou surveys in late June 2017. This task has moved to the FY18 work plan.

JOB/ACTIVITY 1B: Collect data on habitat characteristics of dens of radio-marked bears, and field verify areas of high, medium, and low probability denning habitat based on the predictive model generated in job 1a.

Locating active dens is important not only because we can inspect them post-emergence to gather data about den characteristics, but also because industry needs the den location in order to avoid them during winter off-road activities. We usually locate putative dens by flying aerial radiotelemetry flights in late fall after bears have entered dens for the winter. Occasionally we also make direct observations from the road system or receive reports from Security patrolling the oilfield road system. In fall 2016 we received reports

from oilfield security personnel of 2 bears denning within 0.5 miles of permanent facilities. One putative den was within 0.5 mi of a pipeline that was to be repaired in winter 2016-17. Due to lack of availability of survey aircraft and poor fall weather we were unable to complete a fall aerial den survey. Therefore, we included these 2 putative locations in University of Alaska (UAF) graduate student Nils Pedersen's winter den detection project (see Job 1c). We inspected both dens in February 2017 (see Job 1c) and confirmed that one location was that of radio-collared bear #147 and that the other was occupied by a non-collared bear. We inspected both locations in June 2017 and confirmed that a bear had denned at each site but were unable to collect much data because there was still a snowbank. We anticipate collecting such data in early FY18.

We were finally able to fly a den radio-telemetry survey in March 2017. Due to funding restrictions, we flew only the portion of the study area west of the Sagavanirktok River where industry off-road activity was concentrated. In addition to the den of bear #147, we found 8 putative dens of radio-marked bears by interpolation of their radio signals. No radio-marked bears denned near the unmarked bear's den where they could have been confused with it. None of the radio-marked bear dens appeared to be within the 0.5 mile avoidance zone around industry winter activities.

JOB/ACTIVITY 1C: Evaluate the efficacy of den detection methods (e.g., handheld and airborne forward-looking infrared "FLIR" imagers, trained scent dogs).

Operational funding for this job had been through a National Fish and Wildlife Foundation (NFWF) grant, which ended prior to FY17. We reported results in the NFWF final report appended to the FY14 segment report. Since then we have collected additional data on den detection methods on an opportunistic basis.

One FY14 annual report recommendation was to investigate the efficacy of using a FLIR unit mounted on an unmanned aerial vehicle (UAV, or "drone) to detect active dens. This would potentially provide a more responsive and cost-effective method. In FY16 UAF initiated a graduate research project to investigate this technique. ADF&G committed to assist the project. Part of this assistance was to maintain a sample of radio-collared bears near the road system that would potentially be available to field test the UAV. In winter 2016-2017 graduate student Nils Pedersen tested the UAV primarily on artificial dens in the Kuparuk oilfield. We recommended he test the UAV on the 2 putative dens noted in Job 1b. Initial results with the UAV were not conclusive so Pedersen used his Karelian Bear Dog following the protocols developed by ADFG during the NFWF study. The dog indicated positively at both sites, and subsequent UAV flights and a June 2017 ground inspection supported that conclusion. No other radio-collared bears denned near enough to the road system to be feasibly tested. Final results will be presented in Pedersen's M.S. thesis.

JOB/ACTIVITY 1D: Construct and instrument an artificial den to test the accuracy of FLIR under varying snow conditions.

Operational funding for this job had been through a grant from NFWF that ended prior to FY17. We reported results in the NFWF final report appended to the FY14 annual Federal Aid report. This job has been turned over to UAF graduate student Nils Pedersen

as part of the project mentioned in Job 1c. In addition to testing the FLIR mounted on the UAV, Mr. Pedersen continued testing the handheld FLIR on artificial dens using methods we developed in our proof-of-concept study reported in the NFWF report. Results will be reported in Pedersen's M.S. thesis.

OBJECTIVE 2: Investigate the response of "natural food" bears to the removal of food-conditioned bears from the oil field, especially to determine if these bears attempt to obtain human food.

JOB/ACTIVITY 2A: Capture bears and replace radio collars.

At the beginning of FY16 we had a sample size of 27 bears with functional radio collars. By late FY16, bear mortality, collar loss and likely emigration from the study area had reduced the effective radio-collared sample to 20. Due to uncertainty in future funding and the likelihood that the field portion of the project would end after FY17, in June 2016 we removed collars from 4 more bears that were on the periphery of the study area and did not replace any collars that contained a breakaway mechanism. We retained collars on several bears that would potentially provide an opportunity for the UAF den detection study. We also collared one new bear that was using the Prudhoe Bay oilfield. By June 2017 two additional bears, both adult females, had died of unknown causes, a male had been killed at a North Slope village, and a female had shed her collar. Our total sample size as of the end of FY17 was 13 radio-collared bears. During 2 radio-tracking flights in late FY2017 only 3 females had this year's cubs (COYs), and 2 of these mother bears were food-conditioned half-sisters.

JOB/ACTIVITY 2B: Analyze grizzly bear DNA specimens for individual relationships.

One goal of this project has been to identify individual relationships among bears in the study area and especially those using the oil fields. This provides a sense of the number of bears using the area that may not have been in our capture sample. In addition, individual identification provides insight into cub survival to weaning by confirming maternity-paternity of captured or harvested individuals, the social structure of bears in the area, and the potential familial relationships of food-conditioned bears. Earlier in this project we collected specimens for genetic "fingerprinting" from 3 sources: 1) tissue samples collected at the time of capture from bears newly captured for the study; 2) hair collected on barbed wire hair traps on power poles and other features (e.g. survey posts, oil well markers) within the oil fields; and 3) tissue obtained by using a biopsy dart. We reported results from previous collections in previous Federal Aid annual reports.

Initially, the systematic collection and analysis of hair at 14 established barbed wire hair "traps" on power poles was funded by NFWF and ended in FY14. Since FY14 we have continued to collect hair on an opportunistic basis, with the goal of submitting samples for individual identity analysis when funding becomes available (see Job 2c).

We archived hair samples from power pole hair traps that we collected since 2013, as well as tissue samples collected from harvested bears in Game Management Unit 26B as part of a grizzly bear management project, and hair collected from other sources within the study area. In June 2016 (FY16) we observed several unmarked bears in the area

around the North Slope Borough landfill in the Prudhoe Bay area. The landfill had been upgraded in 2015-2016; however, bears were already gaining access due to poorly designed gates. We collected hair from these gates, in one case observing the individual bear that deposited it. Our hope was that these samples would enable us to determine if the bears currently using anthropogenic foods were offspring of previously food-conditioned bears or instead were "new" bears that have recently learned to exploit an easy food source. In FY17 we had the archived specimens analyzed for individual relationships and compared with previous pedigree analyses. None of the samples from the power poles yielded sufficient DNA for analysis. Only 1 of 3 hair samples from the landfill fence was successfully analyzed for individual identity. That individual was identified as a male offspring of female#102, a bear whose home range was far south of the oilfield. This was the first case of a bear becoming food-conditioned without being the offspring of a food-conditioned parent. The sample from the ear punch of newly collared bear #149 confirmed she was the daughter of bear 006, a food-conditioned bear that we first collared in 1991 and who is the longest-living marked bear in the study. Bear #149's father was bear #137, a 6-year-old male who includes the oilfield as part of his home range, but is not food-conditioned. Analysis of samples from the hunter harvest also yielded some surprises. The only offspring of bear #006's 2010 litter was killed along the Dalton Highway. It was a female sired by male #107, a bear that had entered the western portion of the oilfield but never observed feeding on human food. A third case was a male offspring of bear #007 from her 2010 litter. This bear was killed along the Dalton Highway, more than 100km east of #007's home range. Bear #007 was first collared in 1992, spends time in the oilfields but has never been associated with anthropogenic food. These cases demonstrate the value of DNA analysis in determining vital rates of the population, as well as identifying the source of food-conditioned bears.

Other samples were either compromised by creosote, had inadequate number of roots for amplification, were too old, or had been contaminated by the desiccant used to ship the samples.

JOB/ACTIVITY 2C: Establish barbed-wire hair traps on specific power poles and other permanent structures where bears have been observed rubbing. Hair collected at these sites will be included in the DNA analysis in job 2b.

Due to reduced funding beginning in FY16, we have been able to make only 1-2 annual ground trips to the study area. Previous experience had indicated that hair collected after >2-3 weeks after deposition had a high probability of being too de-natured to provide suitable DNA. In FY16 we removed barbed wire from 6 power poles that had not been visited by bears during the previous 3 years. As of the end of FY 16 we had only 8 poles "active." Having been notified of the project's resurgence in FY18, we abandoned one additional pole, reset the other 7, and added 2 new sites in June 2017.

At one of the new sites we erected a wood tripod as a proof-of-concept test of a portable design that would allow us to collect hair at promising locations without the need for power poles. Depending on results from this new design, we may deploy additional tripods in FY18.

JOB/ACTIVITY 2D: Collect and analyze specimens for stable isotope analysis to identify food-conditioned bears within the oil field sample.

Since the 1990s, we have collected hair and blood samples from the bears we captured. Since 2013 we have also collected opportunistically hair and blood samples from bears killed by hunters in GMU 26A and 26B. Results for analysis of food habits using C and N through FY 2006 were published (Bentzen et al. 2014*). In FY14 samples from bears we captured since 2007, as well as the samples from hunters, were analyzed by the University of Alaska Fairbanks-Stable Isotope Facility for concentrations of stable isotopes of C and N. Since then we have archived samples. We had collected hair and blood samples from the 8 recaptures and 1 new capture in FY16. If funding becomes available, we will have these and the remaining archived samples analyzed at the UAF facility.

In late FY16 we began collaboration with the Department's Marine Mammals program to investigate stress and reproductive hormones from grizzly bear hair using samples we have collected since 1992. Consumables necessary for the analysis were purchased by the Marine Mammals program in FY16, and preliminary analysis conducted by UAF graduate and undergraduate students in FY17. The undergraduate student presented the results in a poster at the UAF undergraduate studies (URSA) day (see section III). The results confirm that cortisol can be extracted from grizzly bear hair using the technique described, and that cortisol levels of grizzly bears in the study area appear comparable to those from other studies in Canada. The most interesting preliminary result is that cortisol levels from food-conditioned bears (i.e., those spending the most time around human activity) were not significantly different from those feeding on natural food in the oilfield (i.e., spending time in the oilfield but not necessarily in close proximity to human activity) or those bears that have not entered the oilfield at all (i.e., most like bears in natural habitats). However, there were a few interesting outliers that far exceeded the standard deviation, and these were all females.

* Bentzen, T. W., R. T. Shideler, and T. M. O'Hara. 2014. Use of stable isotope analysis to identify food-conditioned grizzly bears on Alaska's North Slope. Ursus 25(1):14–23.

OBJECTIVE 3: Write annual progress reports, a research interim technical report in FY16, and a final technical report. Give presentations at scientific forums. Publish results in peer-reviewed journals.

JOB/ACTIVITY 3A: Data analysis and reporting.

Data analysis and manuscript preparation are ongoing. Manuscripts are being prepared on denning ecology, effects of food-conditioning, and grizzly bear den detection.

II. SIGNIFICANT DEVIATIONS AND/OR ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

None.

III. PUBLICATIONS

Starbuck, H., M.J. Keogh, P.M. Charapata, R. Shideler, and K. Hundertmark. 2017. Hair cortisol concentrations of Alaskan grizzly bear (*Ursus arctos*) from the North Slope oilfield. Poster presented at University of Alaska undergraduate student research day (URSA).

IV. RECOMMENDATIONS FOR THIS PROJECT

The following recommendations apply to future research and monitoring:

1. Maintain a sample of ca. 30 GPS-collared bears within the oil field region to monitor demographic characteristics, oil field use, and den locations. Test the feasibility of a "virtual fence" that would alert project staff that the bears have entered or left the oil fields. Investigate the possibility of tying this alert to oil field security to provide a real-time notification that a marked bear is in their area.

2. Conduct periodic radio-tracking surveys of GPS-collared females to investigate cub production and mortality, and to confirm collar loss or bear mortality if the GPS location becomes stationary.

3. Continue to develop the den habitat suitability map.

    a. Ground-truth the precision of the map by a) retrospectively comparing locations of previously occupied dens that have not been inspected (i.e., not included in the development of the den habitat model), and b) randomly selected points that may or not be suitable habitat predicted by the model.

    b. Compare new den locations with predicted habitat values from the map.

    c. Include snow drift modelling as a component of den selection using the same procedure reported by Liston et al. (2016)* for polar bears denning.

4. Once an accurate den habitat map becomes available, identify areas that may be affected by industry winter activities and apply a feasible detection method to identify active dens.

5. Continue to collect and analyze genetic data from newly captured bears, from hair collected at snares around the oil field, and from tissue collected from hunter harvest or department bear control projects.

6. On an opportunistic basis, continue to evaluate the feasibility of using dogs to detect denning bears, especially focusing on the weather and snow conditions (e.g., snow depth, snow density, presence of ice layers) when dogs fail to locate the den or require an unacceptably long time (e.g., >0.5 hr) to detect the den.

7. Continue to collect and analyze bear samples for stable isotope analysis. This may provide an indication that additional bears are becoming food-conditioned. For selected individuals that may be feeding in areas with a marine influence, test for S in

addition to C and N. On an opportunistic basis, collect food items for isotope analysis in order to augment the existing data for the North Slope food web.

* Liston, G. E., C. J. Perham, R. T. Shideler, and A. N. Cheuvront. 2016. Modeling snowdrift habitat for polar bear dens. Ecological Modelling 320:114-134. doi:10.1016/j.ecolmodel.2015.09.010

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