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:** 4.40

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

**PERIOD OF PERFORMANCE**: July 1, 2019 – June 30, 2020

**PERFORMANCE YEAR**: July 1, 2019 – June 30, 2020

**REPORT DUE DATE:**

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**COOPERATORS:** Kerry Nicholson, ADF&G

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## I. PROGRESS ON PROJECT OBJECTIVES DURING PERFORMANCE YEAR

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:** Locate active dens in the fall and collect their habitat attributes in the summer.

ACCOMPLISHMENTS: In fall 2018 we acquired putative den locations for 23 GPS-collared bears based on their changes in activity and interpretation of their GPS locations. We provided these locations on a need-to-know basis to oilfield personnel so they could plan their winter activities. Previously we had noticed that in some cases there were discrepancies between putative den location in the fall and their actual location when we inspected dens the following summer. We assumed this was due to programming of the GPS collars. In order to save battery life during hibernation the GPS collars were programmed to reduce location acquisition to 1/day late in the den entrance period. Once bears entered dens, the GPS signal generally cannot be received by the Iridium satellite. Therefore, it is possible that between the bears' last daily above-ground location and cessation of subsequent signal the bears dug a den at new locations that were not detected until spring emergence when the satellite once again received a signal. We inspected 15

of these dens in August 2019 after snow drifts melted and a helicopter was available. The true locations of most of these dens were within 5-100m of the fall GPS coordinate. However, 2 of the dens were 11.4 and 75 km, respectively, from the fall locations. We concluded from inspection of the GPS file that in one case the bear moved within 1 day into its new den 11.5 km away and the last signal was not accurate. In the other case the bear entered its den late in the fall and its new location 75km away was not recorded until spring when its satellite transmitter once again signaled the satellite. One of the putative den locations was a shed collar, 3 others were not inspected because they were located far out of the study area, and 1 den was in an area too flooded to land and inspect the den. We changed the collar programming for bears that were collared in June 2020 to extend normal frequency of transmissions farther into fall FY21.

**JOB/ACTIVITY 1B:** Continue to collect den habitat attributes from inspected dens to fine-tune a predictive den habitat model.

ACCOMPLISHMENTS: Following confirmation of more accurate GPS location for dens in spring 2019, we inspected 18 dens in August 2019. Following protocols developed previously we collected habitat attributes such as slope, aspect, geomorphic type, vegetation, and use of the den site by other animals such as Arctic ground squirrels and foxes. Prior to FY20 we measured slope with a handheld hypsometer (Nikon Forestry Pro®) that used a laser to measure slope and bank height. In FY20 we collected slope and bank height using 2 methods: (1) the handheld hypsometer, and (2) an iPad Air2 to collect coordinates at the base and top of the geomorphic feature and calculated the slope in a GIS environment. Slopes ranged from 9-45°. Aspect ranged from 58-343° with 12 of 20 between 180-360°. Dens were distributed fairly evenly across geomorphic types; however, noticeably missing were dens in streambanks, a fairly frequent type in other years. One bear denned in the spoil pile along a decades-old, eroded road to DEW Line sites. Another bear denned in a small frost hummock that barely contained the den. Data have been archived in a Microsoft Access® database for further analysis.

In FY20 we identified 13 dens from their GPS locations in fall 2019. We will inspect these dens in FY21 after snowmelt.

**JOB/ACTIVITY 1C:** Compare the den attributes from inspected grizzly bear dens with similar attributes on the most recent version of ArcticDEM.

ACCOMPLISHMENTS: Habitat attributes for dens inspected in FY20 were entered in the Microsoft Access® database. Due to the absence of the Principle Investigator on medical leave for 5 months, no further progress was made on this job. This job will be postponed until FY21.

**JOB/ACTIVITY 1D:** Investigate the role of snow in den site selection. Compare the distribution of snow drifts modeled by the Snow-Dens 3D model with true locations of each den. The drift model may be useful in enhancing the den habitat map.

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ACCOMPLISHMENTS: Due to the absence of the Principle Investigator on medical leave for 5 months, no progress was made on a contract to model snow distribution to compare with known den locations. This job will be postponed until FY21.

OBJECTIVE 2: Investigate movements and home ranges of grizzly bears in the region, and their responses to oil and gas activities and to natural or human-caused removals of food-conditioned bears.

**JOB/ACTIVITY 2A:** Capture bears and replace radio collars. [**Note**: This job was inadvertently left off the FY20 Project Statement but is necessary to meet other objectives and jobs/activities].

ACCOMPLISHMENTS: In FY 20 we captured 19 bears between the Sagavanirktok River and Teshekpuk Lake. We replaced collars on 10 bears (6 females, 4 male) whose collars were scheduled to drop off in August 2020. We re-captured 3 adult males that had shed their collars in FY20. We captured 9 bears new to the study in the oilfield region. As of the end of FY20 we have 27 bears collared (18 females, 9 males). All but 2 bears were fitted with Iridium-based GPS collars. One recaptured female whose home range has been predominantly south of the study area for the past few years was collared with only a VHF transmitter so we can check on survival of her cubs in fall 2020. Another bear was too small to be fitted with a GPS collar.

During these captures we took body measurements, tissue, blood, and hair samples. The blood and hair samples were collected for subsequent stable isotope analysis although we did not anticipate analyzing them in FY20. Samples were archived for future analysis. Isotope analysis can be used to (1) identify food-conditioned bears in the collared population, (2) add to our understanding of North Slope coastal bear diets. The blood samples are also available for disease screening by the Department's Wildlife Veterinarian.

We collected the tissue samples for DNA "fingerprinting" from captured bears and also biopsy darted an additional 3 bears that we did not capture. We expect to submit those samples in FY21.

**JOB/ACTIVITY 2B**: Analyze movements (e.g., locations, rates, and sinuosity of travel) when bears enter the oilfields and compare with those same characteristics of bears that do not enter the oilfields.

We downloaded and archived data from the GPS collars; however, no further progress was made on this job due to the Principal Investigator's absence on medical leave.

**JOB/ACTIVITY 2C:** Compare movements and feeding areas of bears that eat solely natural foods with bears that are food-conditioned.

We downloaded and archived data from the GPS collars; however, no further progress was made on this job due to the Principal Investigator's absence on medical leave.

**JOB/ACTIVITY 2D:** Compare movements of collared animals with "hotspots" identified in ground observations from oilfield security reports.

We downloaded and archived data from the GPS collars; however, no further progress was made on this job due to the Principal Investigator's absence on medical leave.

Occasionally we responded to oilfield security officers' requests to identify an individual bear that was near human activity. We identified the collared bear that was nearest to the location at the time provided by the officer. In some instances, we were also able to proactively notify security that a food-conditioned bear that might come into conflict was in their area.

**JOB/ACTIVITY 2E** Analyze grizzly bear DNA specimens for individual relationships.

The 39 genetic samples collected in FY18 were analyzed in FY20. Thirteen samples were tissue collected from newly captured bears; 2 were tissue to confirm identity of recaptured bears whose tattoos were only partially readable ; 14 were hair from power pole hair snares; 1 was from a tripod hair snare; 7 were hair from the landfill fence; and 2 were from harvested bears. We were able to confirm parentage of 6 of the newly captured bears, including 2 siblings whose mother died when they were yearlings. We confirmed the identity of both recaptured bears. Of the harvest samples, 1 was a 21-year-old male who shed his collar in 2005, and whose parents were in our collared sample. The other was a 21-year-old male not related to any of the known individuals. Yield from the power pole snares was low: only 5 of the 14 samples had enough microsatellites to allow individual identification. The tripod was successful in identifying hair from bear 151. Five of the 7 landfill samples were successful, but all 3 individuals were already known bears.

Samples collected in FY19 include 13 tissue samples from newly captured bears, 4 tissue samples collected by biopsy darting unmarked individuals in the oilfields, 8 samples from 4 cubs orphaned when their mothers were killed in conflict situations, and 5 samples collected from power poles and the 2 tripods. Due to low yield and extensive labor required to maintain power pole and tripod snares, we pulled them in August 2019.

Results from these samples are not yet available and will be reported in FY21.

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.

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

One manuscript was published, and one oral presentation was given.

Pedersen, N.J., Todd J. Brinkman, R.T. Shideler, and C.J. Perham. 2020. Effects of environmental conditions on use of forward-looking infrared for bear den detection in the Alaskan arctic. Conservation Science and Practice. 2.e215.

Perham, C.J. and R.T. Shideler. 2020. Application of a new technology and modern use of an old one to locate bear dens on the North Slope. Address to Alaska Chapter of the Wildlife Society, February 10-14, 2020.

## II. SUMMARY OF WORK COMPLETED ON PROJECT TO DATE.

**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:** Locate active dens in the fall and collect their habitat attributes in the summer.

As of the end of FY20 we have inspected 333 dens of marked bears and collected habitat attribute information on them. We will collect to collect attribute information on new dens.

**JOB/ACTIVITY 1B:** Continue to collect den habitat attributes from inspected dens to fine-tune a predictive den habitat model.

We have collected a suite of den habitat data and den measurements on 333 dens of marked bears since 1992. Two hundred and five of these dens have been inspected after May 2000 when Selective Availability was turned off and GPS coordinate positional error was reduced, generally to a few meters. Data have been archived in a Microsoft Access® database for further analysis.

Analysis of these data is ongoing.

**JOB/ACTIVITY 1C:** Compare den attributes from inspected grizzly bear dens with similar attributes on the most recent version of ArcticDEM.

In FY18 a new publicly available DEM ("ArcticDEM") was published. ArcticDEM was promising because it covered the entire North Slope and appeared to have sufficient resolution (2m) to be useful for modeling den habitat selection. We tested it with a select group of dens for which we had Differential GPS locations in case the accuracy of our coordinates collected by handheld GPS was not sufficiently precise. However, the DEM proved to be inaccurate and, therefore, we did not pursue it.

In FY20 an upgraded version of ArcticDEM became available. We intended to compare slope and aspect data collected at the site with this version to determine if it is useable for modeling. Due to the absence of the Principle Investigator on medical leave for 5 months, no progress was made on this job. This job will be postponed until FY21.

**JOB/ACTIVITY 1D:** Investigate the role of snow in den site selection. Compare the distribution of snow drifts modeled by the Snow-Dens 3D model with true locations of each den. The drift model may be useful in enhancing the den habitat map.

Previous unpublished analysis of 55 dens in pingos and 210 dens in other geomorphic types indicated that the mean aspects of both pingo and non-pingo dens were similar (214°T for pingos and 215°T for non-pingo dens). The preponderance of dens facing the direction opposite the winter prevailing winds suggested that snow drifting may be influencing den site selection. Liston et al. (2015) had successfully tested the snow drift model SnowDens-3D to predict locations for polar bear dens. In FY19 we contracted with Dr. Glen Liston to test SnowDens-3D on ArcticDEM. Results indicated that ArcticDEM was imprecise and in fact had numerous errors in the coverage that eliminated its utility for future mapping.

In FY20 an upgrade to ArcticDEM became available and we intended to contract with Dr. Liston again to run his model with the recent version of ArcticDEM. Due to the absence of the Principle Investigator on medical leave for 5 months, no progress was made on a contract to model snow distribution using the most recent version of ArcticDEM and compare drift depth and location with known den locations. This job will be postponed until FY21.

**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.

As of the end of FY20, we have captured 178 bears since the project's inception in 1990. Capture locations have ranged from near the Arctic National Wildlife Refuge border in the east to near Teshekpuk Lake in the west but centered on the industrial area between the Sagavanirktok and Colville rivers. Until FY17 most of these bears were radio-collared with VHF transmitters. Since FY17 most bears have been fitted with Iridium-based GPS transmitters. As of the end of FY20 we have 24 bears fitted with either VHF or GPS transmitters.

Since the 1990s, collection of hair samples from captured bears and from other miscellaneous sources (e.g., oil well marker pipes, power pole snares, landfill fence) and blood from captured animals has also provided material for analysis of stable isotopes of C and N. Since 2013 we have also collected opportunistically hair and blood samples from bears killed by hunters in GMU 26A and 26B. Results of analysis of food habits using C and N through FY 2009 were published previously (Bentzen et al. 2014). We were able to identify bears that were food-conditioned based on their isotopic signatures. Since FY09 we have archived hair and blood samples pending additional funding. We have continued to collect hair and blood samples at each capture session since 2009, and in FY16 we had those from 2009 to 2016 analyzed at the University of Alaska Stable Isotope Facility. Since FY17 we have collected and archived samples with the expectation that we will analyze them in FY21. During the last several years we have noticed an apparent increase in bears feeding on coastal waterfowl, especially black brant (*Branta bernicula nigricans),* snow geese (*Anser caerulescens*) and white-fronted geese

(*Answer albifrons*). The first 2 species feed heavily on coastal vegetation that is influenced by marine waters. In addition, a few individual bears have been observed feeding on chum salmon (*Oncorhyncus keta*) from the very small run in the Itkillik River. With that in mind in FY21 we anticipate analyzing not only isotopes of C and N, but also S to detect the importance of feeding on marine-based resources in the grizzly bear food web.

**JOB/ACTIVITY 2B:** Analyze movements (e.g., locations, rates, and sinuosity of travel) when bears enter the oilfields and compare with those same characteristics of bears that do not enter the oilfields.

We downloaded and archived data from the GPS collars; however, no further progress was made on this job due to the Principal Investigator's absence on medical leave.

**JOB/ACTIVITY 2C**: Compare movements and feeding areas of bears that eat solely natural foods with bears that are food-conditioned.

We downloaded and archived data from the GPS collars; however, no further progress was made on this job due to the Principal Investigator's absence on medical leave.

**JOB/ACTIVITY 2D**: Compare movements of collared animals with "hotspots" identified in ground observations from oilfield security reports.

Pedersen (2019) compiled and analyzed oilfield security grizzly bear ground reports from 1992-2014 and identified "hotspots" where observations of bears from the oilfield road system and facilities were clumped. Since fitting GPS transmitters on oilfield bears in 2017, we have been able to detect bear locations in relation to facilities within the half hour interval rate at which the collars acquire locations. Because the download interval may be several days after the GPS coordinates are collected, we usually don't have real-time comparisons between the bear's location and its observation by security officers. However, we can retrospectively determine if the bear observed by security was a collared bear, and if so we can identify the individual.

In FY20 we downloaded and archived data from the GPS collars and archived reports of ground observations by security officers. No further progress was made on this job due to the Principal Investigator's absence on medical leave.

However, we continued to respond to oilfield security officers' occasional requests to identify a specific bear that they observed near human activity. We identified the GPS-collared bear that was nearest to the location at the time recorded by the officer. In some cases, the bear was not collared. In some instances, we were also able to proactively notify security that a food-conditioned bear that might come into conflict was near their location

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

We have given oral and poster presentations at numerous conferences of the International Association of Bear Research and Management, and at international and domestic bear-human interaction workshops. We also gave oral and poster presentations at several oil and gas industry conferences and workshops. See Section IV for recent publications and presentations.

**JOB/ACTIVITY 3A:** Data analysis and reporting.

We have focused data compilation and analysis in 6 areas: (1) Development of a den habitat use model from data collected during den inspections; (2) identification of den locations on a DEM of suitable scale; (3) denning ecology and characteristics of dens (e.g., dimensions, site characteristics, entrance/exit timing); (4) physical and demographic characteristics of the local bear population based on capture data and genetic analyses, focusing on differences between food-conditioned segment and natural food segment of the population; (5) home range and movements based on VHF collaring and, more recently, locations collected by GPS collars and how to merge the 2 datasets; and (6) evaluation of methods to detect dens during the hibernation season. Although analyses are ongoing, preliminary results have been presented in Federal Aid reports, oral and poster presentations, and meetings and workshops.

We are collaborating with N.J. Pedersen on preparation of a formal manuscript from his thesis chapter about analysis of grizzly bear "hotspots" from security reports.

## III. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

The principal investigator was on medical leave for 5 months of the reporting period.

## IV. PUBLICATIONS

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.

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

Pedersen, N.J. 2019. Human-bear interactions in the North Slope oilfields of Alaska: characteristics of grizzly bear sightings and use of infrared for bear den detection. M.Sc. Thesis, University of Alaska-Fairbanks.

Pedersen, N.J., Todd J. Brinkman, R.T. Shideler, and C.J. Perham. 2020. Effects of environmental conditions on use of forward-looking infrared for bear den detection in the Alaskan arctic. Conservation Science and Practice. 2.e215.

Perham, C.J. and R.T. Shideler. 2020. Application of a new technology and modern use of an old one to locate bear dens on the North Slope. Address to Alaska Chapter of the Wildlife Society, February 10-14, 2020.

## V. 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.

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 portion of the collar fails.

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. (2015) for polar bear denning.

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

5. Continue to collect and analyze genetic data from newly captured bears, from hair collected incidentally around the oil field, and from tissue collected from hunter harvest or department bear control projects. These data can provide background for a demographic analysis of the both the food-conditioned and natural food segments of the population. Genetic identification of the fate of weaned cubs that appear in the genetic samples can be useful in investigating overall cub survival, fate of adults that are not in the capture sample can assist in evaluating adult mortality, and identification of non-collared bears using the oilfield area can augment the capture sample.

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.