

**FEDERAL AID FINAL  
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**

**PROJECT TITLE:** Black bear abundance and distribution in the Tanana Flats in Interior Alaska

**PRINCIPAL INVESTIGATORS:** Craig L. Gardner, ADF&G; ADF&G coauthors: Nathan J. Pamperin and Brian D. Taras

**COOPERATOR:** None

**FEDERAL AID GRANT PROGRAM:** Wildlife Restoration

**GRANT AND SEGMENT NO.:** W-33-12

**PROJECT NO.:** 17.80

**WORK LOCATION:** Game Management Unit 20A, Tanana River flats

**STATE:** Alaska

**PERIOD:** 1 July 2009–30 June 2014

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**I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH:**

The U.S. Army and the Alaska Department of Fish and Game (ADF&G) were interested in conducting a joint study evaluating both the population density and distribution of black bears (*Ursus americanus*) and the distribution of grizzly bears (*Ursus arctos*) in a portion of the Tanana Flats in Game Management Unit 20A (GMU 20A). The Army needed bear distribution and density estimates to assist in the planning of ground-based training exercises in the Tanana Flats and to meet the requirements of the Army's Integrated Natural Resource and Integrated Cultural Resource management plans. For ADF&G, a better understanding of black bear density and distribution in the Tanana Flats could provide managers insights into the role of black bears as predators on moose (*Alces alces*) calves and would benefit managers in developing black bear seasons and bag limits in GMU 20A. Black and grizzly bears have been found to be effective predators on moose calves in portions of Interior and Southcentral Alaska (Schwartz and Franzmann 1980, Osborne et al. 1991, Gasaway et al. 1992, Bertram and Vivion 2002, Boertje et al. 2009, Keech et al. 2011). GMU 20A is managed by ADF&G to achieve elevated moose harvest (Boertje et al. 2009, Young and Boertje 2011).

## II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

During 1988–1991, Hechtel (1991) estimated the black bear density in the Tanana Flats to be 46–67 bears  $\geq 1$ -year-old/1,000 km<sup>2</sup> based primarily on home range size and range juxtaposition of 25 radiocollared black bears. Because not all bears in the study area were radiocollared, Hechtel (1991:11) made subjective adjustments to the density estimate to include bears not radiocollared and recommended the estimate should be reevaluated. If Hechtel's (1991) density estimate was correct, it would indicate that GMU 20A does not offer premium black bear habitat and, consequently, limits its role of the black bear as a predator on moose. Black bear estimates in other areas of noncoastal Interior and Southcentral Alaska were 60–190% higher (Miller et al. 1987; Keech et al. 2014; J. Caikoski, ADF&G, unpublished data, Fairbanks). Grizzly bears were known to frequent the Tanana River flats but limited data precluded determining if there was a resident population or if the bears observed were primarily transient utilizing the area mostly during moose calving season (Reynolds and Boudreau 1992). Keech et al. (2000) evaluated sources of neonate moose mortality in the Tanana Flats and found that predation mortality was evenly distributed between wolves (*Canis lupus*) and black and grizzly bears but at a lower overall rate compared to other areas in Interior Alaska and northern Canada.

Wildfires have altered the vegetative communities in the Tanana Flats since the conclusion of Hechtel (1991), Reynolds and Boudreau (1992), and Keech et al. (2000). Bear distribution can change due to large scale habitat alteration (Apps et al. 2004). Distribution constriction or protraction will be dependent on the size of affected area and the availability of optimum bear forage. If bear distribution in the Tanana Flats had changed, then possibly the role of black and grizzly bears as predators on moose had also changed. Bear numbers and distribution are inherently difficult to estimate due to poor sightability, large movement patterns, and heterogeneous capture probabilities due to sex and age (Obbard et al. 2010). DNA mark-recapture methodology using hair traps (Woods et al. 1999) has been used to estimate bear abundance in forested habitats where aerial survey methods are not feasible (Dreher et al. 2007; Kendall et al. 2008, 2009; Settlage et al. 2008; Tredick and Vaughan 2009; Coster et al. 2011; Stetz et al. 2014). This method can provide rigorous bear population estimates if the sampling design takes into account capture heterogeneity within and between bear species. Because grizzly bears have much larger home ranges compared to black bears, we were concerned that the sampling intensity adequate for one species would not be appropriate for the other. We decided the best approach based on available funding and the management needs for both the U.S. Army and ADF&G was to design the study to obtain precise estimates of black bear density and distribution in the portion of the Tanana Flats that included both the Army's primary training area and an important moose calving area. The study design was adequate to identify grizzly bear presence in the area but not density.

### III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: Estimate population size and distribution of black bears in a portion of the Tanana Flats in northcentral Unit 20A that includes the U. S. Army's Tanana Flats Training Area and an important moose calving area.

In general, we followed the DNA-based mark-recapture methods described by Woods et al. (1999) to estimate black bear abundance and distribution. We designed our sampling protocol using simulations based on results of previous studies conducted in Canada and southeastern United States (Dreher et al. 2007; Settlage et al. 2008; Tredick and Vaughan 2009; Coster et al. 2011; J. Boulanger, unpublished data, British Columbia, Canada) and seasonal movement data collected by Hechtel (1991) and Keech (ADF&G, unpublished data, Fairbanks). Specifically, we subdivided the 981 km<sup>2</sup> study area into 157 2.5×2.5 km (6.25 km<sup>2</sup>) systematically distributed sample units each (Fig. 1). Due to the small size of the study area and sample units relative to brown bear home range sizes and movement patterns (Reynolds and Hechtel 1988, Reynolds and Boudreau 1992), we were not able to estimate grizzly bear density but identified presence, gender, and relatedness of individuals that used the area. We deployed 1 hair trap in black bear habitat as close to the center of each sample unit as possible and baited with liquid lure. We conducted 5 8-day sampling periods during 10 June–27 July 2010. Sampling was initiated concurrent with increased movement patterns by females with cubs (M. Keech, personal communication) and the maximum molting period (Wegan et al. 2012). Hair traps consisted of a single strand of 4-pronged barbed wire set 48–50 cm above ground around 3–6 trees to form an enclosure with a perimeter of 22–30 m. Three liters of liquid lure consisting of rotted salmon (2 liters) and rotted cow blood were poured on moss in a mound of forest debris that was elevated ~0.3–1 m above ground. We also hung a cloth soaked with lure 3–5 m high in a tree to aid scent dispersion. Hair traps were rebaited at the end of sample period but were not relocated. We also added a secondary lure at each trap site during sample periods 2 (skunk), 3 (fermented egg), 4 (blueberry oil), and 5 (butterscotch and anise oils) to maintain trap novelty. We deployed 7 wildlife motion detection cameras (2 Trail Watcher Model 2035, 5 Reconyx Covert Pros) to evaluate the number of bears and number of cubs (<1-year-old) that visited traps relative to hair capture and identification. Cameras were attached to a tree outside of the trap at a height and distance allowing full view of the trap. After each trapping occasion, we would view photos of all visiting bears, determine which barbs they contacted and then cross reference to our hair collection data to see if we had collected bear hair on those barbs and if the hair sample was individually identified.

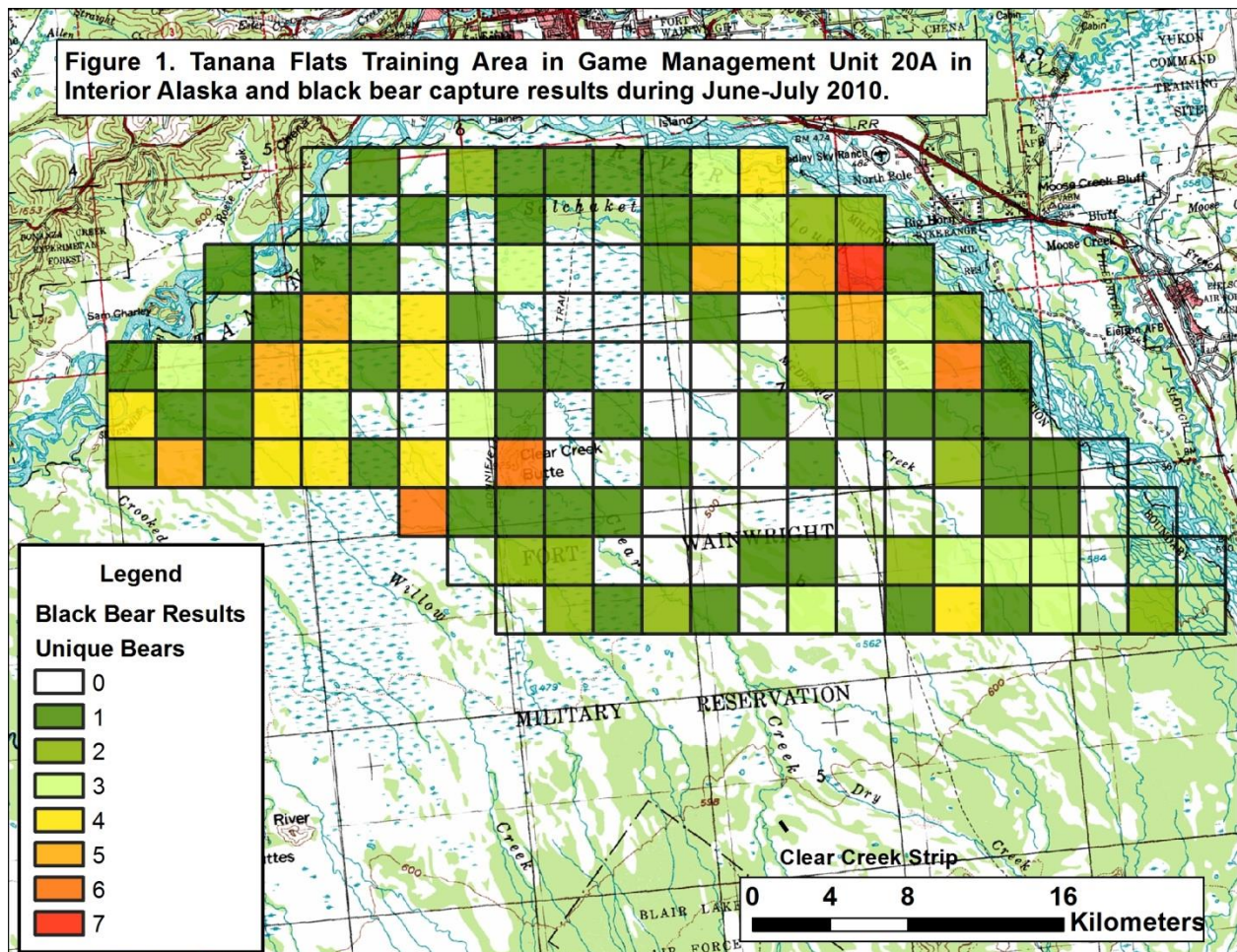


FIGURE 1. Tanana Flats training area in Game Management Unit 20A in Interior Alaska and black bear capture results during June–July 2010.

At the end of the 8-day sample period, we visited each site by helicopter or boat and collected hair. We followed hair collection protocol outlined in Kendall et al. (2008). We discarded any hair samples that were obviously not bear hair. Hair samples were sent to an independent lab (Wildlife Genetics, International, Nelson, British Columbia, Canada) specializing in bear genetic samples. Black and grizzly bears were differentiated using the G10J microsatellite (Mowat et al. 2005, Kendall et al. 2008). The 6 additional microsatellite loci (markers) used to determine black bear individuality were G10M, G10B, G1D, G10U, MU50, and MU59. Gender was determined based on the gender marker ZFX/ZFY and was analyzed alongside of the 7 microsatellite markers resulting in an 8-locus analysis for individual identity. We determined relationships between captured bears by extending the genotypes to 23–markers (including the gender marker). We used the software PARENTE (Cercueil et al. 2002) to determine the probability that a pair of individuals was parent and offspring based on the 23 microsatellite loci.

Black bear density was estimated with maximum likelihood based spatially-explicit capture-recapture models (Efford 2004, Borchers and Efford 2008, Efford et al. 2009, Borchers 2010). The models were performed using Program R package “secr” version

2.3.1; 12/16/2011 (Efford 2011). A set of candidate models was developed and model selection was performed using AIC for small sample sizes (AICc; Sugiura 1978, Hurvich and Tsai 1989) and Akaike weights (Burnham and Anderson 2002).

We identified 81 individual black bears (28 M, 53 F). Of the 81 black bears, we identified 11 mother-father-offspring triads. These 11 litters were sired by 3 males. On 4 occasions, females with 1–2 cubs visited a trap with a camera. During these occasions, the adult female was photographed encountering the wire but none of the cubs left hair on the wire as all walked underneath; however we photographed 1 cub grabbing the wire with its mouth. The population estimate was 59 bears  $\geq 1$ -year-old/1,000 km<sup>2</sup> (SE = 7.3; 95% CI = 46–75 bears) with relative precision at the 95% confidence level = 24.2%. We identified 10 individual grizzly bears (9 M, 1 F). We identified 1 mother-father-offspring triad. Qualitative interpretations of hair capture events indicate that moose calving sites are separate from the black bear concentration areas.

#### **IV. MANAGEMENT IMPLICATIONS**

Based on our density estimate and results from Hechtel (1991), the black bear population trend in this portion of the Tanana Flats appears to be stable indicating that current black bear harvest and season regulations have not caused excessive mortality. Black bear densities in the study area are low compared to the upper Kuskokwim (89 bears  $\geq 1$  year-old/1,000 km<sup>2</sup>; Keech et al., unpublished data) and the Yukon Flats (164 bears  $\geq 1$ -year-old/1,000 km<sup>2</sup>; Caikoski et al., ADF&G unpublished data, Fairbanks). The low density of black bears may explain the lower predation rates by black bears on moose in the Tanana Flats (Keech et al. 2000) relative to other areas in Interior and Southcentral Alaska and in Yukon, Canada, with higher densities of black bears (Boertje et al. 2009). Our data show that even though black bear and grizzly bear abundance is lower in the Tanana Flats training area compared to other areas in Interior Alaska, black and grizzly bears can be found throughout the training area. Encounters with bears by U.S. Army personnel during ground exercises should be expected.

#### **V. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN FOR LAST SEGMENT PERIOD ONLY**

JOB/ACTIVITY 1A: Conduct literature review.

We conducted biweekly literature searches for studies using DNA-based mark-recapture sampling and models. We also searched for publications on black and grizzly bear movement patterns, habitat use, breeding behavior, and survival.

JOB/ACTIVITY 6: Data analysis and reporting.

We completed a draft manuscript entitled “Black bear abundance in central Tanana Flats in Interior Alaska” for future submission to a peer-reviewed journal.

**VI. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THE LAST SEGMENT PERIOD, IF NOT REPORTED PREVIOUSLY**

None.

**VII. PUBLICATIONS**

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#### **VIII. RESEARCH EVALUATION AND RECOMMENDATIONS**

None.

#### **IX. APPENDICES**

None.

**PREPARED BY:** Craig L. Gardner

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