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-4 Wildlife Restoration FY2015

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 2015

PARTNER: Operational funding for earlier segments of this project had been provided by a grant from the National Fish and Wildlife Foundation (NFWF) that expired at the end of December 2013. Funding for fiscal year 2015 (fiscal year = 1 July 2014–30 June 2015) was by federal aid and a grant from ConocoPhillips-Alaska, Inc.

PRINCIPAL INVESTIGATOR: Richard T. Shideler, ADF&G

COOPERATORS: None

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

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

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. Previously, we had obtained a DEM derived from the National Elevation Dataset (NED) 1/3 arc-second imagery that had been upgraded by incorporating Interferometric Synthetic Aperture Radar (IfSAR) imagery of the North Slope. Horizontal resolution of this imagery was ca. 10 m; however, vertical resolution was ±7 m. This limited its usefulness because this magnitude of elevation error on the Coastal Plain of the North Slope could make the difference between a well-drained bank and a flooded marsh (i.e., suitable versus unsuitable denning

habitat). We compared slope and aspect measured at 120 dens encompassed by the coverage with slope and aspect derived from the den's coordinates on the DEM. Resolution scale errors were apparent. In some cases, aspect differed by 180° between the den and the map. Clearly, mapping at a finer scale would be necessary to accurately delineate suitable denning habitat.

Accordingly, we pursued an alternative to analyze DEM's from a small focus area which encompassed the lower Kachemach and Miluveach rivers where there are 9 dens that we had previously inspected. Repsol E &P USA ("Repsol") planned to explore this area for oil and gas, and they had acquired Lidar (Light detection and ranging) coverage for the area. In order to rule out coordinate or other GPS positional errors, we reinspected the den locations in September 2014 using a Differential GPS that recorded locations accurate to within 10 cm. For this focus area we pursued 2 lines of investigation: 1) we prepared a cooperative agreement with Repsol to obtain a DEM from the Lidar data they acquired, and 2) we investigated a new method (Structure from Motion-SfM) to obtain a DEM at a meter to sub-meter scale from orthoimagery using recently-developed aerial photogrammetry methods. Although the cooperative agreement has been signed by both parties, final approval by Repsol has been slowed as a result of the drop in oil prices. Several projects using the SfM technique had been completed by Dr. Matthew Nolan of the University of Alaska Fairbanks. Dr. Nolan acquired high-definition digital imagery with 2 digital cameras mounted in a small fixed-wing aircraft flown that was flown on a low-altitude survey grid. The resulting digital imagery was at the sub-meter resolution. Using specially developed software, Dr. Nolan converted the orthoimagery to DEMs. We contracted with Dr. Nolan to acquire the imagery for the focus area and process it for a DEM. These tasks were completed and we are currently analyzing the DEM. Although we have yet to receive the Repsol DEM we have been assured that we will receive it and we hope to compare the 2 products in FY16, and ground truth the DEM in summer 2016.

Although we have no DEM at a scale that would allow us to generate a habitat *availability* map, during 2013–2014 we analyzed data on den *use* from 199 dens inspected since Selective Availability (SA) was turned off by the Department of Defense in May 2000. SA refers to the deliberate "jitter" in the GPS satellite signal that created an artificial positional inaccuracy of up to 100m from the true location. We focused on slope and aspect because our experience suggested that these variables influence accumulation of snowdrifts which grizzly bears require for insulation over their dens. Although analysis for slope is fairly straightforward, analysis of aspect required use of circular statistics. We analyzed for differences in sex, females with offspring, age, den year, and feeding type (food conditioned vs. natural food). Mean aspect was 212° and 80% of den aspects were between 120° and 288°.There were no statistically significant differences among any of the groups. We analyzed slope for the same parameters. Mean slope varied from 22° to 25° for all sex and offspring classes, and there were no statistically significant differences. Eighty percent of dens fell on slopes between 13° and 36°. There appears to be a trend toward flatter slopes over time. We will investigate potential reasons for this. We will also investigate the effects of bear feeding type on distance of dens from permanent oil field activities. We have noticed that only food-conditioned bears have denned within or very near to the perimeter of the active oil fields, suggesting

that the habituation of food-conditioned bears to human activity may allow them to exploit denning habitat that bears which feed solely on natural food may avoid due to disturbance. Consequently, den site selection for natural food bears may differ slightly from that of food-conditioned bears. Progress on this has been slowed by the loss of the 2 biometricians who worked on this project. Fortunately, their replacements will be available beginning in FY16.

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

Due to reduced funding and poor weather we reduced our den radiotracking effort to one November flight near or within the western portion of the oil fields. We found 25 dens of radiomarked bears by interpolation of their radio signals. Interestingly, 11of those dens were located in areas subsequently proposed for high-intensity seismic exploration in winter 2014–2015. The result was that most companies either shifted their project boundaries or otherwise avoided the dens by the 0.5 mile required by permit stipulation. Due to decreased funding in FY15 we inspected only dens that were within walking distance of the road system or that could be inspected in conjunction with other aspects of the project that required helicopter support (e.g., capture for collar replacement). In FY15 we inspected 1 den of a radiomarked bear from den year 2013–2014 and 2 from den year 2014–2015. We updated the den habitat model in job 1A with habitat data from these dens.

No progress was made on field verification of the den habitat selection model pending completion of the predictive model and availability of funding (see job 1a).

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 summer 2013. We have endeavored to collect additional data on an opportunistic basis.

One of the 2014–2015 dens mentioned in job 1b was found to be very near 3 seismic lines in a priority project that involved a high density of seismic exploration activity. Encroachment on this den could have potentially disturbed the denning female and her yearling and been in violation of permit stipulations. Because of the importance of collecting this seismic data, the company requested further verification of the exact location of the den in order to seek a variance from the 0.5 mi buffer stipulation. They flew an airborne FLIR survey with mixed results and requested that we confirm the den location with scent dogs. They provided funding and logistics, and we conducted a dog survey of the site in February 2015 but the dogs did not alert on any location. From the ground, the radio signal from the bear suggested she was ~100 m from the fall 2014 aerial location. When we ground-truthed the location in June 2015 we found the den within 60 m of the fall coordinates and upwind of the area the dogs searched in February—i.e., well within the dogs capability of detecting a den. We cannot explain the anomaly, especially considering that the dogs have been >90% successful in detecting

grizzly bear dens at far greater distances under similar conditions. These results suggest that we have more to learn about the limitations of both airborne FLIR and scent dogs in detecting grizzly bear dens.

One of our FY14 annual report recommendations was to investigate the efficacy of using a FLIR unit mounted on an unmanned aerial vehicle (UAV or "drone) to detect bear dens. This would potentially provide a more responsive and cost-effective method. The University of Alaska Fairbanks initiated a graduate research project to investigate this. Graduate student Nils Pedersen will be testing the UAV on an artificial den and, if available, radiocollared denning bears. ADF&G has committed to assist the project. Part of this assistance would be to maintain a sample of radiocollared bears near the road system that would be available to field test the UAV.

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 FY15. We reported results in the NFWF final report appended to the FY14 annual federal aid report. In FY15 we assisted UAF graduate student Nils Pedersen with construction and instrumentation of an artificial den in the Kuparuk oil field for the project mentioned in job 1c. In addition to testing the UAV, Mr. Pedersen will continue testing the handheld FLIR on the artificial den using methods we developed in our proof-of-concept study reported in the NFWF report.

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.

In field seasons 2014 and 2015 we recaptured 16 radiomarked bears and replaced their VHF radio collars, and captured an adult male new to the project and fitted him with a VHF radio collar. This brought the sample size to 26 bears with operating radio collars. One of the 11 bears we recaptured was a food-conditioned female with a cub that had been hanging around Deadhorse and the eastern portion of the greater Prudhoe Bay (GPB) oil field but had shed her collar in 2012. She and her radiocollared, food-conditioned mother and their dependent offspring continued to utilize anthropogenic food in Deadhorse and GPB into late fall 2014 and again in early spring 2015. Because our FY14 and FY15 operational funding was from a company that operates in the western part of the oil field, we did not replace collars on bears in the eastern half of the study area. We will remove collars from the few remaining collared bears there if they do not naturally drop off.

In summer 2014 we flew 3 radiotracking flights and relocated up to 25 bears on each flight. We flew a complete radiotracking flight in June 2015 associated with the capture effort. We also searched for 3 non-marked bears, 2 subadults and an adult male, which had been reported to be using anthropogenic foods in Deadhorse and the GPB oil field. It is likely that the 2 subadults are offspring of the food-conditioned females that continue

to feed on anthropogenic food. However, the adult male would be the first adult that became food-conditioned without being related to existing food-conditioned bears. Unfortunately we were unable to find any of the 3 with the flight time we had available.

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 generally and especially those using the oil fields. This provides a sense of the number of bears using the area, insight into cub survival to weaning by identifying maternity-paternity of individuals, and the social structure of bears in the area. Earlier in this project we collected specimens for genetic "fingerprinting" from 3 sources: 1) tissue samples from bears newly captured for the study collected at the time of capture; 2) hair collected on barbed wire hair traps on power poles within the oil fields; and 3) tissue obtained by using a biopsy dart. We reported results from collections from previous years in the FY14 federal aid annual report.

Operational funding from NFWF ended in FY13. Therefore, in FY14 we discontinued collection of hair from power pole hair traps. In general, degradation of DNA in the samples prevented identification of new bears. Wildlife Genetics International suggested that the DNA was denatured because ultraviolet light from continuous daylight on the North Slope in combination with the long interval between sample collections (e.g., 2–3 weeks) allowed UV to degrade the DNA in hair follicles. In addition, some of the samples were contaminated by creosote on the power poles. We have archived hair samples from power pole hair traps that we collected late in 2013, as well as tissue samples collected from harvested bears in Game Management Unit 26B as part of a grizzly bear management project, and from 1 new adult male captured in summer 2014. When funds become available we will send these samples to Wildlife Genetics International in Nelson, British Columbia, Canada for analysis.

In FY14 the USGS-Alaska Science Center geneticist requested tissue samples from several study bears that have unusually light silver coat coloration. There had been speculation that these might have potential polar bear hybrid influence. Genetic analysis confirmed that there was no recent polar bear hybridization. In FY15, these and a few additional samples from the study bears were also analyzed by deep genomic sequencing to identify when polar bears and brown bears diverged. Results from this analysis have been included in a manuscript in review for the journal *Nature-Genetics* (see Section III).

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 budget in FY15, we made only a few ground trips to the study area. Because of the long interval between these trips there was a high likelihood that any DNA would be denatured by the time we were able to collect hair (see Job 2b). Furthermore, the lack of funding eliminated genetic analysis; therefore, we did not collect any hair. However, in June 2015, during a lull in capture operations we did visit one power pole hair trap near Deadhorse. Although no bears had rubbed on this particular

pole during previous field seasons, we did find hair during this visit. Unfortunately we could not determine how long the hair had been there so we did not collect it.

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 and since 2013 from bears killed by hunters. Those samples were analyzed by the University of Alaska Fairbanks-Stable Isotope Facility for concentrations of stable isotopes of C and N. Although several of the bears previously identified as food-conditioned continued to have isotope signatures consistent with an anthropogenic food diet, none of the hunter-killed bears or other radiocollared bears had an isotope signal derived from anthropogenic food. We are in the process of statistical analysis of these data and are preparing a presentation at our regional staff meeting in early FY16.

We collected hair and blood samples from the 16 recaptures and 1 new capture in FY15. If funding becomes available we will have these samples analyzed at the UAF lab.

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 was ongoing. Two scientific journal articles are in process (see Section III, Publications). With the biometrician staff back at full complement we expect data analyses to accelerate in FY16.

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

The following manuscript has been accepted with minor revisions for publication:

G. E. Liston, C. J. Perham, R. T. Shideler, and A. N. Cheuvront. 2015. Modeling snow habitat for polar bear dens with SnowDens-3D. Ecological Modeling.

The following manuscript is in preparation:

T. Lan, J. Cheng, A. Ratan, W. Miller, K. Rode, T. Atwood, S. Farley, R. T. Shideler, S. L. Talbot, T. Mailund, and C. Lindqvist. *In prep*. Genome-wide evidence for a hybrid origin of modern polar bears. Nature-Genetics.

IV. RECOMMENDATIONS FOR THIS PROJECT

The following recommendations apply to future research and monitoring:

1. Maintain a sample of ca. 30 radio-marked bears within the oil field region and monitor demographic characteristics, oil field use, and den locations. Dependent upon funding, equip ≥6 bears that frequent the oil fields with GPS collars and test the feasibility of a "virtual fence" that will alert project staff that the bears have entered 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 radiotracking surveys of dens within the oil-field region and provide locations to industry to meet their permitting requirements to avoid occupied dens, and to test precision of the habitat map using future dens.

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.

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 or from biopsy darts.

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. 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.

8. Expand the geographical scope to areas such as northeastern NPR-A where we have had to reduce effort, and where industry is actively exploring and developing.

9. Continue support of the UAF graduate project, including testing the UAV on marked bears in their dens.

AKW-4 4.40 North Slope Oilfields Grizzly Bears FY2015
Annual Research Performance Report

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